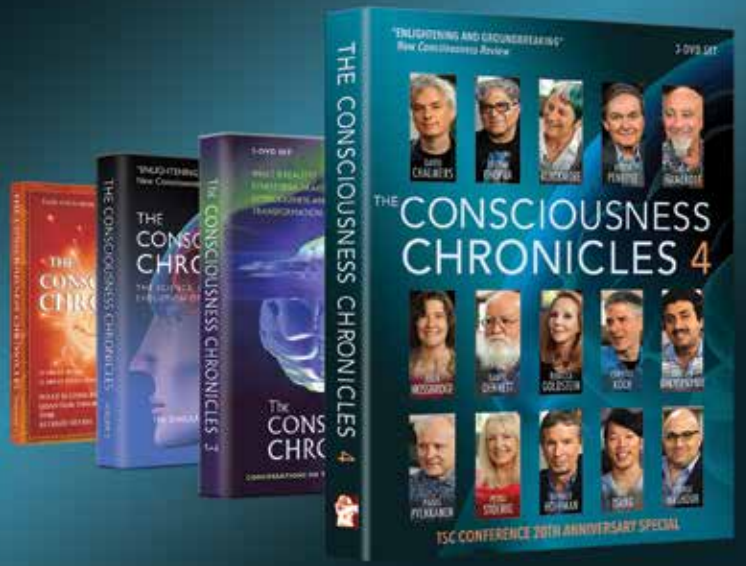
LET'S TALK CONSCIOUSNESS 4



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TSC 2016 TUCSON

THE SCIENCE OF CONSCIOUSNESS

CENTER FOR CONSCIOUSNESS SCIENCE
UNIVERSITY OF MICHIGAN MEDICAL SCHOOL

THE UNIVERSITY OF ARIZONA
Center for
Consciousness Studies

www.consciousness.arizona.edu | April 25-30

TSC2017

THE SCIENCE OF CONSCIOUSNESS

Shanghai June 2017

Sponsored by

Crystal Globe Conscious Enterprises

and

The University of Arizona Center for Consciousness Studies

Higher dimensions of consciousness
'Way of the Tao' & The 'I Ching'
—Lao Tzu

The University of Arizona Center for Consciousness Studies and University of Michigan Center for Consciousness Science

Present

TSC 2016 TUCSON
THE SCIENCE OF CONSCIOUSNESS

APRIL 25-30, 2016

Loews Ventana Canyon | Tucson, AZ

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TSC 2016 TUCSON
THE SCIENCE OF CONSCIOUSNESS

WELCOME to The Science of Consciousness 2016!
April 25-30, 2016, Loews Ventana Canyon, Tucson, Arizona

"To have a glimpse of what consciousness is would be the scientific achievement before which all others would pale." – William James

After 23 years, the seminal conference 'Toward a Science of Consciousness' is now simply 'The Science of Consciousness'. But as consciousness cannot be observed, scientifically explained, nor commonly defined, is there now truly a 'Science of Consciousness'? Are we there yet?

We *do* have essential questions. Is the brain a computer? Does it process or generate conscious information as output? When, where and how did consciousness evolve? Can we have free will, or are we just 'along for the ride'? Will consciousness be reproduced through brain mapping, transhumanism and/or artificial intelligence? Or, does the brain 'tune into' and organize consciousness or its precursors existing naturally in the universe? What are the implications of either view on the nature of existence and treatment of mental and cognitive disorders?

These and many other questions will be debated in a week-long gathering of scientists, philosophers, artists, meditators and interested people at Loews Ventana Canyon, a luxurious eco-resort in the mountains just north of Tucson, Arizona. The program will consist of Pre-Conference Workshops, Plenary talks, Concurrent talks, Posters and Exhibits, Social Events and Entertainment.

TSC 2016 marks the 23rd anniversary of the international, interdisciplinary Tucson Conference on the fundamental question of how the brain produces conscious experience. The conference is co-sponsored and organized by the Center for Consciousness Studies at the University of Arizona and by the Center for Consciousness Science at the University of Michigan.

The Science of Consciousness (TSC) is the largest and longest running conference emphasizing broad and rigorous approaches to conscious awareness, the nature of existence and our place in the universe. TSC brings together perspectives, orientations and methodologies from neuroscience, philosophy, medicine, quantum physics, cosmology, biology, psychology, anthropology, artificial intelligence, technology, contemplative and

experiential traditions, the arts, culture, humanities and other disciplines. Cutting edge, controversial issues are emphasized.

Over 1000 participants are expected from 60 countries over the course of the week. Over 500 abstracts were submitted and 400 are included in the program.

Sponsored by
Center for Consciousness Studies, The University of Arizona
Center for Consciousness Science, University of Michigan

The Conference Opening is Tuesday, April 26, 2016 at 1:45 pm.
The first Plenary Session follows at 2:00 pm.
(Additional Plenary Sessions are Wednesday through Saturday April 27-30.)

Plenary Sessions: 12 Plenary sessions before the entire conference audience occur serially from Tuesday afternoon, April 26, through Saturday afternoon, April 30. Wednesday through Saturday Morning sessions (3 speakers) are from 8:30 a.m. to 10:40 a.m., followed by a 30 minute break. Second sessions Wednesday through Saturday (2 speakers) are from 11:10 am to 12:30 pm., followed by a lunch break. Afternoon sessions (3 speakers) are from 2:00 p.m. to 4:10 p.m. There is a free afternoon Thursday April 28, midway through the conference, with no plenary session.

Thank you to our Plenary Speakers
Stanislas Dehaene, Anil K. Seth, Stuart Hameroff, Rudolph Tanzi, Selen Atasoy, Anirban Bandyopadhyay, Deepak Chopra, David Chalmers, Naotsugu Tsuchiya, Richard Brown, Jakob Hohwy, Aaron Schurger, Hartmut Neven, Christian Szegedy, Henry Stapp, Kelvin McQueen, Alyssa Ney, Terrence W. Deacon, Katherine T. Peil, Anthony Hudetz, Walter J. Freeman, György Buzsáki, Alison Gopnik, Robin Carhart Harris, Martin Monti, Dean Radin, Stuart Kauffman, George Mashour, Jimo Borjigin and Peter Fenwick.

We also want to thank our Time, Free Will and the Brain Panel participants: Ruth Kastner, Daniel Sheehan, Ron Gruber, Marcin Nowakowski, Matti Vuorre, Julia Mossbridge.

Concurrent Sessions: 24 concurrent sessions occur in parallel 8 per night on 3 nights, from 5:00pm to 7:30pm, Tuesday April 26th, Wednesday April 27th and Friday April 29th. Each session is chaired by a moderator and has 6 speakers, each with 20 minutes plus 5 minutes discussion (125 minutes/session), a total of 144 Concurrent talks.

WELCOME to The Science of Consciousness 2016

Social Events
Fun social gatherings are a TSC tradition and include the:

- Tues. Opening Welcome Reception 7:30pm to 9:30pm
- Wed. Poster Session 1 – Art/Tech/Health Exhibits – Reception 7pm to 10pm
- Wed. late-evening Club Consciousness 10pm to midnight
- Thurs. Dinner Under the Stars (Optional) 7pm to 10pm
- Wed. Poster Session 2 – Art/Tech/Health Exhibits – Reception 7pm to 10pm
- Fri. "Poetry Slam/Zombie Blues/Talent Show" 10pm to midnight
- Sat. Closing "End of Consciousness" Party 8pm to ???
  Featuring a performance by 'Dorian Electra and the Electrodes'

Poster Sessions
Poster presentations are written or illustrated on a board with author(s) present, as the audience circulates. There are 2 Poster Sessions, each with ~100 posters. Wednesday, April 27 and Friday, April 29th from 7:00 – 10:00 pm. In the Grand Ballroom Salons B & C / Cash bar.

Art/Tech/Health Exhibits
There are 2 Art/Tech/Health Exhibits (installations, demos, easel art) Wednesday April 27 and Friday April 29th from 7:00 to 10:00 pm
In the Grand Ballroom Foyer and Adjacent Rooms / Cash bar.

East West Forum
A full day symposium within the Pre-Conference Workshop Program, The East-West Forum is organized by Dayalbagh Educational Institute (DEI), Agra, India, on Monday April 25th from 9:00am – 5:00pm in the Kiva Ballroom.

History of TSC
The first TSC conference was held in 1994 in DuVal Auditorium at the University of Arizona Medical Center and subsequently elsewhere in Tucson in even-numbered years. These have alternated with co-sponsored international TSC conferences in various locations around the world in odd-numbered years. The Center for Consciousness Studies (CCS) at the University of Arizona was established in 1998 by the Arizona Board of Regents. TSC and CCS are due to the work over the years of Al Kaszniak, David Chalmers, Jim Laukes, Jay Sanguinetti, Stuart Hameroff and the late Alwyn Scott, a co-founder of CCS. Since 2007, CCS and TSC have been successfully managed by Abi Behar-Montefiore, subsisting entirely on TSC conference registration fees and sponsorships. CCS is hosted in the Department of Anesthesiology in the University of Arizona College of Medicine and Banner – University Medical Center Tucson.

Thank you to our international colleagues and friends who helped make the TSC alternate year conferences possible:

1995 Ischia, Italy – Chloe Taddei-Ferretti
1997 Elsinore, Denmark – Alwyn Scott
1999 Tokyo, Japan – UN University, Mari Jibu, Kunio Yasue
2001 Skovde, Sweden – University of Skovde, Paavo Pylkkanen
2003 Prague, Czech Republic – Ivan Havel
2005 Copenhagen, Denmark – Morten Overgard
2007 Budapest, Hungary – George Kampis
2009 Hong Kong, China – Hong Kong Polytechnic, Gino Yu
2011 Stockholm, Sweden – Christer Perfjell
2013 Agra, India – DEI, Rev. Prof. P.S. Satsangi, Vishal Sahni
2015 Helsinki, Finland – University of Finland, Paavo Pylkkanen
2017 Shanghai, China – Crystal Globe Conscious Enterprises

2016 Co-Sponsors
The Center for Consciousness Studies, The University of Arizona, Tucson
The Center for Consciousness Science, University of Michigan, Ann Arbor

Program Committee
Stuart Hameroff, Co-Chair, The University of Arizona
George Mashour, Co-Chair, University of Michigan
Abi Behar-Montefiore, CCS, The University of Arizona
Harald Atmanspacher, ETH Zurich
Brit Brogaard, University of Miami
Hakwan Lau, University of California at Los Angeles
Paavo Pylkkanen, Universities of Helsinki and Skovde
Jay Sanguinetti, The University of Arizona
Marilyn Schlitz, Worldview Enterprises; IONS
Gino Yu, Hong Kong, Polytechnic University; SME Creativity Center

Conference Director
Abi Behar-Montefiore, Center for Consciousness Studies, Assistant Director

Sponsors
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Quantum Gravity Research
YetTaDeL Foundation

Cooperating Organizations
Department of Anesthesiology, The University of Arizona
UA Departments of Psychology, Cognitive Science, Philosophy
Consciousness Central TV
Consciousness Chronicles
Dayalbagh Educational Institute (DEI)
Society for Mind-Matter Research
Swiss Biennial on Science, Technics + Aesthetics
Transformative Technology Lab
The Allen Lab, UA Department of Psychology

Exhibitors
CCS-TUS Study
Deepak Chopra DreamWeaver
HeartMath
mYndful
Neuroelectrics
SoundSelf
Starlab
TruPhone
Quantum Gravity Research
MyHeadquarters
Journal of Consciousness Studies/Imprint Academic
CCS-TUS Study
Eran Keyhani (Halgheh) "Interuniversal Mysticism (Circle)"
Planetary Science Institute

Prizes
Harmony Books /Penguin Random House
HEAD/Penn
OPRC KCUT
Whole Foods Tucson
UA Alumni Association

Bhaumik Prize
For the second time, the Bhaumik Prize in Consciousness Studies will be presented. Dr. Mani Bhaumik announced that the $10,000 award will be presented at the conference to the Center for Consciousness Studies and Dr. Stuart Hameroff to continue research efforts in the science of consciousness.

Dayalbagh Educational Institute (DEI) and the East-West Forum at TSC2016
Special acknowledgement to Rev. Prof. Prem Saran Satsangi, Leader of Radhasoami Faith, Dayalbagh and Chairman, Advisory Committee on Education, Dayalbagh Educational Institutions.

THANK YOU

The TSC Conference and Center for Consciousness Studies wish to thank the Program Committee, in particular Co-Chairs George Mashour (University of Michigan) and Stuart Hameroff (The University of Arizona) and CCS Assistant Director and TSC Conference Director Abi Behar-Montefiore for her superb administration.

We are grateful to SBS web guru Ed Xia for many years of IT support. We appreciate the additional support from AHSC BioCommunications team members, in particular, Sr. Graphic Designer Roma Krebs. Please accept our gratitude for your overall contribution to present this event through all your design concepts.

We also thank the University of Arizona Department of Anesthesiology support staff and Dr. Stuart Hameroff's colleagues in the B-UMC surgical operating rooms, in particular Dr. Wayne Jacobsen, Chairman, Department of Anesthesiology. We are grateful to our original sponsors, the Fetzer Institute and the YeTaDel Foundation who supported us for many years. We also thank The Bhaumik Foundation, The Chopra Foundation, The Dayalbagh Educational Institute (DEI), Alvin J. Clark, Klee Irwin, and Quantum Gravity Research.

This year's volunteers include long-time friends Stephen Whitmarsh, Will Reid, Jesse Bessinger, Harrison Hameroff, Uzi Awret, Ming Ming Gao and members of the Jay Sanguinetti and John JB Allen Labs in Psychology at the University of Arizona. Thank you to Dorian Electra and the Electrodes, Timbre Wolf and the Zombie Blues Band: Michael P. and The Gullywashers – for keeping us in tune! And to all of you for presentations at the Poetry Slam/ Zombie Blues/Talent Show which have become a tradition at TSC.

Thank you to Loews Ventana Canyon Resort: Derek McCann, General Manager; Nick Pazzi, National Sales Manager; Victoria Wasko, Conference Manager; Mary Miniaci, Reservations Manager; Ryan Bunker, Director of Marketing; Stevan Kuehnle, Director of Banquets; Ken Harvey, Executive Chef; Martin Charlton, Food and Beverage Director; Gilbert Lewis, Director of Security; Alice Bruce, Director of Front Office; Carlos Tenorio, Director of Housekeeping; Amanda Sotomayor, Spa Manager; the entire Front Desk Team –Bellstaff: Peter Mwangia, Nick Vergara, Clint Fells, Christian Meisel, and Cliff Dool.

Thank you to the University of Arizona Procurement and Contracting, Thomas D. Fiebiger, the UA Foundation, UA Financial Services, CCS Staff and Volunteers, Consciousness Central TV, Commotion Studios and UAHS BioCommunications.

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Journal of Consciousness Studies
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Contact: Abi Behar-Montefiore (520) 247-5785 – center@u.arizona.edu

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TUCSON – KEY NUMBERS/ADDRESSES

Loews Ventana Canyon Resort (Conference Venue)
7000 North Resort Drive
Tucson Arizona 85750
(520) 299-2020

Aloft Hotel
1900 E Speedway Blvd, Tucson, AZ 85719
Main: (520) 908-6800

Maximum Car Transportation
(520) 399.2400
maximumtrans09@aol.com

The University of Arizona
UA Main Telephone Number (520) 621-2211
UA Parking and Transportation (520) 626-7275

Banner – University Medical Center Tucson
1501 N. Campbell Avenue, Tucson, AZ 85724 (520) 694-0111

IN CASE OF AN EMERGENCY DIAL 911

CCS Office, (520) 621-9317
CCS TSC Conference Manager
center@u.arizona.edu – cell/text: (520) 247-5785
Conference website: www.consciousness.arizona.edu

Next year, the 24th conference, TSC 2017, will be held in Shanghai, China co-sponsored by Crystal Globe Conscious Enterprises. TSC 2016 and future TSC conferences are co-sponsored and organized by the Center for Consciousness Studies at the University of Arizona, Tucson and the Center for Consciousness Science, University of Michigan, Ann Arbor.

TSC 2016 TUCSON
THE SCIENCE OF CONSCIOUSNESS

PRE-CONFERENCE OVERVIEW

24 Pre-Conference Workshops (see LIST on pages 12-14)
Monday, April 25 – 7:00 am to 10:30 pm
Tuesday, April 26 – 9:00 am to 1:00 pm

East-West Forum
Monday April 25 – 9:00 am to 5:00 pm

2016 CONFERENCE SESSION OVERVIEW

Several types of presentation sessions make up the TSC conference: Pre-Conference Workshops, East West Forum, Plenary Sessions, Concurrent Sessions, Poster Sessions, Art/Tech/Health Exhibits

CONFERENCE OPENING — Loews Ventana Canyon
Tuesday, April 26 – 1:45 pm (Plenary 1 begins at 2:00 pm)

Plenary Sessions 1-12 (see INDEX on pages 23-25)
Tuesday, April 26 – 2:00 to 4:10 pm
Wednesday, April 27 – 8:30 am to 4:10 pm
Thursday, April 28 – 8:30 am to 12:50 pm
Friday, April 29 – 8:30 am to 4:10 pm
Saturday, April 30 – 8:30 am to 4:10 pm

Concurrent Sessions 1-24 (see INDEX on pages 26-33)
Tues*day, April 26 – 5:00 to 7:30 pm*
Wednesday, April 27 – 5:00 to 7:30 pm
Friday, April 29 – 5:00 to 7:30 pm

Poster Sessions (see INDEX on pages 35-44)
Wednesday, April 27, Poster Session 1 – 7:00 to 10:00 pm
Friday, April 29, Poster Session 2 – 7:00 to 10:00 pm

Art/Tech/Health Exhibits (see INDEX on pages 45)
Monday, April 25 – set up
Wednesday, April 27, A1 – 7:00 to 10:00 pm
Friday, April 29, A2 – 7:00 to 10:00 pm

Art/Tech/Health Exhibits are more interactive than the concurrent and plenary sessions and will demonstrate art, media, sculpture and experiential techniques with power point, installations, body and canvas.

SOCIAL EVENTS

Welcome Reception
Tuesday, April 26, 7:30 to 10:00 pm
Bill's Grill, Cascade Terrace, Main Lobby Lounge, Patio; Grand Ballroom Foyer

Club Consciousness
Wednesday, April 27 – 10:00 pm to midnight / KIVA BALLROOM & PATIO
Dorian Electra and The Electrodes and Timbre Wolf

Conference Dinner 'Under the Stars' [optional: tickets required]
Thursday, April 28 – 6:30 to 10:00 pm
6:30 to 7:30 pm / Sunset Cocktails on the FLYING V PATIO
7:30 to 10:00 pm / Dinner at KIVA BALLROOM PATIO
Stargazing with the Planetary Science Institute

Poetry Slam/Zombie Blues/Talent Show
Friday, April 29 – 9:30 pm to midnight / KIVA BALLROOM
Talent Show: Featuring You!

9:00 pm	*Gather at Kiva Patio*
9:45 pm	*Warming up with Michael P and the Gullywashers*
10:15 pm	*Poetry Slam*
11:00 pm	*Zombie Blues*
11:45 to 12:30 pm	*Music and Dancing*

Following the poems, attendees are invited to perform one or more verses of the Zombie Blues with musical accompaniment by Michael P. and the Gullywashers. Write your own verse to the original soulless lament:
"I act like you act... I do what you do... but I'll never know, what it's like to be you. What consciousness is... I ain't got a clue... I got... the Zombie Blues."

'End-of-Consciousness' Party
Saturday, April 30, 8:00 pm until ??? / KIVA BALLROOM
This is a TSC tradition. Enjoy food, drink, cash bar and music in a party setting. Special performance by Dorian Electra and the Electrodes.

PRE-CONFERENCE WORKSHOP PROGRAM

Monday Morning, April 25 – 7:00 am to 8:00 am

- **A Tenniscentric Approach to Consciousness** / LOEWS TENNIS COURTS
  (Mark Valladares)
  TENNIS CLINICS Monday 4/25 thru Saturday 4/30 – 7:00 am to 8:00 am
  TOURNAMENT Thursday 4/28 – 3:00 to 5:00 pm
  [Sponsored by OPRC KCUT; Tennis balls provided by HEAD/Penn]

Monday Morning, April 25 – 9:00 am to 1:00 pm

- **ALL DAY FORUM PART 1: DEI (Dayalbagh Educational Institute)**
  East-West Forum / KIVA BALLROOM

EMERITUS CHAIRS OF THE EAST WEST FORUM

East: Revered Prof. P.S. Satsangi
Chairman, Advisory Committee on Education
Dayalbagh Educational Institutions, India

West: Prof. Stuart Hameroff
Director, Centre for Consciousness Studies
University of Arizona, Department of Anesthesiology

2016 EAST WEST FORUM CHAIRS

East:
Prof. Anirban Bandyopadhyay, NIMS Japan
Prof. Subhash Kak, Oklahoma State Univ., USA
Prof. P. Sriramamurti, DEI, India
Dr. Bani Dayal Dhir, DEI, India
Mr. Thubten Samphel, Tibet Policy Institute, Dharamshala, India

West:
Prof. James Barrell, Univ. of West Georgia, USA
Prof. Rocco J. Gennaro, Univ. of Southern Indiana, USA
Dr. Chris Fields, Sonoma, California, USA
Prof. Paavo Pylkkanen, Univ. of Helsinki, Finland

Forum Organizer:
Dr. Vishal Sahni, Dayalbagh Educational Institute (Deemed Univ.), India
Forum Coordinator :
Dr. Bani Dayal Dhir, Dayalbagh Educational Institute (Deemed Univ.), India
Forum Coordinator and Organizer – Video-conferencing:
Mr. Prem Prashant, Member, Divinity Forum (Dayalbagh / @DEI-location)

Abstracts for the East-West Forum are LISTED on pages 241-262.

Monday Morning, April 25 – 9:00 am to 1:00 pm

- **Quantum Biology - Nature of Life** / SALON F
  (Stuart Kauffman, Jack A. Tuszynski, Katherine T. Peil, Travis Craddock, Anirban Bandyopadhyay, Stuart Hameroff, Dean Radin)
- **Kant and the Conscious Mind** / RINCON
  (Tobias Schlicht)
- **Consciousness Versus Attention** / SANTA RITA
  (Carlos Montemayor, Haroutioun Haladjian)
- **Curriculum for Consciousness Studies** / SABINO
  (Frank Echenhofer, Allan Combs, Gino Yu, Beth Torpey, Chip McAuley)
- **PSI research and Consciousness** / SALON J
  (Arnaud Delorme, Julia Mossbridge, Julie Beischel)
- **Consciousness, Memory and Music** / SALON K
  (Alexander Graur)
- **Altered State Healing in the Amazon** / SALON L
  (Tania Re, Giuseppe Vitiello)

Monday Afternoon, April 25 – 2:00 pm to 5:00 pm

- **ALL DAY FORUM PART 2: DEI (Dayalbagh Educational Institute)**
  East-West Forum / KIVA BALLROOM
- **Designing a Conscious Robot** / SALON E
  (Christian Lebiere, Peter (Piotr) Boltuc, Ron P. Loui, Troy D. Kelley, Kristin E. Schaefer)
- **Consciousness in Animals** / SALON F
  (Margo DeMello, Robert W. Mitchell, Julie A. Smith, Sara Waller)
- **Consciousness and the Arts, I** / VENTANA ROOM – 2ND FLOOR
  (Robert J. Sawyer, James Kerwin, Kipleigh Brown, Dorian Electra, Marilyn Schlitz)
- **Transformative Technology** / SALON J
  (Jeffrey A. Martin, Rollin McCraty, Robin Arnott, Jay Sanguinetti
- **Unity of Consciousness** / SALON K
  (Zoran Josipovic, Judith Blackstone)
- **Naturalizing the Conscious Mind** / SALON L
  (Harald Atmanspacher, Hedda Hassel Mørch, William Seager, Michael Silberstein)

PRE-CONFERENCE WORKSHOP PROGRAM

Monday Evening, April 25 – 7:30 pm to 10:00 pm

- **"Super Genes" Can Consciousness Guide Evolution?** / KIVA BALLROOM
  (Deepak Chopra, Rudolph Tanzi)
  Refreshments will be served

Tuesday Morning, April 26 – 9:00 am to 1:00 pm

- **First Person-Third Person Perspectives** / SALON D
  (Marjorie Woollacott)
- **Quantum AI and Machine Consciousness** / SALON E
  (Hartmut Neven, Christian Szegedy, James Tagg, Marcus Abundis
- **Anesthesia Research and Consciousness** / SALON F
  (George Mashour, Dinesh Pal, UnCheol Lee, Anthony G. Hudetz, Travis Craddock)
- **Complexity and Consciousness** / SALON J
  (Alex Hankey)
- **Hot Topics in Cognitive Neuroscience** / BOARD ROOM
  (Hakwan Lau)
- **Philosophical Theories of Consciousness** / SALON K
  (Rocco J. Gennaro)
- **Walter Freeman Festschrift** / SALON L
  (Walter J. Freeman)
- **Consciousness and the Arts II** / VENTANA ROOM – 2ND FLOOR
  (Nell Teare, Lora Nigro, Kevin Rutkowski, Sascha Seifert, Nick Day)

Thursday Afternoon, April 28 – 3:00 to 5:00 pm

- **A Tenniscentric Approach to Consciousness** / LOEWS TENNIS COURTS
  (Mark Valladares)
  TOURNAMENT Thursday April 28 – 3:00 to 5:00 pm
  [Sponsored by OPRC KCUT; Tennis balls provided by HEAD/Penn]

NOTES

TUESDAY, APRIL 26, 2016 | CONFERENCE OPENING | PLENARY SESSION 1

1:45pm	**CONFERENCE WELCOME – KIVA Ballroom**		
2:00pm - 4:10pm **PLENARY SESSION 1**	**PLENARY SESSION 1: Five Roads to Consciousness (1)** *For details, see Plenary INDEX on pages 23.* Stanislas Dehaene I Anil K. Seth I Stuart Hameroff		
4:10pm - 5:00pm	break		
	EXEC BOARD ROOM	**SALON L**	**CORONADO**
	For details, see Concurrent INDEX on pages 26.		
5:00pm - 7:30pm **CONCURRENT SESSIONS 1-8**	**CONCURRENT SESSION 1:** **Knowledge, Argument, Explanatory Gap and Conceivability**	**CONCURRENT SESSION 2:** **Panpsychism, Idealism and Metaphysics 1**	**CONCURRENT SESSION 3:** **Agency and Mental Causation**
7:30pm - 10:00pm	**WELCOME RECEPTION / Bill's Grill, Cascade Terrace, Main Lobby Lounge, Patio; GRAND BALLROOM FOYER. Hors d'oeuvres. Light dinner / Cash bar.**		

WEDNESDAY MORNING, APRIL 27, 2016 | PLENARY SESSIONS 2-4

	KIVA BALLROOM
	For details, see Plenary INDEX on pages 23.
8:30am - 10:40am	**PLENARY SESSION 2:** **Brain Biology** Rudolph Tanzi I Selen Atasoy I Anirban Bandyopadhyay
10:40am - 11:10am	break
11:10am - 12:30pm	**PLENARY SESSION 3: KEYNOTE SESSION** **Consciousness and Reality** Deepak Chopra I David Chalmers
12:30pm - 2:00pm	break
2:00pm - 4:10pm	**PLENARY SESSION 4:** **Five Roads to Consciousness (2)** Naotsugu Tsuchiya I Richard Brown I Jakob Hohwy
4:10pm - 5:00pm	break

Tuesday CONCURRENTS Cont.				
SALON K	**SALON F**	**SALON E**	**SALON D**	**SALON J**
For details, see Concurrent INDEX on pages 27-28.				
CONCURRENT SESSION 4: **Neural Correlate of Consciousness (NCC) 1**	**CONCURRENT SESSION 5:** **Quantum Approaches**	**CONCURRENT SESSION 6:** **Time and Consciousness**	**CONCURRENT SESSION 7:** **PSI and Non-Locality**	**CONCURRENT SESSION 8:** **Meditation and Technology**

WEDNESDAY AFTERNOON, APRIL 27, 2016 | CONCURRENT SESSIONS 9-16

Wednesday CONCURRENTS			
	SALON J	**SALON K**	**SALON L**
	For details, see Concurrent INDEX on pages 28-29.		
5:00pm - 7:30pm **CONCURRENT SESSIONS 9-16**	**CONCURRENT SESSION 9:** **Phenomenal Consciousness**	**CONCURRENT SESSION 10:** **Panpsychism, Idealism and Metaphysics 2**	**CONCURRENT SESSION 11:** **Agency and Free Will**

WEDNESDAY EVE, APRIL 27, 2016 | POSTER SESSIONS & ART/TECH/HEALTH

	For details, see Poster INDEX on pages 35-39 and Art/Tech/Health INDEX on page 45.
7:00pm - 10:00pm	**P1 Poster sessions and A1 Art/Tech/Health Exhibits** are available to view during this 3-hour period – **GRAND BALLROOM FOYER, SALONS B & C**
9:00pm - 12:00am	**CLUB CONSCIOUSNESS / KIVA BALLROOM** Dorian Electra and Electrodes, Timbre Wolf

THURSDAY MORNING, APRIL 28, 2016 | PLENARY SESSIONS 5-6

	KIVA BALLROOM
	For details, see Plenary INDEX on pages 24.
8:30am - 10:40am	**PLENARY SESSION 5:** **Consciousness and Free Will** Aaron Schurger | École Polytechnique Fédérale | Lausanne
10:40am - 11:10am	break
11:10am - 12:30pm	**PLENARY SESSION 6:** **Artificial Intelligence / Machine Consciousness** Hartmut Neven | Christian Szegedy
	NO CONFERENCE SESSIONS UNTIL FRIDAY MORNING:

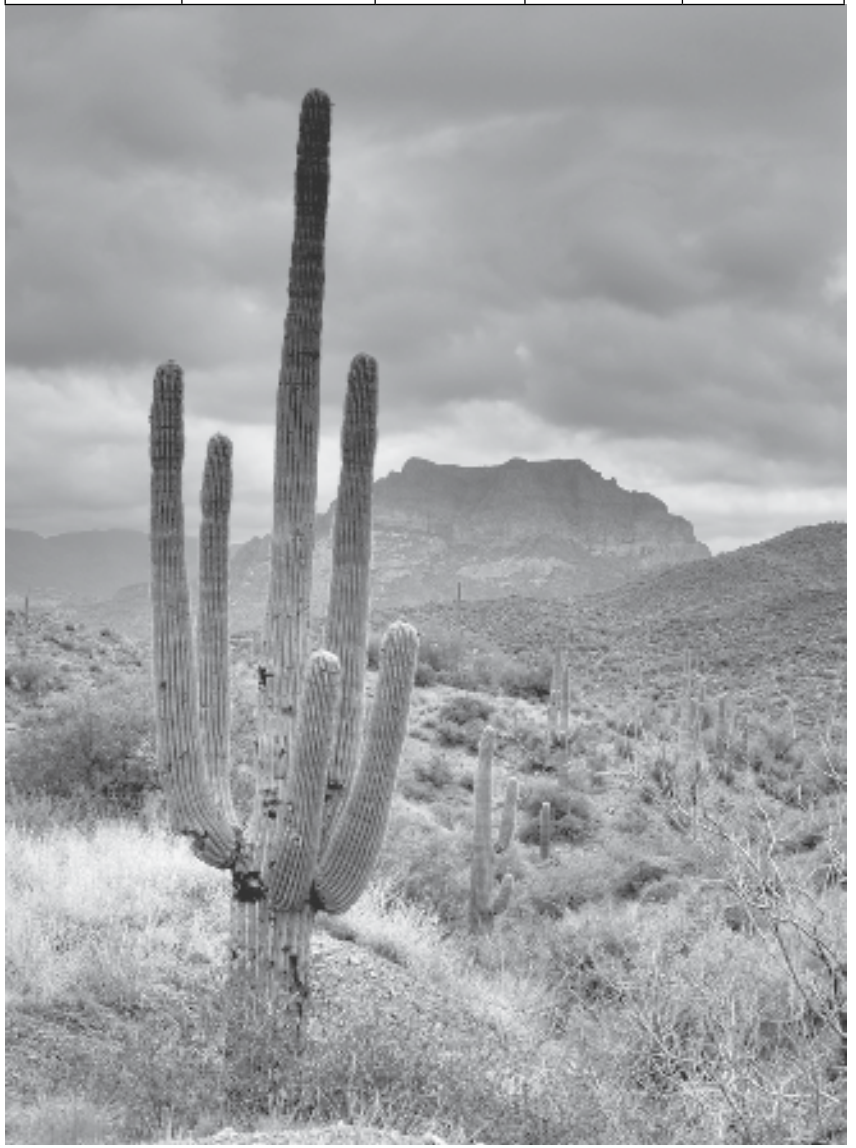
THURSDAY AFTERNOON, APRIL 28, 2016 | TENNIS TOURNAMENT

	LOEWS TENNIS COURTS
3:00pm - 5:00pm	**Tenniscentric TOURNAMENT** / LOEWS TENNIS COURTS Tennis balls provided by HEAD/Penn

THURSDAY EVENING, APRIL 28, 2016 | DINNER

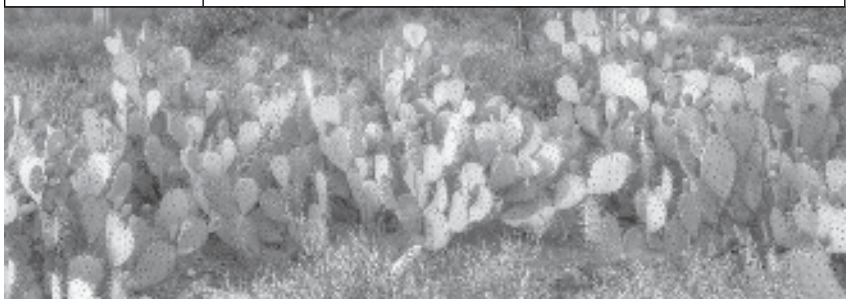
	KIVA PATIO
6:30pm - 7:30pm	**Optional DINNER 'UNDER THE STARS'** / KIVA PATIO Purchase Ticket for this Event at General Registration – based on availability Dinner, Dancing, Cash Bar Music by Michael P. and The Gully Washers

Wednesday CONCURRENTS Cont.				
CORONADO	**EXEC BOARD RM**	**SALON F**	**SALON E**	**SALON D**
For details, see Concurrent INDEX on pages 29-30.				
CONCURRENT SESSION 12: **The Extended Mind**	**CONCURRENT SESSION 13:** **Neural Correlate of Consciousness (NCC) 2**	**CONCURRENT SESSION 14:** **Vibrations, Scale and Topology**	**CONCURRENT SESSION 15:** **Cellular and Intra-Cellular Processes**	**CONCURRENT SESSION 16:** **Meditation 2**



FRIDAY MORNING, APRIL 29, 2016 | PLENARY SESSIONS 7-9

	KIVA BALLROOM
	For details, see Plenary INDEX on pages 24.
8:30am - 10:40am	**PLENARY SESSION 7:** **Quantum Approaches 1** Henry Stapp | Kelvin McQueen | Alyssa Ney
10:40am - 11:10am	break
11:10am - 12:30pm	**PLENARY SESSION 8:** **Evolution and Consciousness** Terrence W. Deacon | Katherine T. Peil
12:30pm - 2:00pm	break
2:00pm - 4:10pm	**PLENARY SESSION 9:** **'Pribram Session' Brain Dynamics** Anthony Hudetz | Walter J. Freeman | György Buzsáki
4:10pm - 5:00pm	break



FRIDAY AFTERNOON, APRIL 29, 2016 | CONCURRENT SESSIONS 17-24

	CORONADO	SALON L	EXEC BOARD RM
	For details, see Concurrent INDEX on pages 31.		
5:00pm - 7:30pm **CONCURRENT SESSIONS 17-24**	**CONCURRENT SESSION 17:** **Metacognition and Agency**	**CONCURRENT SESSION 18:** **Panpsychism, Idealism and Metaphysics 3**	**CONCURRENT SESSION 19:** **Unity and Self**

FRIDAY EVENING, APRIL 29, 2016 | POSTER SESSIONS & ART/TECH/HEALTH

	For details, see Poster INDEX on pages 39-44 and Art/Tech/Health INDEX on page 45.
7:00pm - 10:00pm	**P2 Poster sessions and A2 Art/Tech/Health Exhibits** are available to view during this 3-hour period – **GRAND BALLROOM FOYER, SALONS B & C**
9:00pm - 12:00am	**CLUB CONSCIOUSNESS / KIVA BALLROOM** Zombie Blues, Poetry Slam – Michael P and the Gully Washers

Friday CONCURRENTS Cont.

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SATURDAY MORNING, APRIL 30, 2016 | PLENARY SESSIONS 10-12

	KIVA BALLROOM
	For details, see Plenary INDEX on pages 25.
8:30am - 10:40am	**PLENARY SESSION 10:** **Scale and Connectivity** Alison Gopnik I Robin Carhart-Harris I Martin Monti
10:40am - 11:10am	break
11:10am - 12:30pm	**PLENARY SESSION 11:** **Quantum Approaches 2** Dean Radin I Stuart Kauffman
12:30pm - 2:00pm	LUNCH at a location of your choice
2:00pm - 4:10pm	**PLENARY SESSION 12:** **Anomalous Conscious Experience** George Mashour I Jimo Borjigin I Peter Fenwick
4:10pm - 8:00pm	FREE TIME
8:00pm until ???	**END-OF-CONSCIOUSNESS PARTY (KIVA Patio / Ballroom)** Food, Music, Cash Bar / Entertainment by Dorian Electra and the Electrodes

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PL 1 – PL 12

Tuesday, April 26 through Saturday, April 30
(PL1 Tues | PL2-4 Wed | PL5-6 Thurs | PL7-9 Fri | PL10-12 Sat)

Twelve Plenary Sessions, including one Keynote Session (PL3), will be presented this year at Loews Ventana Canyon Resort in the KIVA BALLROOM – Tucson, Arizona.

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PL3: Consciousness and Reality

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PL4: Five Roads to Consciousness 2

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There will be 24 Concurrent Sessions at this year's TSC2016. Concurrent talks are 20 minutes each, with 5 minutes for questions. There are five speakers persession, covering focused areas of the same theme. (LCD projectors and laptops available.)

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A1: Art/Tech/Health Exhibits

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- Patrick Palucki, Multistable Projection
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- Stephen Whitmarsh, EEG Synth

NOTES

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1.0 Philosophy

1.01 The concept of consciousness

1 Mary and the Concept Mastery Strategy Torin Alter <talter@ua.edu> (Philosophy, The University of Alabama, Tuscaloosa, AL)

According to social externalism, one can possess a concept not only in virtue of one's intrinsic properties but also in virtue of relations to one's linguistic community. Derek Ball argues that Burgean reasoning associated with this view undermines both the knowledge argument and a popular strategy for resisting it, known as the phenomenal concept strategy. Elsewhere I argued that (a) Ball's argument can be refuted by ascribing a role to concept mastery in understanding how Mary's knowledge grows when she leaves the black-and-white room (i.e., in understanding Mary's progress) and (b) failing to ascribe this role to concept mastery threatens to undermine two of the knowledge argument's main premises. Call that the concept mastery strategy. Ball has since argued that the concept mastery strategy cannot succeed. In this paper, I will defend and further develop the strategy, largely in response to Ball's criticisms. Along the way, I will discuss related arguments due to Gabriel Rabin. **C1**

2 From 'Physical' to 'Metaphysical': Heinrich Harrer's Seven Years in Tibet Within the Paradigm of States of Consciousness Supriya Baijal <supsthegrt@gmail.com> (English Studies, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Seven Years in Tibet (1952) by Tibetologist Heinrich Harrer (1912-2006) which simply begins as a mere journey to explore the Forbidden City, Lhasa towards the end becomes much more than a journey. Harrer's literary work is a gripping delineation of his skepticism, perplexity with frequent questioning of various aspects of Tibetan Buddhism. His journey becomes remarkable as it brings to light aspects related to re-incarnation and other religious beliefs of Tibetan Buddhists. The real journey of the writer to metaphysical consciousness begins when he comes in association with the Dalai Lama. The paper attempts to explore and analyse Harrer's voyage as a philosophical and spiritual voyage and locate it within the paradigm of altered states of consciousness. 'Altered States of Consciousness' are states in which the quality of experiences is significantly different from ordinary states of consciousness. It would situate Harrer's vacillations during his journey within the framework of different material and higher transcendental states of consciousness. The paper would re interpret this physical journey as something which results in the discovery of his Self to a great extent. An attempt will also be made to draw together some concepts of Hinduism and Tibetan Buddhism to throw more light on the concept of transcendental consciousness. **P1**

3 The Horor Theory of Phenomenal Consciousness Richard Brown <onemorebrown@gmail.com> (Philosophy, City University of New York, LaGuardia, Brooklyn, NY)

Higher-order theories of consciousness in general build on the idea that phenomenal consciousness crucially depends on a kind of inner awareness, which constitutes a kind of access to ones own mental life. First-Order theories, in contrast, explain phenomenal consciousness in terms of outer awareness. Traditionally this is cashed out as what is known as the Transitivity Principle, which can be put intuitively as the claim that mental states that we are in no way aware of being in do not count as conscious states. Recently we have seen higher-order theorists look for ways to go beyond the traditional transitivity principle. I will focus on the recent attempt to formulate a higher-order thought theory of consciousness that rejects the claim that the higher-order state makes some first-order state become phenomenally conscious. I have introduced the acronym HOROR, for Higher-Order Representation of a Representation, as a name for this kind of theory. The central claim of HOROR theory is that phenomenal consciousness consists in having the appropriate kind of higher-order thought, which itself instantiates a kind of inner awareness of one's own mental life. This is brought out clearly when thinking about cases where the intentional content of the higher-order state mischaracterizes the first-order states that one is actually in. If, for example, one has a first-order perception of green but has a higher-order thought with the content "I am seeing red" then what it is like for you will be like seeing red. This suggests that the higher-order state itself is phenomenally conscious, while the first-order state is state-conscious. State consciousness is a matter of which first-order state are in fact the target of the higher-order thought. Phenomenal consciousness is a matter of which states are like something for the creature to be in. HOROR theory is thus a variant of representational or intentional theories of consciousness. Truly first-order representationists, like Dretske and Tye, appeal to first-order representations of properties in the world as the ground for phenomenal consciousness. Consciously seeing red on this view is to have a representation that there is a red object in the environment. Higher-order theories of consciousness also appeal to a unique kind of mental representation, which is why the view retains some of the appeal of first-order theories. This higher-order representation is thought-like in having intentional content and assertoric force. And it represents oneself as instantiating first-order (world-directed) representations. The concepts that figure in these higher-order representations are the concepts of worldly properties and not of the qualitative properties. I represent myself as seeing red, the physical color that physical objects have, and in so doing I become aware of my first-order qualitative state, but as the kind of state that is accompanied by thoughts about blue objects. The explanatory force of the position comes from the representational/intentional content of this higher-order representation. It does not come from a relation that holds between the first-order state and the higher-order state. It comes instead from my higher-order thought attributing these states to myself. **PL4**

4 An Appendage Theory of Consciousness Keith Chen, Zhiyue Wang <cloudwrongmk@gmail.com> (Computer Science, University of Texas at Austin, Dallas, TX)

In the search for a satisfying theory of consciousness, a fundamental question is "just how scientific can a theory of consciousness be?" Many theories of consciousness make explicit claims about necessary physical substrates - a move that seems to bridge intuitions and assumptions about consciousness and empirical verification. But are these bridges satisfactory? I argue that the answer is "not really." Some of these bridges are not bridges, and they produce seemingly empirical theories that are really just science-y. I will also explore some key assumptions underlying current empirical theories and show that these theories are not empirical in the usual sense. To begin: 'run-of-the-mill' type empirical theories make some claims about the relationship between some set of phenomena that are observable - say, change in B follows change in A. However, theories of consciousness are a bit fancier, and I will differentiate and compare theories derived from 3rd-person intuition and those via 1st-person intuition. Theories from 3rd-person intuition: As paradigm cases of approaches from 3rd-person intuition, neural theories of consciousness (e.g., Zekman, Koch, Dehaene, Crick) propose that some neural activity A is the substrate of consciousness. However, neural activity cannot be interpreted in a vacuum. To say that A produces consciousness is really to say that A produces some pattern of behavior B that's intuitively judged to be suggestive of consciousness C. Here, the empirically verifiable claim is that B follows A. Where does C fit in? C appears to be a floating appendage in this testable claim about A and B. And just how much can C fit itself into test ability? It appears that so far as phenomenology eludes measurement beyond the form of report or other consciousness-suggestive behavior, C will remain an appendage - bridged by a 3rd-person intuition, i.e., an assumption. Theories from 1st-person intuition: A currently popular paradigm case here is the Integrated Information Theory. The theory begins with some claims about necessary physical substrates, then some statements of causal relations within this physical architecture. Claims about physical relations - empirically, at least - cannot begin in a vacuum. From where do these claims arise? The 1st-person approach begins with an intuition that relates some contents of awareness to claims about physical substrates: they begin with an intuitive appending of consciousness to measurable phenomena. How might one falsify this type of claim? The method of falsifying 1st-person theories must make reference to some measure of conscious, as consciousness is the phenomenon in question. The falsification of these claims, then, must follow the resolution of the problem of measuring consciousness empirically. If this holds, the appendage of consciousness via the 1st-person intuition produces circular, unfalsifiable claims. **P1**

5 **A Final Destination: The Human Universe** Deepak Chopra <carolyn@chopra.com> (The Chopra Center, Carlsbad, CA)

This session will discuss the seven universes that human beings have devised to explain existence, leading to the conclusion that the cosmos has evolved to reflect human evolution. This is not a philosophical observation but a "must be so" when it comes to such baffling dilemmas as the origin of life and the appearance of consciousness. The seven universes reflect human perceptions about reality itself. They are 1. The Divine Universe: The first universe was created by God or the gods, who served as the origin of life and mind. 2. The Classical Universe: The second universe was created and ruled by fixed laws of nature knowable through human reason. 3. The Relativistic Universe - The third universe, based on Einstein's General Theory of Relativity, preserved the unity of the classical universe but showed that a new spacetime geometry was necessary. 4. The Quantum Universe: The fourth universe was still ruled by laws of nature, but in place of constants a large element of randomness and probability was introduced. Einstein's attempt to preserve a unified scheme akin to the classical

universe was rejected. Because no one to date has been able to make the relativistic universe mesh with the quantum universe, an enormous mathematical guessing game began and still continues. There are many exotic universes that could be described, according to one's belief in theories such as steady state, eternal inflation, superstring, many worlds, the multiverse, M theory, and so on. All are mathematical in nature. They do not describe how reality actually works, although there's always the optimistic hope that theory and reality may match. Taken as a group, these theories all belong to the present universe, which is: 5. The Uncertain Universe, based on many equations, some critical observations, and huge expenditures of time and money to attempt to extract new data about the fabric of nature. On its own terms this universe has reached a dead end in that exotic phenomena like dark matter and energy, which exist subempirically, may constitute the bulk of creation yet lie beyond any kind of observation and experimentation. Uncertainty isn't a comfortable state to live with, so two other universes have recently cropped up. 6. The Conscious Universe, which is based on the notion that random events may not be enough to explain the exquisite fine tuning of the laws of nature and, more importantly, the rise of life on Earth. 7. The Human Universe, which is based on the undeniable fact that any universe is only knowable through the human mind's ability to think about reality. If all knowledge is rooted in human consciousness, perhaps we are viewing not the real universe but a selective one based on the limitations of the brain. This last proposition leads to the conclusion that the apparent evolution of the cosmos since the Big Bang has been parallel to, and totally dependent upon, human consciousness. We are the conscious agents who create reality in our own image. Although totally contradictory to physicalism, the Human Universe may be completely necessary if we have any hope of solving the remaining Big Questions concerning the inexplicable emergence of life and conscious beings in a cosmos that has no necessity to produce either. **PL3**

6 A Fuzzy Logic Based Framework for Measurement of Consciousness Quotient Ankur Das <adas.dei@gmail.com> (Electrical Engineering, Dayalbagh Educational Institute, Agra, UP India)

Consciousness is an enigma that is as difficult to define as it is to quantify. In recent past, it has been considered to be comprised of the following seven dimensions for determining the value of overall Consciousness Quotient - Physical, Emotional, Cognitive, Spiritual, Social-Relational, Self and Inner Growth. In this paper, factors that contribute in varying the value of each of these dimensions are defined. The contribution of any factor towards a dimension of an unquantifiable entity such as consciousness in this case, can be viewed to be dependent upon the following three variables: First, its relative importance (or weightage) vis-a-vis other factors, i.e., the extent of change that it can bring about in that dimension of consciousness and eventualy in the overall Consciousness Quotient. Therefore, if the relative importance of a factor is high, it has higher potential of causing a significant change in the CQ, even though it might presently not be exhibited in a considerable amount. Second, a factor's present manifestation level in the individual, i.e., an assessment of the state in which it presently exists. Accordingly, if the current level of manifestation is low, it will require a commensurately large change in its present state in order for it to bring about an increase in that dimension and correspondingly in the overall Consciousness Quotient. Third, the state change efficiency for a factor, i.e., a measure of the efficiency with which its manifestation level in the individual can improve. A factor possessing a high state change efficiency can transit from a low to a higher level with a relatively low effort level expended in the process. This paper presents a novel fuzzy logic based approach for measuring consciousness that exploits linguistic variables for quantifying the contribution of factors affecting dimensions of consciousness. Towards this end, such factors are identified and a framework, for measuring their contribution for their respective dimensions in order to compute the Consciousness Quotient, is given. **P1**

7 Probing or Priming? an Xphi Re-Evaluation of the Knowledge Argument Craig DeLancey <craig.delancey@oswego.edu> (Philosophy, SUNY Oswego, Oswego, NY)

The canonical arguments that consciousness cannot be explained by something like contemporary physical theory each rely upon a thought experiment. Results from a survey of several hundred subjects reveal two reasons to re-evaluate these arguments. In the experiment, 300 subjects were presented a simplified version of the Knowledge Argument. Subjects were students who were not philosophy majors, who had not taken a course in the philosophy of mind, and had not learned of the thought experiment before. After the presentation, subjects were asked several questions. For most subjects, one of these questions included an interpretation of the thought experiment. After this, students were asked to choose between four interpretations of the thought experiment. These were: – [a] A red experience is something we use to get around in the world, like being able to walk or ride a bike, and scientific knowledge gives us facts not skills. – [b] A red experience is too complex for someone to learn what it is like from just reading neural science textbooks, lectures, and the other kinds of things scientists typically learn from. – [c] A red experience is not a thing that interacts with the physical world, and sciences only explain interactions between physical things. – [d] None of the above (there is another reason not listed above). (The order of the first three options was randomized across questionnaires.) Subjects were significantly more likely to choose the primed interpretation (the interpretation suggested in an earlier question) compared to controls (who were not previously exposed to an interpretation). This result shows that the interpretations of thought experiments can easily be shaped by the way the thought experiment is presented. For example, in his paper "Epiphenomenal Qualia," Frank Jackson first states that his thought experiments will show that qualia are not physical information. Such a claim can influence readers to find this a more plausible interpretation of a thought experiment when it is then presented. A corollary result is particularly relevant to the study of consciousness. In Jackson's thought experiment, Mary has learned all the relevant science about color vision without ever having seen color. Subjects who agreed that Mary learns something new when she first sees a color had to choose between the four interpretations above. Choice [c] is Jackson's own interpretation. Choice [a] is an example of an attempt to save physicalism with an ability approach. However, both control and primed subjects overwhelming preferred choice [b] to these other interpretations; even those primed for another interpretation were most likely to choose interpretation [b]. But this is overwhelmingly the least common interpretation expressed in the literature about consciousness. Thus, the claims of philosophers as to what is obvious, or what is likely to be believed (unprompted) by others, are not reliable in this context. This especially casts doubt on those two-dimensionalist approaches in which it is claimed that thought experiments can reveal a meaning that must be explained by any physical theory. **C1**

8 Introduction to Metacomputics Simon Duan <simon.x.duan@live.com> (Metacomputics Labs, London, United Kingdom)

The simulation hypothesis that describes the universe as the output of a simulated reality exercise has been receiving increasing acceptance through popular culture such as the movie The Matrix and has also been taken seriously by increasing number of philosopher, computer scientists and physicists. Suppose the universe is a computer simulation, the following questions remain to be answered - Where is the computer? Where does it come from? How is it built? What are its properties? Who is the programmer? The metacomputics model is proposed to address these questions. Metacomputics is the systematic study of the origin, fundamental structure, composition, nature, properties, dynamics and applications of the Metacomputation System that constructs and operates the universes as its processing output. In this model Consciousness is assumed to be the source of all existence and is defined as the potential power to conceive, to perceive, and to be self-aware. The content of Consciousness is a 3-tier hierarchy structure (Unity, Duaity, Trinity) that gives rise to the platonic metacomputation system (MS). This MS consists of three faculties (data, program and processor) that construct and operate the processed existence. In this model, the platonic clock in the absolute space time is derived by descending from unity to duality state of existence. The platonic clock regulates the speed of computation in the platonic computer. Platonic time is described as one directional perpetual progression of the pixel square wave in the screen of the platonic computation system grid that is composed of cells of potential and projected power of consciousness. Future is represented by the parts of the pixel square wave that are moving towards but have not yet arrived at present moment; Past is represented by the parts of the pixel square wave that have moved away from present moment; Present moment is the moment when switching and therefore computation takes place. Thus there is a fundamental asymmetry between past (processed data) and future (unprocessed data). Due to computational irreversibility, platonic time has directionality and cannot flow backwards. The platonic clock that regulates the platonic computer is primary. Physics conception of time is secondary as it is derived from measuring relative movement of objects that are output of the platonic computation. The relationship between the primary and secondary times can be established by physics experiment. According to this model multiverse is composed of many parallel levels of creation. Each level of creation is constructed from parallel platonic computers operating at different platonic clock speeds. Time dilates when ascending from lower to higher levels of creation. The platonic computer that constructs the physical universe has at least 4119 bits memory. The proposed MS model predicts that the fundamental building block of the physical universes is powered voxel in the constructed 3D space. The metacomputics model offers a new perspective and clarity on many important concepts and phenomena that have perplexed humans for millennia, including: consciousness, existence, creation, time, space, multiverse, reality, laws of nature, language, entity, mind, experience, thought, feeling, emotion, sensation and action. **P1**

9 Informational Subsystems of the Consciousness Florin Gaiseanu <florin.gaiseanu@techemail.com> (Bucharest, Romania, Bucharest, ROMANIA Romania)

Based on the observation of YES/NO dualism of our decisions on any informative context, it is shown that information determines actually our life and species evolution by adaptation for survival. Therefore, it is defined the info-creational field and thought as an information operator on this field, allowing to describe the individual I as a receiver and producer information system, as follows: I = I(informed matter) + I(info-programmed) +I(info-operational) (1). We can therefore define ourselves as informational entities (the I), composed by informed matter IM (physical body), connected with the Operative Information System (OIS = (CASI) + (CDC)), able to elaborate the attitude (information output) and execute the orders for adaptation, and with the Programmed Information System (PIS) to support mainly the functionality of the physical "hard" (IM), as an integrated system. We suggestively defined as Center of Acquisition and Storing of Information (CASI) all brain areas contributing to the acquisition, operation and storing of information as a database library and also the Center of Decision and Command (CDC) as the sum of all brain areas responsible both for the information processing/elaboration of the decisions, and for order transmission to the executor centers. We are a bio-complex unit equipped with a bio-computer (hard) plus an info-creational system (software) - part of it as the subconscious (PIS) component, represented by the information of specie gathered from the previous generations plus personal experiences during the lifetime - and another component as the conscious subsystem, playing an active role to gather/process information by (OIS). The input information could be disseminated by two ways: (i) as attitude, which is the reaction to the input received information; (ii) by genetic transmission, assuring the reproduction of the specie: Info Input -> [(CASI) -> (CDC)] <=> [PIS] <=> [IM] -> Info Operational Output (=Attitude) (2) (Input info) -> (OIS) -> (PIS) -> (IM) -> genetically informed matter -> Genetic transmission (=Info genetic output) (3) Consciousness appears thus be an information system which allows the adaptation to the environment and survival of species, supported by informed matter (physical body) to maintain functionality of the whole. Detailing, the personal I could be described as: I = I(created) + I(create) + I(am) +I(love) + I(want) + I(think) + I(believe) (4) I(created) represents the genetic info-programmed subsystem, I(create) is the creation subsystem, mainly contributing to the genetic transmission (3), I(am) is the part detecting our personality and status, I(love) is the emotion subsystem, I(want) is a main contributing subsystem to the circuit (2) (attitude), I(think) is the analysis and decision subsystem, and I(believe) would be the system of the moral structure values communicating with the high spiritual survival aspirations. The output in (2) with effect in (3) by a long-time repetitive process is a result of a contribution of each subsystem of (4), supported by the informed matter. It is suggested that the consciousness could be supported by the antientropic properties like that of antimatter (Gaiseanu, Phys.Consc.Life Cosm&Astrophys. J., 1, 2016). **P3**

10 Modes of Material Nature: A Mathematical Model of Consciousness Based on Eastern Philosophical Traditions Mauricio Garrido <mgd@bigainesville.org> (Columbia University, Professional Studies; Bhaktivedanta Institute, Gainesville, New York, NY)

Consciousness is postulated by some to be a fundamental entity (Chalmers, 1996). As such, how is it affected by and how does it affect the world around us? Eastern philosophies such as Vedanta and Sankhya hold that consciousness is fundamental and explain its interactions with matter in terms of the modes of material nature, or gunas, which act as both consciousness filters and the make-up of matter itself. Dasgupta (1961) describes the gunas as ?the universal characteristics of all kinds of mental tendencies? (p. 468). According to the Bhagavat Purana, on one hand all material elements are infused with the gunas. And on the other hand, our psycho-physical disposition consists of mixtures of the gunas (Prabhupada, 1976). Thus, more than just a personality indicator to describe an individual's behavior - such as the Myers-Briggs Indicator (Langton & Robbins, 2007) - or perceptual sets that are created by motivation (Coon & Mitterer, 2008), the gunas have an important ontological status in the metaphysics of Vedanta and Sankhya. Although there have been studies on inter-guna correlations (Das, 1991 and Pathak et al., 1992), only until recently has a fully statistically-validated, quantitative tool been developed to assess them individually (Wolf, 1999 and Stempel et al., 2006). This tool has been used in meditation studies (Schmidt & Walach, 2014) and speech rehabilitation (Caturvedi, 2000). We now present a mathematical model of the gunas that aims at understanding the results of some of these studies, which use the tool developed by Wolf to quantify the gunas. A delineation of the different characteristics that make up the different mental faculties according to the Bhagavad Gita and Bhagavat Purana is presented to create interacting modules. The states of this machinery are then linked to the gunas and dynamics are included in this state-space. Finally, the results from some of the studies that involve guna theory are explained using this model. **P2**

11 Realization of Consciousness or the Process of Becoming Conscious About Consciousness Tatiana Ginzburg <putevoditel@gmail.com> (Game Master's School, Saint-Petersburg, Russian Federation)

Man structures the World through his consciousness. It allows us to create descriptions and rely on them in making free choices. However what if the consciousness is fundamentally more complex than our ability to describe it? The metaphor: A stone falls into the center of a square pond. Stone's splash creates waves spreading from the center to the square walls of the pond.Each wave reaches the walls and reflected goes back colliding with the coming in waves.The waves' interference creating very intricate shapes. The simple concentric arrangement of the original waves is not obvious anymore. Some of them suppress, some reinforce, some interference creating the more and more complicated picture. Different waves reach the center, others being reflected cross and intersect causing a new stage of reflection, reaching the borders again and creating new and new cycles.The picture becomes more and more complicated, and the same time it is being symmetrical. The complexity emerges. And each and every interaction of somewhat with something creates the new level of complexity. Now imagine it on a scale of universe ... The universe is heterogeneous, pulsing, rippling, appearances smashed into smithereens.. and, all that in non-stop transformation, and all that creating fluctuations. The fluctuations are taken from the chaos that is Eternal Maybe the world is so complex and diverse that - it's chaos? Chaos is commonly understood as the absence of order. Let's for a moment image chaos being the antithesis of cosmos and not merely absence of order. There are systems in Cosmos that one can observe as order; such objects as nodes and connection between them emulate order/pattern. Chaos - is supersystem. The supersystem is so complex that it is beyond our ability to recognize the order in it. The complexity of the supersystem makes us halt scrutinizing its intricacy; we do not have sufficient sensibility? It could be presumed that there is overwhelming level of complexity, which one tends to call chaos; the chaos which still contains all kinds of order. There is no order, which could be immobilized therein to live in it. And this is the paradox that is generated by me, as a consequence of speech (of me talking?) I can express this as follows: Everything there IS; Even what there is not - there IS Thus, we arrive at a new model of consciousness - the model that spatters beyond description... Therefore we come to the new model of consciousness - splashing over the description... **P2**

12 Evolution and The Mystery of Consciousness Mayuri Gogoi <mayurigogoisingh@yahoo.com> (Philosophy, I.P.College For Women, Delhi University, New Delhi, Delhi India)

Although we are close to consciousness like nothing else, yet, there is nothing is as baffling as it is. What makes it appear mysterious is our failure to understand the mechanism by which neurons that are physical entities produce subjective feelings. There are many like McGinn who has acknowledged a kind of 'cognitive closure' regarding consciousness. It is actually surprising to find such outright admittance by many about the impossibility to unravel the mysteries of consciousness, insisting that there are limits to our power of understanding. But do we need to fall back on such desperate solutions? In this paper, I will try to throw light on the conceptual errors because of which we have not been able to demystify consciousness. It may be because of the faulty way in which we have started asking the question itself. Since the pre-Socratic days thinkers have formed the habit of asking 'What basic staff the whole world is made of?' There has been an over-emphasis either on consciousness or bodily identity. Because of excessive leaning on one aspect of reality rather than considering it as a whole that we have not been able to come across a single satisfactory evaluation. If one starts from such misbegotten assumptions, than, it will definitely lead to a network of problems. One should be wary of labelling something as a deep mystery. We generally project the knots in our understanding of the concept of consciousness and thereby imagine it to be deeply mysterious. There are some conceptual entanglements that stand as an obstacle in our knowing consciousness. For this I will try to apply Wittgenstein's advice of taking the whole picture into consideration to know what reality is like rather than taking about it in parts. What seems to be desirable is to leave the Cartesian shadow land and seek out the Aristotelian sunlight, where one can see much better. The unit should not be an abstracted body or the brain but the whole living person. One way of demystifying consciousness involves showing that physical and mental items are suitable to each other. The best evidence of this can be found in the theory of evolution. In due course of time because of the ongoing process of evolution, many complex abilities happen to a sentient being. As the biological constitution becomes more and more complex, more and more forms of apprehensions, responses and reactions becomes possible. There is nothing mysterious about it. We now have reasonably good answers to such questions, although, there is a lot more for us to know about the neural processes which are responsible for it. This has added fuel to the mystery element. What we need to understand is that there is a need

to re-evaluate the whole picture. The gulf between the brain and consciousness is an illusionary one. On the contrary, it would have been profoundly mysterious if no neural processes were required for an animal to be endowed with consciousness. **P1**

13 Chalmers Hard Problem Extended to Individual Sense Organs Franz Klaus Jansen <jansen.franz@orange.fr> (Assas, France)

Mental functions comprise global perception, memory imagery and neutral reflection. Global perception is composed of elementary sensation by all sense organs and stimulated reminiscence of linked memory episodes. Chalmers hard problem concerns the phenomenology of global perception and memory imagery, which contrast with neutral reflection. The phenomenology of seeing red in global perception is completely different from the abstract concept of a physical wavelength of 700 nm in neutral reflection and cannot be reduced to it, thus there is a profound phenomenological gap. However, there are other phenomenological gaps, since similar gaps can be found when comparing different sense organs with each other. Seeing and hearing a bell can be easily separated at the television screen. Only seeing the bell gives no indication on its sound and vice versa a sound alone cannot represent the visual form of the corresponding bell. This confirms a profound phenomenological gap between sense organs. One sense organ cannot be reduced to another, nor can it be replaced by any other, in a similar way as seeing red cannot be reduced to a physical wave length. In neuroscience seeing and hearing are represented by highly specialized brain regions, seeing is represented in the primary visual cortex of the occipital lobe and hearing in the primary auditory cortex of the temporal lobe. Similar gaps can be found for sense organs in the skin activated when touching a bell, such as the perception of hardness, of heat or vibration. Touching experience is represented by brain regions in the primary somatosensory cortex in the post central gyrus of the parietal lobe. Thus the localization in different brain regions correlates with a different phenomenology of sense organs. Neutral reflection allowing categorization, association, structuring and conceptualization is also localized in a different brain region, the prefrontal cortex. Seeing red can be categorized to the concept of a color, but the simultaneous presence of the phenomenology of red would disturb the category color, since other colors are simultaneously concerned. Thus the category color has to eliminate the phenomenology of red for covering all the other colors. When further reducing color to physical wavelengths, even the notion of color has to be replaced by physical notions. Thus abstraction to concepts in the different brain region of the prefrontal cortex also creates a profound gap to sense organ phenomenology, constituting the hard problem. Concepts behave like mirrors for sensory organs, since the abstract concept of seeing or hearing represents the action of sensory organs but without the corresponding phenomenology. Neutral reflection can mentally compare an abstract concept to global perception and memory imagery, which shows the great gap induced by the presence or absence of sense organ phenomenology, which characterizes the hard problem. Since the phenomenological gap between all sense organs can be attributed to their different brain localizations, the gap between perception and imagery of red versus neutral reflection of a wavelength might also be due to the same reasons and explain part of the hard problem. **P2**

14 A Unified 3d Default Space Consciousness Model Combining Neurological and Physiological Processes that Underlie Conscious Experience Ravinder Jerath, Molly W. Crawford; Vernon A. Barnes <rj605r@aol.com> (Augusta Women's Center, Augusta, GA)

The Global Workspace Theory and Information Integration Theory are two of the most currently accepted consciousness models; however, these models do not address many aspects of conscious experience.We compare these models to our previously proposed consciousness model in which the thalamus fills-in processed sensory information from corticothalamic feedback loops within a proposed 3D default space, resulting in the recreation of the internal and external worlds within the mind. This 3D default space is composed of all cells of the body, which communicate via gap junctions and electrical potentials to create this unified space. We use 3D illustrations to explain how both visual and non-visual sensory information may be filled-in within this dynamic space, creating a unified seamless conscious experience. This neural sensory memory space is likely generated by baseline neural oscillatory activity from the default mode network, other salient networks, brainstem, and reticular activating system. **P2**

15 Si Based Approach to Explicate Consciousness Garima Kapur <kapur.garima@gmail.com> (Physics and Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Consciousness is being studied and defined by various physicists, biologists, philosophers, neurologists, psychologists and theologists throughout the world. Cosmology of one's consciousness has uniform correspondence with the cosmology of universe (Discourses of Radhasoami Faith, 1909).

In other words, consciousness is something which exists in every living cell, which within brain decides a particular solution from multitude of solutions, and has some foundation in universe. With reference to W.F.Kruger's 'An Adaptive WTA (winner-take-all)' circuit, which allows multiple winners in the network and can be controlled with state of consciousness in brain, we would like to explain the state of consciousness in brain. In Si using floating-gate MOS transistor synapse technology electron store information (i.e., charge) and support quantum computation within the electronic components (electron injection (addition) and electron tunneling (removal) across the floating gate), which in turn with feedback can introduce self correction feature or adaptation in circuit. In the same way, consciousness is present within every living cell (in brain) and being utilized to control the functions or operations of the brain. We have simulated the adaptive WTA circuit using BSIM3 level49 MOSFET models in T-Spice 0.35'm CMOS process and emulated that the after attaining state of consciousness the visual brain perception can be controlled. Hence, with reference to study on consciousness I would like propose that consciousness is a state or condition which can be attained or in other words need to be attained to answer all the unanswered questions of science and religion. **P2**

16 Partially Unified Subjects and Masrour's Theory of Conscious Unity Bernard W. Kobes <kobes@asu.edu> (Philosophy, Arizona State University, Tempe, AZ)

Farid Masrour, "Unity of Consciousness: Advertisements for a Leibnizian View" (2014), presents a clear account of phenomenal unity as emerging from experiences of specific relations. E.g., I hear birds singing, and I feel elated; these two experiences are phenomenally unified in virtue of my experience of the singing as the cause of my elation. Experiences are phenomenally bound in virtue of experiences of specific relations that connect them. Experiences of relations form chains and networks of connected experiences. The theory explains phenomenal unity in an ampliative way, in terms of something other than primitive unity. It treats synchronic and diachronic phenomenal unity in a uniform fashion, and it implies a "federal" cognitive architecture in Tim Bayne's sense, in that local centers are minimally connected. Despite these attractions, I will argue, Masrour's theory fails to explain the sense in which split brain subjects may have phenomenally disunified conscious experiences. I propose an emendation of Masrour's theory on which chains and networks of experienced relations may to a greater or lesser degree include further experienced relations that "jump" links in the chain or network. The emended theory gives the needed account of split brain disunity; it also yields a sense in which subjects may be consciously unified to varying degrees. Further, the theory suggests a novel sense in which phenomenal states are conscious to the degree that they are present to a subject. **C19**

17 From Correlation to Causation: The Pluralist Way Crystal L'Hote <clhote@smcvt.edu> (Philosophy, St. Michael's College, Vermont, Burlington, VT)

Causal pluralism is the umbrella view that causation is not a single kind of relation or connection between things in the world" (Godfrey-Smith 2010), that, for instance, causation might be legitimately understood probabilistically, mechanistically, and/or counterfactually, depending on the empirical context. Causal pluralism thereby makes more palatable the possibility that correlation is (only sometimes) causation, and that evidence sufficient to establish a correlation is (only sometimes) also sufficient to establish causation. Is causal pluralism viable, and to what extent can it bolster the claim that neural activity that is reliably correlated with consciousness is also its cause? I identify several desiderata. This talk engages the work of Cartwright (2004), Williamson (2006), and Reiss (2011), among others. **C10**

18 Consciousness - The Fifth Dimension Oded Maimon <maimon@tau.ac.il> (Tel Aviv University, Tel Aviv, Israel)

The fifth dimension extends the known power set, which present all the currently known possibilities of a set. It is the consciousness dimension that is the essence of the set. We introduce and develop the Unity operator of all the members, which is generated from the members of the set. The Unity operator is also (and at the same time) the generator of the set members. The members are the incarnation of the essence, which are easier seen and felt. For example for two parties which hold opposite opinions there are four possibilities: The null set (none of the above, or ignoring both), justifying one of the sides, or both (which is a conflict state that may never be resolved). The Unity operators produces a different option that results from the two opposite opinions, and contain both! We show how this operator work in sacred geometry, in psychology (peace within conflicting opinions inside a person) and in society at large. **P1**

19 Six Sigma Spirituality - An Eastern Methodology Gazal Mathur, Sohang Mathur; Bhakti Mathur; Mrityunjay Mathur <gizzymathur@gmail.com> (Consciousness Studies, Dayalbagh Educational Institute, Mumbai, Maharashtra India)

This paper addresses the need to engage with the internal without defacing the external. It offers a methodology by which one can come full circle - realize higher dimensions and as seen from the Eastern philosophical perspective. Six Sigma is a concept that may prove significant in our endeavor. It has proven useful in the business arena as it seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability. We aim to adopt this time tested method and label it as the: 'DHARMA' Methodology (Each parameter will be elaborated upon further in this paper) 1. Defining in order for us to perfect our spirituality, we must first define it. Now, this may prove to be a challenging task from the onset as spirituality has been defined in a myriad of ways. We may all agree that it is derived from the root word spirit. The spirit is an entity which is not comprehensible by our obvious senses (sight, touch etc.). Thus, this necessitates the awakening of another sense or higher level of consciousness. Morality alone would not be sufficient to awaken this consciousness. Spirituality aims at a purification of one's inner self and an ultimate merging with the Universe or as some may define it, with God. 2. Hearing Yourself - this entails a phase of introspection. One may question - "What is holding me back from spiritual purification". The ensuing response would be a number of vices. Indian Philosophy refers to them as Kaam, Krodh, Lobh, Moh and Ahankaar (lust, anger, greed, attachment and ego). It is also the removal of our understanding of - I - and the recognition that the 'We' is actually 'I'. 3. Analyze - once we have recognized the deviants - what are the tools required to cleanse them. This would necessitate an internal as well as external commitment. Seva (service), Satsang (brotherhood) and Sumiran Dhyan (meditation) may be the prescribed course. 4. Remedy - the above course may be further broken down into actionable plans. Each sphere would require intrinsic modifications (humility, concentration, meditation) as well as the creation of a suitable external environment (peaceful, environmentally sound yet creative and ethical society) or succinctly - better worldliness. 5. Monitor - Once we tread on this remedial path, we may be able to monitor our progress. As we begin to imbibe the requisite behavioral qualities - we may witness an incline in our intuitive capabilities. This may actually work as proof of our progress. 6. Adopt - the final stage is a permanent adoption of all these processes and will eventually lead to the awakening of a higher awareness. The mysteries of the universe may no longer remain an enigma. Thus in this paper we aim to bridge the gap between the social and the self as well as scientific with spiritual. By creating a prescribed methodology, we create a gradual gradient for ourselves which, with constant monitoring, will lead to the creation of a 'complete man.' **P1**

20 The Biofield Anatomy Hypothesis Eileen McKusick <emckusick@gmail.com> (Biofield Tuning Institute, Winooski, VT)

Eileen Day McKusick has spent the last 20 years bouncing sound, like sonar, off the human body and the area around it. She has discovered a mathematical pattern around the body that is the same in everyone - a sort of binary storage system that appears to be the record or memories of a person's lifetime, stored acoustically in what appear to be standing waves within the biomagnetic field, or biofield of the body. The microtubules on cell membranes may serve as antennae that both read and broadcast these waves. Eileen is the originator of a sound therapy method called Biofield Tuning, the founder of the Biofield Tuning Institute (Burlington VT and San Diego), and the author of the best-selling book, "Tuning the Human Biofield: Healing with Vibrational Sound Therapy" (Healing Arts Press, 2014). She is currently at work on a PhD at the California Institute of Human Science where she is seeking to create instrumentation to test her hypothesis, and in doing so, potentially reveal the existence of consciousness outside the human body. McKusick's increasingly busy therapeutic practice led her to work with thousands of people over the course of two decades, a process which revealed what she calls "The Biofield Anatomy": a precise map of mind and memory that details where specific memories, emotions, relationships, and more are stored. Just as the brain is compartmentalized with different areas responsible for different functions, so is the human biofield. McKusick has found that traumatic memories exist as "pathological oscillations" within this field, and that a simple tuning fork can be used to both locate and modulate these frequency patterns, leading to the immediate and often profound resolution of a wide variety of symptoms. McKusick has taught this method to hundreds of students who are able to use this map to produce the same kind of outcomes in their clients. Essentially the process seems to reduce the "noise in the signal" of the acoustic and electromagnetic systems of the body. Eileen's curiosity about the nature of the both the information and energy she was encountering in her practice led her on a research journey to understand and explain and also test her findings. In doing so, she has brought together frontier Biofield Science, Electric Universe Theory and esoteric tradition to form an intriguing and revolutionary perspective on mind, memory, and cosmology. Learn more at www.biofieldtuning.com **P2**

21 Toward a Uniform Vocabulary of Subjectivity Bill Meacham <bmeacham98@yahoo.com> (Earth Harmony Inc., Austin, TX)

Ambiguity pervades language about consciousness and subjectivity. To counter it, this paper proposes a common terminology. An operational definition is given of the term "subjectivity," and from that standpoint usages of the terms "experience," "consciousness" and "awareness" are proposed. The approach is both phenomenological in the tradition of Husserl and analytic in the British tradition, attempting to clarify terminology used to discuss what is found in investigations of consciousness. **P2**

22 Yoga-Meditation-Pranayama and Music are Safe, Ideal and Powerful Therapeutic Tools to Boost Immune System, Enhance Memory, Cognition and Uplift Individual Consciousness Levels to Universal Shyamala Mruthinti <mruthsh@gmail.com> (Datta ImmunoChem Inc., Mableton, GA)

Tremendous progress has been made in science and technology in unraveling several scientific discoveries, using sophisticated instruments and modern technologies. Majority of current treatment methods used by conventional medicine are targeted against specific disease causing genes, proteins, neurochemicals, anti-inflammatory agents etc. Despite of rapid increase in number of hospitals, doctors, and new drugs introduced into niche market every day; patient numbers have been increasing rather than decreasing. Given the situation, an alternative holistic approach of treatment incorporating Yoga-Meditation-Pranayama and Music might be more effective in combating various diseases compared to traditional medicine alone. We are 3-Dimensional figures encompassing Body-Mind-Spirit, which are intricately connected, cross-talk, co-influence and uplift each other and harmonizing these 3 states is crucial for health of body and mind. We mistake mind as an organ and anticipate to cure the disease of the mind with drugs which are geared towards certain neurochemical imbalances. Mind is not an organ nor is limited to our body and brain, but mind is equated with consciousness, a subjective sense of self-awareness. Mind is the powerhouse for memory, cognition, creativity, intelligence, learning, rationalism, self-awareness etc. Stress, depression, anger and negative thoughts alter certain genes, protein leading to certain chemical imbalances in the brain tissue and loss of synaptic connections. Thanks to few eminent scientists, doctors, philosophers and religious leaders who have brought the significance of mind-body-consciousness into the field of neuroscience. An eminent astrophysicist, Dr. Neil de Grasse Tyson, quotes thus: The good thing about science is that, it's true whether or not you believe in it. It is not that we are better than the universe, we are part of the universe. We are in the universe and the universe is in us. Upanishads says: as is the human body, so is the Cosmic body, as is the human mind, so is the Cosmic mind, as is the microcosm, so is the macrocosm, as is the atom, so is the Universe. Meditation, Yoga and Music enhances immune regulation, neurotransmission and renders positive effect on mental, physical and emotional states. For children with attention deficit hyperactivity disorder known as ADHD, music therapy improves attention and focus, reduces hyperactivity, and builds social skills. According to Yoga, there are 72,000 nadis (nerves) in our body. Our brain has billions of neurons which are tightly wired through synaptic connections and they are well coordinated similar different instruments synchronizing in symphony of orchestra. World famous music therapy healer composer, yoga master; Shri. Ganapati Sachidananda Swamiji of Mysore Ashram has composed > 5,000 musical tunes specific for each disease type and has cured several diseases using novel musical compositions. (www.healingmusictherapy.com and www. nadaragasagara.org). His musical tunes have helped several coma patients, autistic children and other cognitive related disorders and cancer patients. In summation, healthy mind is healthy body and not vice-versa. Meditation-Yoga-Music are powerful tools in channeling Cosmic energy to every cell and neuron; to correct, re-wire and repair allowing the natural cure and healing to occur and experience unbound love, peace and joy within! **P2**

23 Bayesian Information-Theoretic Surprise (Bits) Theory of Attended Access and Phenomenal Consciousness in Bayesian Hierarchical Predictive Processing Framework Anatoly Nichvoloda <nichvoloda@yahoo.com> (Philosophy, Graduate Center City University of New York, Boonton, NJ)

In my presentation I outline a basic structure of a theory of perceptual consciousness with a working title of "Bayesian Information-Theoretic Surprise (BITS) Theory of Attended Access and Phenomenal Consciousness." Starting with Bayesian Hierarchical Predictive Processing (BHPP) framework from Andy Clark and Jakob Howhy's influential treatment of it as a computationally feasible account of perception, attention and consciousness, I suggest to re-conceptualize the framework as a special

case of Claude Shannon's Information Theory of Communication. Specifically, Information-Theoretic construal of BHPP framework identifies the error between an original prediction and an actual outcome of an observation as a certain amount of information gained by the system. Since the suggested Information-Theoretic construal of BHPP framework has engineering roots, it carries an essential requirement of a clean functional separation between representation units and error units that the system operates upon. I argue that functional roles of these units of representation correspond to the distinct functional roles that Ned Block and David Chalmers assign to Access consciousness and Phenomenal consciousness.According to this construal, to the extent that the system correctly predicts the causal structure of the world, that content can be said to be accessed by the system. In other words, the intentional content that both the top-down (efferent) signal and bottom-up (afferent) signal share (as measured by Mutual Information) is poised to be used by the system for further cognition and guiding of behavior because this content correctly represents the causal structure of the world (Access consciousness). Phenomenal consciousness, according to the Information-Theoretic construal of BHPP framework, arises when the difference (error or BITS) is observed by the system in the process of comparing the initial prediction (top-down efferent signal) and modulated prediction (bottom-up afferent signal). I suggest that qualitative properties arise due to the error being instantiated as a difference between two physical magnitudes (e.g. two different voltage values) that serve as symbols in predicted and observed signals in the context of the functioning of the Bayesian Information-Theoretic Predictive Processing framework. The essential feature that makes this difference possess qualitative properties (vs. other kinds of differences) is that it performs a function of information (reduction of uncertainty) in the context of functioning of Shannon Communication Channel. Further, following Andy Clark and Jakob Howhy, I suggest that attention is a process that exogenously and/or endogenously modulates Bayesian Information-Theoretic Hierarchical Predictive Processing framework thus providing the system with a certain balance of Access and Phenomenal consciousness every time an error/information is observed. Thus, the theory agrees with Jesse Prinz's view that attention is necessary and sufficient for consciousness and argues that Bayesian Information-Theoretic construal of Attended Access and Phenomenal consciousness largely shares the when and where of consciousness as argued by Jesse Prinz's Attended Intermediate Representation (AIR) Theory of Consciousness. **C9**

24 The Computational Awareness Theory: Toward a Rigorous, Intuitive and Highly Explanatory Science of Consciousness Edward Porter <ewporter@gmail.com> (Fort Worth, TX)

The alleged "hard problem of consciousness" is based on a false assumption – that consciousness is so different in kind from anything explained by science that science cannot even begin to explain it. This is false because consciousness is nothing but awareness of information, and because science specifies that all of reality have the same thing – awareness of information. We call this often overlooked awareness that is both demanded by, and defined by, the laws of physics "computational awareness" ("compwareness" for short). Compwareness is the awareness of variable values required for the equations of physics to compute as a function of those values, as physics demands. The computational awareness theory hypothesizes that consciousness is nothing but compwareness of brain computation. The compwareness theory replaces the old "hard problem of consciousness" with a new hard, but less hard, problem – how brain compwareness could have all the wonderfully rich qualities we experience in consciousness. To explain these qualities, or "qualia," of consciousness we need to explain the qualities, or qualia, of brain compwareness – i.e., what's aware of what, when, how, and with what unities in the massively parallel, massively interconnected computations of the brain. Surprisingly, we can already make a large hypothetical mapping between qualities of brain compwareness and qualities of conscious awareness. My presentation will focus on the current state of this mapping, the major intellectual challenges it still faces, and this mapping's future as we learn increasingly more about the brain, including more about the possible role of quantum effects on brain compwareness. The compwareness theory provides a major step toward a rigorous, intuitive, and highly explanatory science of consciousness: It is rigorous because it provides a specific scientific definition of what consciousness is believed to be – i.e., an awareness of information specified by the causal information architecture of brain computation. It is intuitive because it explains conscious awareness of information in terms of something very similar – the brain's computational awareness of the same information. And it is highly explanatory because its hypothesis that conscious awareness is the same thing as brain compwareness allows us to map back and forth between science's increasingly detailed knowledge of the qualities of brain computation and increasingly detailed understandings of the qualities of consciousness. **P1**

25 Mr Market's Mind: A Collective Consciousness Patrick Schotanus <patrick.schotanus@kamescapital.com> (PhD Candidate, Edinburgh, Midlothian United Kingdom)

The individual human mind is a complex adaptive system that interacts with similar systems which gives rise to a collective consciousness. The latter is manifested in capital markets. Specifically, the market's mind consists of investor minds connected via physical extensions and infused with intersubjectivity. Price discovery, the self-organizing process in capital markets aimed at value creation, is modern society's psychophysical bridging. Prices are discovered symbols which capture the information that is realized both physically and phenomenally. Among its goals, this paper hopes to stimulate the exploration of markets and their data from the mind-body perspective rather than the flawed machine perspective which has dominated research. The recent financial crisis has underlined the need for such new thinking. This proposition is also relevant in light of the mind-body problem, a complex problem that is usually only discussed from the individual perspective. Still, it is likely that a permanent solution to this problem remains elusive. In fact, it is preferable for both our health and our wealth. **P2**

26 Comparative Study of Radhasoami Faith and Hinduism Kumar Sourabh, Shweta <shweta.db@gmail.com> (R.S.Sabha, Agra, Uttar Pradesh India)

Hinduism is the most comprehensive science of consciousness. After realizing that phenomenal world is relativistic, the next stage is realizing that the truth in phenomenal world is determined by state of consciousness of the observer. There begins the study of consciousness. The Mandukya Upanishad in Atharva Veda expounds the states or avasthas of consciousness. There are four states in which man perceives the world, jagrut (waking), swapna (dream), sushupti (dreamless sleep) and turiya (the fourth state). In the waking state, the being called Vaisvanara, is outwardly cognitive and perceives gross objects. In the dream state, the being called Taijasa, is inwardly cognitive and perceives subtle objects. In dreamless sleep, the being called Prajna, is blissful, opening up to Soul-consciousness. The being in this state is and perceives the causal world. There are four faculties of Truth-Consciousness (Atma Chaitanya) too - intuition, inspiration, discrimination and revelation. Inspiration is the source, intuition is the means, discrimination is the judge and revelation is the destination in the seeking of Truth. What makes the Radhasoami Faith, unique from Hinduism. According to teachings of the Radhasoami Faith, there are three elements in the human body: the coarse matter of which the physical body is made; the subtle matter of which the human mind is made and the third, the spirit which is the life and soul of the human body and brings about the evolution and development of man's body and mind. The human body and mind both are perishable or mortal, while the spirit is immortal. Corresponding to these, there are three Grand Divisions in the Creation, namely, the pure spiritual region, called Nirmal Chetan Desh; the Brahmanda or Region of Universal Mind in which the mind dominates over spirit; and the Pind Desh or Physical Universe in which matter is pre-dominant. A spirit can attain salvation or freedom from the cycles of birth and death, only if it enters the purely spiritual region. According to the Radhasoami Faith, the Supreme Being has blessed the human body with certain latent faculties, by awakening which, the spirit entity can establish contact with different regions of the Creation. The Supreme Being has also been pleased to ordain the advent on earth from time to time of holy and awakened Souls from the highest region for the salvation of jivas. They are emanations of pure spirituality and known in the language of the religion of saints as Param Sants. In Radhasoami Faith they are described as Sant Satgurus who are in communion with the Supreme Being and are His representatives upon the earth. The Faith lays down that in order to awaken the spiritual faculties through Surat Shab Yogas. In Hinduism the Universe is having three lokas and in Rahdsoami faith is higher state which start from the highest state of Hinduism. **P1**

27 Subjectivity, Objectivity - Via a Reflection Principle John Strozier <john.strozierccs@yahoo.com> (Science, Mathematics,Technolog, SUNY, Empire State College, Sedona, AZ)

In order for Physicalism to explain consciousness, we must address two basic problems: 1) the relationship between first-person subjective experience and third-person objective description of an object, event, or process; and 2) the source of subjective 'feelings' such as pain, touch, etc. and visual experience. In particular, we argue that: 1) Reported first-person and third-person viewpoints of an object can be analytically described in terms of one another in the limit that the third-person viewpoint is constructed of a sufficient number of first-person reported viewpoints. We assume that a 'report' is an action caused by an access-conscious state that, in turn, is created by an internal analysis of first-person perceptual conscious 'experiences'; and 2) Subjective 'feelings' can be analogously described in terms of off-sets between current sensory data and built-in set-points that are constitutive

of a Very Clever Robot (VCR). In particular, we suggest that subjective 'feelings' are 'off-sets' that have made themselves known as access conscious states (Block (2011)) via a Reflection Principle (described below) operating on input sensory data. Access conscious states have a memory component and can be reported and acting on. The Reflection Principle: a) Inputs to the senses from the external/internal world (eye, tactile, etc.) are encoded into neural spikes that feed forward into the brain through many serial and parallel modules. These modules build various neural representations of the world that represent some aspect of the input sensory data - what, where, color, texture, etc. that address, via their biological origin of "what is it like' (Nagel (1974), the conscious property of qualitative character. b) Neural projection operators operating on the various model representations, generate outgoing neural signals. Basically these neural signals are reflections analogous to a generalized optical reciprocity theorem (Rayleigh (1900)) of the incoming neural signals used to build the internal brain models (representations). The reflected neural signals move outward instantiating two properties of consciousness, subjective perspectivity and intentionality, by scanning the object/process of the experience – 'looking at something else', touching it; in general interacting with it by 'reaching out' 'to something else' in a subjective, first-person mode. These projected neural signals do not travel outside the body; but, depending on their modality, travel either to the bodily affected areas (pain, touch) or other parts of the brain (vision, audition, olfaction); c) In addition, the outgoing projected neural signals interact in the brain with incoming neural data from the senses to generate differences for feedback to the representations (world models). The differences are input for negative feedback to correct the models, and for positive feedback as attention to objects/processes that need immediate action. Perception, awareness, attention, report, phenomenal consciousness, access consciousness, and cognition are discussed in terms of the Reflection Principle and psychological experiments. Also we discuss those "feelings" where feedback between the environment and the brain is essential; and how those "feelings" are analogous to VCR computer generated offsets. Essential in this comparison are the reactions to stimuli of one-celled animals as compared to many-celled animals. **C22**

28 Overview of Studies Leading to Concept of Plant Consciousness Devaguptapu Sumir, Devguptapu Swanti; D. Sarveshwara Rao <sumir.rao@gmail.com> (DEI ICT Center, Rajaborari, Timarni, Madhya Pradesh India)

Consciousness is a trait of life. This review article touches on several aspects of emergent topics in the field of plant consciousness, ranging from descriptions enumerated in the text based on intuitive knowledge of scholars of religion, to the conclusions derived from scientific investigations in the disciplines of sensory biology, electrophysiology and molecular biology. At the end, implications of conscious interactions between plants and man are also appended to it. Consciousness studies were prevalent in ancient India as given in Vedas and Upanishads dating back to second millennium B.C. It recognized that all plants possessed internal sensitivity, and feel pain and pleasure. The Vedanta divided the degree of consciousness into five broad categories: Acchadita (covered), Sankucita (shreenken), Mukulita (budding), and Purnavikisita (fully blossomed). The plant consciousness is apparently operational in the physical world in making some of the choices that may include: when and where to forage for nutrients and where to allocate those nutrients and derived organic molecules within the organism; when to reproduce and the number of progeny to create; how to mount a defense against attack and in what tissue or organs; and when and where to transmit chemical signals to surrounding organisms. These responses must occur within the context of changing environment, including periodic and meteorological variation regarding light, nutrients, water, wind, temperature and attack. The seat of all these responses remains within the multi cellular confines of the complex plant body. It is now amply clear that plants can efficiently produce electrical signals in the form of action potentials and slow wave potentials(= variation potentials) and long distance propagation of these signals proceeds in the vascular bundles. Ultimately, the plant coordinates signals coming through electrical, hydraulic and chemical sources. Plants perform complex information processing and also use synaptic modes of cell-cell communication. Endocytosis has been found to be an essential process of plant cells which impinges upon all aspects of plant life. Auxin emerged as a plant-specific neurotransmitter. Recent advances in plant molecular biology have identified, several proteins typical of animal neuronal systems, such as acetylecholine esterases, glutamate receptors, GABA receptors and endocannabinoid signaling components, as well as, indicating signaling role for ATP, NO, and ROS. Significant advances are also made in ecological studies on plant-plant, plant-insect, and plant-man communications, revealing a complex plant behaviour. It is also implicated in plant neuronal signals perception, processing, and the integration of ambient signals. New concepts, like quantum consciousness etc., are needed for advancing our rudimentary understanding of the primary perception skills and plant consciousness. **P2**

29 The Basic Nature of Consciousness and The Structure of Entanglement Explained By The X-Structure Arnold Therner, Steen Loeth; N-B Therner, Per Bruus-Jensen <ncp@x-aions.org> (- Advanced Institute of Ontolo, NCP X-AIONS New Cosmic Paradigm - Advanced Institute of Ontological Principles, Skoevde, Sweden)

Ontologically, according to the X-structure, the Multiverse/Cosmos is not simply an inert and random collection of energy and matter but, on the contrary, is a living infinite and all-embracing entity; an immaterial "Something" with the will and ability to experience, and which through this experience attains disposal over so-called consciousness, continuously generated by the X-structure. Reality fundamentally represented by the primordial domain of existence "Xo" is an all-embracing unmanifested, virtual world of emptiness and stillness, containing infinite potential of creative possibilities. The Xo-nature is continuously activating an indivisible, integrated Triune Operating Principle with three functional aspects: X1 Creator and Experiencer (the subject/I, emptiness, stillness); X2 Creative and Experiential Ability (energy, morphogenetic effect constants); X3 the Created and Experienced (objectively represented by movement, the material illusion and subjectively represented by: life-experience/consciousness). This fundamental X-structure is in principle the same for all living things and describes our immortal nature, how it is constructed and operates. In addition to the temporary physical body, there is an immortal paraphysical body, which the physical body is completely dependent on. The X-structure is activating and transforming the emptiness and stillness into energy, force, movement, matter and the subjective side of it all, namely; experience/consciousness. X2 is expressed by seven extremely subtle qualitative "fundamental/basic energies" with specific characteristics. These qualitative basic energies build up everything from the most subtle (thoughts, feelings, memories etc.) to the very densest (physical matter, black holes etc.). The primary fundamental energy operates via a number of so-called cosmic creative principles - morphogenetic effect constants; formative forces that sustain and organize life and reality. We can empirically observe the effects of these morphogenetic effect constants in the laws of nature. The X2-function and its morphogenetic effect constants "split up" the all-embracing totality (Xo), and create a contrast to the status of non-duality and non-locality. The nature of infinity and eternity is divided and separated into life-units, individuals, as well as states, distances, space, time, etc. The complementarity of wholeness/oneness and duality/separation, and "the structure of entanglement" are formed and expressed through the morphogenetic effect constants (X2).The result of the interaction between the Subject (X1) and its Creative/Experiential Ability (X2) is represented by the Created (X3); namely the material illusion as objective reality on one side - and - the experience of it as subjective reality on the other, "the subjective reality complex". In fact it is all about the Creation of Experience/Consciousness - and this is the superior task of the Triune Operating Principle and thereby of Life itself. If we go deeper into this structure and process, we will also find the solution to the so-called hard problem of consciousness. The X-structure is based on the intuitive knowledge illustrating the Cosmic Worldview conveyed by the Danish intuitive philosopher and mystic Martinus Thomsen, especially presented by his collaborator Per Bruus-Jensen and "the X-Project" by NCP X-AIONS, New Cosmic Paradigm with Advanced Institute of Ontological Principles and New Science, researching the Ontology of the Cosmic Worldview and presenting New Science, www.newcosmicparadigm.org **P1**

1.02 Materialism and dualism

30 Dualism Physically Embodied Richard Miles <r.miles538@btinternet.com> (Surrey, United Kingdom)

In response to your mission statement as an independent scholar, I propose the term 'Dualism Physically Embodied' which is my approach to human function. This will replace the outdated anachronistic non-sense as described in both the Oxford and Stanford Philosophers encyclopedias, under the heading of dualism. Which should then be retitled as either traditional dualism, Cartesian dualism or believers dualism. As none of these serve a practical purpose in understanding consciousness or anything else, in fact they are a hindrance. What is the physical duality that we empirically know about ourselves and generally take for granted or choose to ignore? We have of course numerous left and right physical dual attributes, but my talk is of dualism physically embodied and is specifically about the parts that are conscious and the parts that are not conscious, together with all of the interactions that go on between them. During sleep we seem to loose consciousness and memory of time passing, but still have 24/7 non-conscious autonomic activity, keeping us alive, (hopefully). Also during sleep we subdue some of the somatic muscles and nerves we use when awake. This separability requires a type of physical switching. Animals that hibernate have a means of turning down their entire physical function to conserve energy. A mono system analogy of this would be like a

light switch dimmer rheostat. However, with humans changing from awake to sleep requires at least a dual physical function of switching. An analogy for example, would be like a dual speaker balance control where one speaker (conscious somatic) is turned down, whilst the other speaker (non-conscious autonomic) is not or is enhanced. This is at least what is required in controlling the physical duality that we all have. I suspect it is this physical dualism and interaction that Descartes and so many others have struggled with. We know a lot more now than Descartes did, plus I do not have the religious pressure that he had nearly 400 years ago. It is the physical being of the person with all of the biological activity that it includes,that is its driver. There is no need to look for anything ethereal to drive it. Physically driven, the nervous spectrum functions and interacts with itself and the outside world via the connectome of the brain, satisfying the autonomic needs. Our body and brain work as an embodied unit. Conflict can arise due to our dual activity causing minor abuse to suicide. This internal activity can be portrayed or represented in works of art, design, invention and organisation. The embodied physical approach to dualism cannot be ignored, unless you are foolish. **P1**

31 A Challenge to the Causal Closure of the Physical Dan Norton <dannorton@ucdavis.edu> (Philosophy, University of California, Davis, Davis, CA)

A common argument for physicalism is the "causal argument," a key premise of which is the "completeness of physics" or "causal closure of the physical" principle. (See, for instance, David Papineau's "The Rise of Physicalism.") According to this principle, all physical goings-on can be entirely accounted for, at least in principle, in physical (or nonmental) terms. It is often thought that empirical evidence inductively supports this principle. I contest the sufficiency of the empirical evidence (and therefore the soundness of the causal argument) in a way that I have not seen done in the literature. Although science has been able to explain a great deal about the inanimate and animate world in purely physical terms, we are not nearly at the point where we could say with confidence that every physical event "including the behavior of every particle in the brain" can even likely be explained without appealing to nonphysical phenomena, such as ontologically irreducible mental forces. To know whether special mental forces act on the brain, we would first need to know how the brain would behave in the absence of special mental forces acting on it. If, as I argue is indeed the case, we do not currently know in a sufficiently fine-grained level of detail how the brain behaves in the absence of special mental forces, we have no basis for judging whether any brain behavior we observe departs from how the brain would behave in the absence of special mental forces, and so we cannot judge whether special mental forces are present. For all we know, special mental forces affect only a miniscule part of the brain in a way that is far too subtle for our current instruments and methods to detect. Until we have a much more thorough understanding of the behavior of the brain than we do at present, I conclude, we should (if there are not independent reasons to reject it) remain open to the idea that the physical domain is not causally closed to nonphysical causal influences and, in particular, to ontologically irreducible mental forces. **P1**

32 Quantitative Analysis of a Dualism Quantum Interface Between Consciousness and Brain Michael Remler <mike@remler.com> (Neurology, UCDavis, Berkeley, CA)

Dualism requires bidirectional causality between the non-material Consciousness and the material Brain. That interface between Consciousness and Brain is physically possible if and only if Consciousness can change or not change the quantum states of matter in Brain and is aware of what it has done or not done. If Consciousness controls and is aware of what the state of all the bonds that control all the conformationally changeable molecules in all the pores in all the synapses in all the Human Cortex then strong bidirectional causality is established. The Human Cortex has approximately 4E+10 neurons, with 2.4E+14 synapses controlled by 2.5E+16 ionic channels and 1E+17 pore conformational molecules. If Consciousness monitored and changed or did not change each pore molecule it would completely control and be informed on all cortical function. Quantum transitions take 1E-23 sec so that even under the most burdensome assumption that each molecule was monitored sequentially the whole Cortex would be controlled each microsecond, essentially instantaneously compared to the physical events of the brain. Treating the change or non-change of each pore molecule as one bit of information transfer, if the pore molecule conformational change takes 1E-3 sec the bit rate per pore is the inverse, 1E+3 bits/sec or a potential maximum of 1E+20 bits/sec for the entire cortex. This is a huge rate by any contemporary standard and more than sufficient to carry the data of all human behavior. Conformational changes typically take on the order of 150 KJoule/mole. If every conformational molecule in the cortex was changed at every opportunity 1/millisecond, a totally unrealistic assumption, it would require 2160 KJoule/day = 500 (dietary) Kcalories/day. More realistic would be no more than 100 Kcal/day. The Brain consumes approximately 25% of the human body's typical 2400 Kcal/day, leaving this estimate of the Dualist interface quite modest in metabolic terms. The concept of a non-material entity controlling the quantum states of matter is well established, for example in quantum entanglement. The effect of determining the quantum state of one of two entangled photons is transmitted instantaneously, impossible for material messenger, to the other photon. Although not validated in current physics, there was nothing intrinsically unscientific in the 19th century about the concepts of a non-material caloric in thermodynamics or nonmaterial luminescent ether in electromagnetism. All non-material entities in science are inferred as the most reasonable explanation for the behavior of matter. Nothing in this removes any portion of the materialist understanding of the Brain except the necessity to address the «Hard problem,» how to explain the creation of Consciousness from ordinary matter. **P1**

33 Dualism Without Conceivability Arguments William S. Robinson <wsrob@iastate.edu> (Iowa State University, Ames, IA)

Many discussions of dualism turn on the acceptability (or not) of a conceivability argument, i.e., an argument that employs a principle relating (some form of) conceivability to the metaphysical possibility of zombies. In this talk I show how the distinction between physical properties and phenomenal qualities can be made and supported without appeal to such an argument. Dualism can be based instead on an appeal to the best explanation of the fact that experience by itself gives no hint of the existence of, or relations among, certain low-level entities – namely those, such as neural activations, molecules, or reflectance profiles, that physicalists say are constitutive of or represented by experiences, and that dualists hold to be causes of experiences. The dualism that is supported in this way is a genuine dualism and it is compatible with both the metaphysical possibility of zombies and the metaphysical impossibility of zombies. **C1**

34 Dark Energy: New Possibilities for The Science of Consciousness Gavin Rowland <gwrowland72@gmail.com> (School of Medicine, Monash University, Australia, Castlemaine, Victoria Australia)

Dark energy appears to occupy all space, and therefore presumably also occupies the subatomic spaces within the atoms of our brains. Yet very little is known about it. Could dark energy be the extra ingredient we require to understand consciousness? In this work, I present a new and detailed theory of the mind, in which nonmaterial consciousness interacts quantum mechanically with the brain. Dark energy offers a number of possible interesting properties. Firstly, being nonmaterial, dark energy is not necessarily bounded by the speed of light. Nonlocal activity escapes the usual restrictions of causality, enabling passage of nonmaterial information backwards in time and instantaneously across distances. This is proposed to introduce new insights to problems such as free will and the binding problem. The 'otherness' and intentionality of conscious experiences may not be as hard to explain if they are occurring in a separate, nonmaterial realm. I suggest that existence can be defined as a 'what', a 'when' and a 'where'. It is proposed that the 'what' of our universe (i.e. complexity - atoms, molecules, life forms) is actually a fundamental dimension comparable to space and time. If it is a dimension then, similar to space, it should be capable of an ongoing expansion in the direction of increasing degrees of complexity. And indeed it is - as Stuart Kauffman puts it, our universe is "indefinitely open 'upward' in complexity."(1) I then suggest that the laws and constants of the universe (seemingly finely tuned for the eventual existence of complex life) are all part of this dimension. This view is not incompatible with the concept of entropy (as energy dispersal). It seemingly requires a universal nonlocal consciousness in order to anticipate the required laws. I also advance an argument that the big bang should have generated two types of dark energy - one that is eternally spatially expanding and another eternally contracting.(2) Incorporating the complexity dimension into spacetime, this model predicts that one type of dark energy speeds time, expands space and constructs complexity. The second dark energy is predicted to slow time, contract space and destroy complexity. There are correlations here to the emotions. Positive emotions appear to be constructive, expand attention, and speed subjective time. Negative emotions appear to narrow attention, slow subjective time, and are destructive (particularly in the more extreme forms found in psychopathology). In this model of consciousness, there is an ever-fluctuating ratio of positive to negative dark energy or 'headspace'. The positive-negative valence of information is important in determining that ratio. As our type of headspace is our window on reality, excesses of either type of dark energy can alter our perception. The implications for various mental illnesses are discussed.(2) 1. Kauffman, S. A. Foreword to: Ulanowicz, R. E. (2009) A Third Window: Natural Life beyond Newton and Darwin. West Conschohocken, PA: Templeton Foundation Press. p. xii. 2. Rowland, G. W. (2015) Mind Beyond

Matter: How the non-material self can explain the phenomenon of consciousness and complete our understanding of reality. Melbourne: Burdock Books. **P1**

1.03 Panpsychism, neutral monism, and idealism

35 Symmetry Breakdown in a Holistic Reality Harald Atmanspacher <atmanspacher@collegium.ethz.ch> (Collegium Helveticum, Zurich, Switzerland)

This presentation explores a formal approach to descriptive levels of reality and how to relate them to one another. Within the decompositional variety of dual-aspect monisms (such as those of Bohm, Pauli-Jung, or d'Espagnat) a basic level of reality is conceived of radically holistic, without distinctions, and thus unspeakable. Formally speaking, introducing distinctions means to break symmetries. It will be discussed how insights of depth psychology (such as those of Freud, Jung or Matte Blanco) support this formal approach. The range between fully differentiated consciousness and the most undifferentiated realms of the unconscious will be related to the tension between epistemic and ontic viewpoints and, ultimately, to Quine's idea of an ontological relativity. **C10**

36 Moving Towards PSI: A Proposal for a Psychophysical Science of Consciousness Richard Choate, Basti, G.; Frohlich, D. R. <choater@stthom.edu> (University of St. Thomas, Fredericksburg, TX)

The current paradigm within the philosophy of mind presents us with a choice between the Scylla of dualism on the one hand, and the Charybdis of physicalism on the other. We argue that this paradigm is not only unnecessary, it excludes the possibility of solving the mind-body problem. But if the current paradigm cannot solve the mind-body problem, then we have no adequate foundation for a science of consciousness. We contend that a form of neutral monism can solve the mind-body problem and thus serves as the best theoretical foundation for a science of consciousness. Herein, we propose a modified, nonlinear, evolutionary version of Giulio Tononi's Phi equations which can incorporate Phi's potential as an empirical measurement of consciousness without leading to a form of panpsychism. Lastly, by incorporating perspectives from evolutionary biology and neuroscience, we show how this framework could help resolve the ongoing question of which kinds of systems are sufficient for supporting consciousness. **P2**

37 Dynamical Origin of the Self/Other Distinction at the Core of Conscious Experience Terrence W. Deacon <deacon@berkeley.edu> (Biological Anthropology, University of California at Berkeley, Berkeley, CA)

In many respects, quantum phenomena have provided a novel way to reframe Cartesian dualism. Superposition of mutually exclusive classical states and the existence of entangled states that violate spatial-temporal localization fit well into what Descartes called res cogitans 'a 'mental' realm that he defined as lacking clear physical-temporal extension. Descartes contrasted this with the realm that he called res extensa, which included all classically extended physical processes. I believe that this resonance with Cartesian dualism is the source of the intuition that consciousness might have a quantum explanation. The dualistic Cartesian vision is, however, deeply flawed and so the appeal of quantum theory because of its superficial compatibility with this paradigm should be viewed with skepticism. This does not deny the importance of quantum processes for a full account of conscious agency, but warns against over-interpreting what quantum theory can explain with respect to conscious experience. Though indeterminate quantum phenomena may provide the sensitivity to initial conditions that contributes to free will they provide no account of the interiority and self-other perspective that is at the core of conscious experience. This leaves many quantum theorists to argue for some version of a panpsychic paradigm, in which conscious mental experience is simply assumed to be a basic property of the universe, but this does not help to explain why having a working brain should distinguish conscious from non-conscious physical systems. Recently, Giulio Tononi and colleagues have argued that a network of strongly coupled, highly re-entrant, information-processing components constitutes the basis of the conscious experience produced by a functioning brain. This theory 'integrated information theory (IIT)' proposes that a measure of the extent of systemic informational integration (phi) is also a measure of the 'quantity' of consciousness in a system. In IIT the determination of the self-other distinction is based on the relatively weaker coupling segregating a highly coupled subsystem from its information surroundings. This lack of a definitive determination of self versus other has led Tononi to also propose a version of panpsychism. These decisions to abandon the attempt to provide a causal explanation for self-experience in favor of an unexplained panpsychic basis reflect the failure of these approaches to deal with the so-called hard problem of consciousness, despite contributing to certain less-central aspects of the consciousness problem. Before assuming that this is an intractable problem, however, we need to be certain that it is impossible to answer these more basic questions: 'Is there a physical dynamical process that can constitute an intrinsic self/other distinction?' and 'How could such a process produce what might be described as the 'interiority' of the self-perspective?' But an intrinsic self/other distinction is not only a feature of conscious experience. Every living organism from the simplest bacterium to human beings can be understood as a locus of self-agency, because of the way they maintain, defend, repair, and reproduce their distinctive far-from-equilibrium dynamical organization. As many previous writers have argued, this distinctive defining feature of life parallels the self/other interior/exterior feature of conscious experience. **PL8**

38 Presence: The Mode of Existence Shared by Phenomenal Consciousness with the Temporal Present Georg Franck <georg.franck@tuwien.ac.at> (Digital Methods in Architectur, Vienna University of Technology, Vienna, Austria)

Panpsychism, though respected for attacking the Hard Problem head-on, suffers from the impression of an all too drastic cure to dualism. It accounts for the mind-matter distinction supposing that mind is intrinsic to matter: from the macroscopic level all the way down to the elementary level. In order to implement the idea, mentality has to be decomposed, in a way akin to Leibniz' dissolution of the full-fledged monand into 'petites perceptions', into ever more primitive forms of sub- and finally proto-consciousness. If executable at all, this decomposition risks missing the mark set by the Hard Problem. The decomposition of the conscious mind into traces of mentality supposed to inhere in elementary particles will have to work backwards through the processes synthesizing the contents of experience from sub-conscious constituents. By focussing on the intentionality of consciousness it risks to miss what the Hard Problem is about: the very mode in which subjective experience exists. The mode in which consciousness exists is mental presence. Mental presence is a mode fundamentally different from the mode in which the material brain exists, but intimately related to the temporal present. Ontologically, presence and reality are independent of one another, even though they easily overlap in the composite mode of actuality. The independence is easily seen by asking what happens when (a) presence is suppressed and (b) reality is abstracted away. By suppressing presence, the phenomena relying on mental presence as well as the difference between present, past and future are done away. Subtract reality and you are left with the phenomena resisting reduction plus the process of temporal change (in distinction from real change). The paper suggests to supplant panpsychism by a metaphysics of presence that clearly distinguishes, and by way of distinction establishes the communality, between mental presence and the temporal present. Mental presence is subjective: tied to the perspective of the first person. The temporal present is objective in the perspective of the third person. People agree on living in a common Now as well as on the world state happening to surface in it. What connects mental presence and the temporal present is the strictly processual nature of existence. The process inherent in presence is temporal change. In terms of processuality, presence and reality translate into the difference between temporal change and real change. Real change means that world states differing in time also differ in structure or function. Temporal change means that world states having been future become present and then past. The paper endeavors to translate the unification envisioned by panpsychism into terms of presence and time. Instead of uniting mentality and materiality immediately, it suggests going into the way presence and reality connect in actuality. When looked at from within experience, this connection reappears in the relation between temporal change and real change. Both these lines project into an ontological account of the mode in which consciousness exists. **C2**

39 The Deep Structure of Experience Andrew Lee <andrewyuanlee@gmail.com> (Philosophy, New York University, New York, NY)

When we think about the structure of the physical world, we take the wide variety of macrophysical properties we can perceptually discern to be ultimately grounded in a small collection of microphysical properties we cannot perceptually discern. In other words, we ascribe to the physical world a deep structure. For the most part, theorists have assumed that we cannot ascribe a similar kind of structure to experience, where the wide variety of macrophenomenal properties that we can introspectively discern are ultimately grounded in a small collection of microphenomenal properties we cannot introspectively discern. I will argue that we can coherently ascribe a deep structure to experience, and that we must do so in order to get a systematic picture of experience. My aim in this paper is to characterize this deep theory of the structure of experience, to address some of the concerns one might have about ascribing a deep structure to experience, and to offer a promising way of thinking about the structure of experience. **C2**

40 Panmnemism and the Value of Experiential Information Adam Melinn <adammelinn@hotmail.com> (Philadelphia University, Denver, CO)

This paper introduces the theory of Panmnemism as a variation of panpsychism. Rather than making claims about spirit or sentience existing in all things, panmnemism references the ability of inanimate objects to store experiential information as memories. Memory, or mneme, is to be understood as the capacity to store information concerning the experiential qualities of existence. Experiential information can be stored as memory. Memories can be retrieved and communicated to investigators. From these claims, it will be concluded that non-human animals, plants and inanimate objects possess a form of memory, as well as forms of semi-linguistic communication of the information within those memories. Viewing the world in this way allows all entities to contribute to the development of knowledge. Such contributions lend purpose to all things. Without a consensus based definition for what consciousness is, philosophers are left discussing the various elements which constitute conscious thought. Multiple traits and abilities might figure into the assembly: self-awareness, rational thought, recollection, language, empathy, moral judgment and creativity are all functions of a conscious mind. No single trait is sufficient to represent the presence of sentience. Consciousness can best be understood as a convergence or overlapping of a number of these spheres. Essential to this Venn diagram are the spheres of communication and memory. Memory plays an essential role for identification by providing a constant for the continuity of consciousness. The first-person narrative of any individual is dependent upon reliably referencing identical memory points within that individual's history. What is self-awareness without memory? Because I can recall the same specific childhood fishing trip I was able to picture five years ago, ten years ago and twenty years ago, I can be sure that the events which have taken place over those twenty years fall within the same life narrative. This elevates the forming and saving of memories to a high position among the necessary cognitive abilities of sentient beings. This is the formative basis for conscious reflection as well as the requirement for maintaining a continuity of self. All things have experiences. Experiential information can be stored as memories. Memories can be retrieved and communicated to investigators. From these claims, it can be concluded that non-human animals, plants and inanimate objects possess a form of memory, as well as forms of semi-linguistic communication of those memories. **C2**

41 Mental Combination and Integration Hedda Hassel Morch <heddahm@gmail.com> (Philosophy, NYU, University of Oslo, New York, NY)

The combination problem for panpsychism is the problem of explaining how complex (human and animal type) consciousness can arise from combining entities with simple (fundamental particle type) consciousness in the right way. According to Tononi's Integrated Information Theory (IIT), combined consciousness is correlated with maxima of integrated information: mental combination occurs when a whole (such as an area of the brain) integrates more information than the sum of its parts (such as atoms or neurons). But correlation is not the same as explanation. In order to solve the combination problem, not only do we need to know that mental combination is correlated with integrated information, we also need to know why. IIT also aims to explain why the correlation holds on the basis of a set of axioms about the structure of consciousness, but many philosophers find this explanation unsatisfactory. Now, IIT is not the only theory that connects mental combination with a kind of integration. Panpsychists such as Whitehead and Hartshorne held that combined (i.e., unified) consciousness correlates with organic unity, which as they describe it is very similar to IIT's notion of integration. But they explain this correlation by appeal to some distinct principles which are not found in IIT. In this talk, I consider whether and how these principles can contribute to an explanation of why mental combination should be correlated with integration, either as a supplement or an alternative to some of IIT's axioms. **C18**

42 Schrodinger's Neurons. An Experimentally Testable Explanation of Conscious Mind. (physicalism.com) David Pearce <dave@knightsbridge.net> (Brighton, East Sussex United Kingdom)

Any scientific theory of conscious mind should explain (1) why consciousness exists at all (the 'Hard Problem') (2) how consciousness could be locally or globally bound by a pack of membrane-bound, supposedly classical neurons (the phenomenal binding / combination problem) (3) how consciousness exerts the causal power to allow us to discuss its existence (the problem of causal over-determination) (4) how and why consciousness has its countless textures (the "palette problem"). Yet above all, any adequate scientific theory of consciousness should offer novel, precise and empirically falsifiable predictions, not mere retrodictions. A good scientific conjecture should be in Popper's sense 'risky'. Further, the outcome of a well-designed experimental test should - by antecedent agreement - satisfy both proponents and critics. The protocol is outlined of a molecular matter-wave interferometry experiment designed to test what is naively the reductio ad absurdum of quantum mind. Phenomenal binding of distributed neuronal feature-processors in the CNS is classically impossible. Instead, phenomenal binding consists of coherent superpositions of neurons at sub-femtosecond timescales. The phenomenally-bound classical world-simulation of one's everyday experience consists in sequences of neuronal 'Schrodinger's cat states' that natural selection has harnessed to track fitness-relevant patterns in the local environment. Our phenomenally bound minds are akin a virtual reality world-simulation running at around 10^15 quantum-coherent frames per second. Intuitively, thermally-induced decoherence - the scrambling of phase angles between components of an individual neuronal superposition - is too rapid in the warm, wet CNS for selection pressure to harness such superpositions - in humans if not navigating robins. The dynamical timescale for a "Schrodinger's neurons" conjecture would seem wrong by many orders of magnitude. For we normally assume that phenomenally-bound conscious states of mind must 'emerge' on a time-scale of milliseconds via (somehow) patterns of classical neuronal firings. By contrast, even the most robust neuronal superpositions will be 'destroyed' (i.e. their quantum coherence is irreversibly delocalised into the larger CNS-environment combination though uncontrolled environmental entanglement) over naively ludicrously short time-scales. The interferometry experiment outlined puts our commonsense intuitions to the test. Barring some revolutionary breakthrough, in vivo interferometry to probe neuronal superpositions in the CNS is beyond the reach of twenty-first century technology. However, live subjects aren't needed to test the non-classical basis of phenomenal binding. Cultured in vitro neuronal networks should suffice. Is binding-by-synchrony really binding-by-superposition? First, "train up" a multi-layer neuronal network with a suitable input-output device to recognise a variety of externally presented inputs. Then, identify the distributed neuronal feature-processors implicated in diverse object recognition on a standard, classically parallel connectionist account, i.e. the "local" phenomenal binding of perceptual objects. Routine neuroscanning can pick out what we would naively describe as the synchronously activated distributed neuronal feature-processors elicited by any given stimulus, i.e. textbook connectionist neuroscience. Three experimental outcomes are possible: 1. no telltale non-classical interference pattern. (Copenhagen, 'dynamical collapse' interpretations, GRW, etc) 2. a non-classical interference pattern that's just random neural noise. (e.g. Tegmark, Schlosshauer) 3. a perfect structural match. Our conjecture predicts (3). **C18**

43 Panpsychism and Compositionality: A Solution to the Hard Problem Anand Rangarajan <anand@cise.ufl.edu> (Computer/Information Science, University of Florida, Gainesville, FL)

We begin with the assumption that all emergentist approaches are inadequate to solve the hard problem of experience. Consequently, it's hard to escape the conclusion that consciousness is fundamental and that some form of panpsychism is true. Unfortunately, panpsychism faces the combination problem. How do proto-experiences combine to form full-fledged experiences? Since the combination problem has resisted many attempts, we argue for compositionality as the missing ingredient needed to explain mid-level experiences such as ours. Since this is controversial, we carefully present the full argument below. We start, following Frege, by asserting that experience cannot exist without being accompanied by a subject of experience (SoE). An SoE provides the structural and spatio-temporally bounded "container" for experience and following Strawson is conceived as a thin subject. Thin subjects exhibit a phenomenal unity with different types of phenomenal content (sensations, thoughts etc.) occurring during their temporal existence. Next, following Stoljar, we invoke our ignorance of the true physical as the reason for the explanatory gap between present day physical processes (events, properties) and experience. We are therefore permitted to conceive of thin subjects as physical compositions. Compositionality has been an intensely studied area in the past twenty years. While there is no clear consensus here, we argue, following Koslicki, that a case can be made for a restricted compositionality principle and that thin subjects are physical compositions of a certain natural kind. In this view, SoEs are natural kind objects with a yet to be specified compositionality relation connecting them to the physical world. The specifics of this relation will be detailed by a new physics and at this juncture, all we can provide are guiding metaphors. We suggest that the relation binding an SoE to the physical is akin to the relation between a particle and field. In present day physics, a particle is conceived as a coherent excitation of a field and is spatially and temporally bounded (with the photon being the sole exception). Under the right set of circumstances, a particle coalesces out of a field and decays. We suggest that an SoE can be conceived as akin to a particle coalescing out of physical fields, persisting for a brief period of time and then dissipating - in a manner similar to the phenomenology of a thin subject. Experiences are physical properties of

SoEs with the constraint (specified by a similarity metric) that SoEs belonging to the same natural kind will have similar experiences. The counter-intuitive aspect of this proposal is the unexpected "complexity" of particle-like SoEs but we have already been prepared for this by the complex behavior of elementary particles in ninety years of experimental physics. Consequently, while it is odd at first glance to conceive of subjects of experience as particles, the spatial and temporal unity exhibited by particles as opposed to fields and the expectation that SoEs are new kinds of particles, paves the way for cementing this notion. Panpsychism and compositionality are therefore new bedfellows aiding us in resolving the hard problem. **C2**

44 Towards a Non-constitutive, Russellian Theory of the Mental S Siddharth <siddharth.nias@gmail.com> (Humanities, National Institute of Advanced Studies, Bengaluru, Karnataka India)

In this paper, I would like to argue for a non-constitutive, Russellian form of panpsychism - a form of monism that takes phenomenal consciousness/experience to be fundamental and the intrinsic nature of any concrete, real (and physical) entity. The statement of the hard problem is in a way an argument for the ontological irreducibility of the mental/consciousness/experience to the physical (as conventionally understood by Science). Taking this ontological irreducibility as the starting point, philosophers - most prominently Galen Strawson (2009) - have further argued against 'radical emergence', concluding that experience must be fundamental. Strawson also argues that experience fills an important gap in our understanding of the physical - the intrinsic property of physical entities, a view that is referred to as 'Russellian Panpsychism'? (Chalmers, 2013). Strawson concludes that the fundamental constituents of the physical world, or 'ultimates' are experiential entities. Strawson characterises these ultimates as Subjects of Experiences that are Single Mental Things (SESMETS), and further ontologically unifies the subject of experience and the experience. A major problem facing panpsychism is the combination problem- the question of how microexperiences (or microexperential entities) combine to form macroexperiences, like experiences of human subjects. I would like to argue that no such combination is possible, drawing on the intuition articulated by William James. Indeed, it seems that the impossibility of radical emergence entails the impossibility of combination. However, the impossibility of combination need not imply the impossibility of panpsychism, but only that we would have to conceive of a non-constitutive version of the same. Given that combination of experiences is impossible, I argue that any experience - including your and my experience at any moment - is the experience of a single sesmet, a single ultimate. Since experience is the intrinsic property of any (physical) entity, any change in the content of experience implies that the new experience is a new entity. At any moment, the universe is an aggregation of its fundamental constituents- ultimates or sesmets- and any combination or emergent unity between a set of ultimates is always in reference to a third subject of experience, like human subjects. Such a conception of (physical) reality would mean that what we now understand as the fundamental laws of physics - laws that relate extrinsic/structural properties like mass, charge, spatial position- are actually the laws that relate one sesmet/experience qua its extrinsic properties with another sesmet/experience qua its extrinsic properties. What we have almost no idea about, I argue, are the laws that relate one sesmet/experience qua experience with another sesmet/experience qua experience (notwithstanding the question whether such laws can ever be known to us). Such laws would govern, at any given moment in time, the experiential content of any one sesmet given the experiential content of all other sesmets that exist. I shall conclude by dwelling upon on how such a non-constitutive, intrinsically experiential reality could be, and what principles ought to govern the ideal set of laws. **P1**

45 In Defense of Neutral Monism Michael Silberstein <silbermd@etown.edu> (Philosophy, Elizabethtown College, Lancaster, PA)

Chalmers says we are at an impasse when it comes to the hard problem and that it's time for some radical ideas. Here it will be argued that he has left out an important alternative to fundamentalism, strong emergence and panpsychism. Namely, neutral monism. A thorough account of neutral monism will be provided thus demonstrating its distinctness from the alternatives. And it will be shown that neutral monism deflates the hard problem, integrates experience into the natural world, all while suffering none of the major objections to the alternatives. **C10**

46 The Contingency or Necessity of Mind Giuliano Sterrantino <gste8242@uni.sydney.edu.au> (Sydney, New South Wales Australia)

Varieties of panpsychism arguably share a common commitment: that the precursors of mind are somehow ubiquitous in the world, even if instances of mind are relatively rare. Although this provides a conceptual basis for an explanation of the relations between the objective world of physical objects, and the subjective immediacy of personal experience, it produces other problems. For example, if the precursors of conscious mentality are everywhere, what distinguishes subjects from objects, beyond the self-directed partiality (or chauvinism) of a particular form of life? If panpsychism is true, whatever distinguishes a conscious subject from an inanimate object, it cannot be due to something beyond the scope of the physical world; a world defined (in somewhat circular terms) by the reach of our concepts and scientific instruments. However, if the scope of the physical can be preemptively widened to include as-yet undiscovered, disruptive facts about the world, or - more controversially - something beyond the world that bears a relation of a satisfactory type to the world so as to serve as an explanatory basis, then panpsychism arguably achieves an additional purchase on our thinking, at least to whatever degree such scope-widening arguments succeed. But is this commitment to the ubiquity of the precursors of conscious mentality also a commitment to the necessity of conscious minds in the world, no matter how rare they seem to be? In other words, should panpsychists be committed to the idea that the world could not have failed to produce conscious minds? Is the complex of subjective experience that we know as the moment-to-moment, self evident fact of our own minds an inevitability? Further, should physical duplicates without consciousness not only be impossible, for panpsychists, but also (and perhaps paradoxically) be inconceivable? This paper argues that varieties of panpsychism are actually committed to this necessity of mind, and that the consequences of this commitment are still to be addressed, particularly when the position that is arguably held by contemporary, mainstream science is contrasted: that all conscious minds (whatever that might mean) are entirely contingent; are quite possibly a fleeting phenomenon in the world; and need not have occurred at all. The paper concludes that this distinction, between the contingency and necessity of mind, sheds light on basic assumptions and prejudices being brought to the problem of consciousness, and related discussions. **C2**

47 Diffractivity and Multisense Continuum Craig Weinberg <whatsonster@gmail.com> (multisenserealism.com, Durham, NC)

In the science of consciousness, one question that we must eventually ask is, What is the event horizon of consciousness? Where does the rubber hit the road? Are all sensations, feelings and thoughts derived from a common source? Many theories offer ways to correlate consciousness with formal systems such as neurology or information processing, but the accomplishment of correlation itself is taken for granted from the start. I think that this is a problem which turns out to be identical to the Hard Problem. Without an explanation of precisely what is doing the actual relating in Relativity or the actual integrating in IIT, we have not solved the problem, only hidden it from ourselves. The hypothesis of Diffractivity begins by rejecting emergence-based theories on the grounds that they provide no explanation for their own origin. Diffractivity inverts the assumption of an unconscious universe which produces consciousness so that it is the appearance of unconsciousness which is proportional to dissociation by insensitivity. Diffractivity is intended as a philosophical conjugate to Relativity, but it can be adapted to any theory which reduces to a formal system. In Hameroff and Penroses Orch OR, the Diffractivistic conjugate to the Objective Reduction would be a Subjective Inflation. In Tononi & Kochs IIT, Information Integration would be preceded an Aesthetic Disintegration. Bohms Implicate and Explicate Order would be diffracted from the order-transcending Multisense Continuum. Any system based on structures, including mathematics and logic, would find new roots beyond formality and extend to fusion with the Continuum. This is not intended as an appeal to supernatural metaphysics but a logical extension of the proposition of ordinary sense as fundamental. By grounding all substances and conditions into a foundation which is purely aesthetic, we gain insight into the philosophical and technological issues of the 21st century. The empirical observations of science and math remain the same, only their interpretation changes. Diffractivity proposes that objects, dreamed or real, are produced by the same filtering, but with a different scale of experiential density or significance. Time and space emerge as limits on awareness rather than axioms of existence. We can see and understand white light as a colorless brightness which reveals color through diffraction of light itself. Diffractivity proposes that all phenomena are fragments of a universal experience, and that the maximum degree of fragmentation within any given frame of perception constitutes its math and physics. Electromagnetic effects would be affects of effectiveness, in the same way that light is a seeing of seen-ness. What we experience as physics, chemistry, and biology is suggested to emerge from fundamental levels of diffraction. Our sense of subjectivity provides a limited unveiling, or re-acquaintance with that which has been alienated by time, space, and entropy, giving the brain a new identity as an aesthetic diffraction engine. **P2**

1.04 Ontology of consciousness

48 Now, Now, Now: The Intimacy of Mindfulness Carmel Ashton <atma.vidya.one@gmail.com> (CreateSpace Publ, Mount Victoria, NSW Australia)

"There is a growing recognition that a fuller understanding of consciousness is needed if human life on earth is to remain viable. So far science is falling short of this need". Robert Thurman, 2008 The contribution from science is impressive: ranging from those in physics, mathematics, medicine and the neurosciences to philosophy, parapsychology, education, anthropology, and more. As well philosophers, mystics, prophets, poets, scientists, have written of the nature of consciousness, and the essential Unity underscored more recently by quantum mechanics. Yet debate often goes around in circular motion, without consensus of what Consciousness actually is. Researchers have shown that within human development, levels of human consciousness are hierarchically arranged, with relatively few people advancing beyond the rational to transpersonal stages. Human reason and abstract thinking emerge through the rational level of mind, the manifestations of which have brought the unprecedented scientific advances in technology, medicine, industrialization, changing the way we humans live on and share the planet. Research over several decades suggests that most adults do not think at the rational level most of the time, operating at a level between low-level rationality and a stage characterized by concrete rather than abstract thinking. Extensive research indicates that as we advance in our level of mind, our worldview broadens, problem-solving ability expands, and our perspective becomes more inclusive with deeper compassion and concern for other than self, other life forms and the environment. Only a small percentage of the adult population thinks at high levels of rationality and above. It is not surprising then that we consequently face serious challenges, ranging from crises in personal and community health to the failure of natural systems across the planet. Addressing this situation in an appropriate and adequate manner requires an increase in our individual and collective level of consciousness. From a scientific perspective this can be seen within the hierarchical nature of human development, and effecting cognitive functioning, moods and emotions, perceptions and behavior, speech and social interactions, concern for environment and interaction with the forces of nature. As consciousness evolves within the individual, these different aspects of consciousness also change, toward becoming more inclusive of other as self. Science has shown unequivocally that Mindfulness meditation produces demonstrable effects on brain and immune function, on psychological/personal development, on social behaviour. This research appears in a wide range of disciplines including medicine, neurosciences, psychology, and other social sciences. Specifically, recent research from leading universities indicates that Mindfulness meditation leads to neuroplastic changes in structure and function of brain regions involved in attention, emotion, and self-awareness. It is growth in these areas that is characteristic of movement to more refined and more inclusive levels of human functioning. Within a comprehensive overview of research from various disciplines, links between findings in neuroscience and human development will be highlighted. The Mindfulness technique I share enables the person to move from sensing the self separate, to experiencing intimate connection within the cosmic wholeness of Consciousness. The experiential is facilitated and supported by visual and video presentation. **P1**

49 Rather Simple Non-Reductive Consciousness Piotr Boltuc <epetebolt@gmail.com> (Philosophy, University of Illinois, Springfield, Springfield, IL)

Most scientists agree that first-person consciousness, in some form, emerges in evolutionarily old animals (and is clearly present in frogs). Hence, we should not search for the gist of non-reductive consciousness in advanced brain functionalities, such as self-reflection or high-level thoughts. (Research of those fields though interesting, but not quite in identifying the correlate of the 'what it is like' feel.) There are two forks in the road towards defining first-person consciousness; most people miss both. The first fork is the difference between merely functional sense of phenomenal consciousness (a robot that reacts to audible, visible, or olfactory impulses roughly the way humans do) and the sense Block intended. Advocates of non-reductive consciousness build cases based on functional phenomenal consciousness in support of the non-reductive versions. Yet, those approaches fail, and there are reasons why: All cases in which we can build a biologically inspired cognitive architecture (BICA), a robot that satisfies the conditions of the case, can support both Block's non-reductive and Franklin's reductive version of phenomenal consciousness. Hence, these are not arguments for non-reductive consciousness. In a recent article I demonstrate how Jackson's knowledge argument can be re-described into BICA-Mary (a robot that has been programmed with all propositional knowledge about colors but has to be 'initialized' into recognizing colors by its sensors being exposed to them). Since BICA-Mary lacks non-reductive consciousness the case does

not work as an argument for such consciousness. The second fork distinguishes between the content of phenomenal consciousness and something else, for whom there is something that it is like to feel those experiences. Unger's example of twins with identical content of consciousness demonstrates why such subject of experience matters: If one of the twins is going to undergo excruciating pain in a moment, it makes a difference to each of the twins which one of them it is going to be. (If Hume and Parfit were right, this should not matter. This point will be made clearer when we discuss Jack Gallant's experiment: We can read the content of one's visual perceptions through fMRI. Hence, privileged access is not about the content of consciousness but merely the-old-good-Tom-Nagel-style feel of it. Hence, advocates of non-reductive phenomenal consciousness should be committed to the epistemic subject beyond the content of phenomenal consciousness. Non-reductive aspect of consciousness is closer to hardware than software; it is analogous to a stream of light produced by a light bulb. The stream of first-person consciousness may not come from a very advanced sophisticated brain structure, but rather from something relatively simple and evolutionarily much older than many people seem to expect - ARAS, the center of wakefulness, is one such potential candidate but this is merely a suggestion what kind of thing to look for, details are not for a philosopher to craft. **C19**

50 Consciousness and C. S. Peirce's Answer to the Riddle of the Sphinx Soren Brier <sb.ibc@cbs.dk> (International Business Communi, Copenhagen Business School, Fredriksberg, Denmark)

Husserl wrote that the beginning of Galilean science where models are related to a mathematical ideal world changed the role of philosophy as the queen of all sciences fundamentally. Positivism and analytical philosophy later tried to get rid of all traditional metaphysical thinking of the meaning of human life and its place in the Cosmos. Science made its own from a human subjects point of view unembodied meaningless mathematical metaphysics, not at least through the mathematizing of modern logic. Cognitive science later attempted to produce a transdisciplinary science based on the objective definition of information. But this physicalist and informationalist paradigm is theoretically unable to encompass the conscious experience and existential meaning that are the basic requirements for producing science. Thus a scientific explanation of consciousness that is not partially based on phenomenology seems logically impossible therefore the many (unsuccessful) attempts to naturalize. C.S. Peirce's pragmaticist semiotics attempts to bridge the gap between natural sciences and humanities by combining a phenomenological approach with an evolutionary and realistic understanding of nature and society in the development of a semiotic theory of mind and consciousness. Though a contributor to the development of modern logic and science Peirce, through inventing a semiotics that embraced phenomenology, tried to heal the split Husserl saw. Philosophy aims primarily at the kind of knowledge that gives unity and system to the whole body of human, social and natural basic sciences through a critical examination of the grounds of our convictions, prejudices, and beliefs. Where Husserl wanted to heal the split he observed through his pure phenomenology, Peirce integrated his semiotics with a pure mathematical analysis of phenomenology and the coining of three new basic categories Firstness, Secondness and Thirdness to guide empirical research. Peirce's work is famous for the transdisciplinary semiotic framework its new philosophical basis makes possible. More controversial this foundation also suggests a new understanding of science and spirituality and the relation between them, which transcends the usual way we separate these matters in the West since the Romantics. Peirce wanted to solve the riddle, expressed in Transcendentalists spokesman Ralph Waldo Emerson's poem The Sphinx of what the place and nature of man's role in the universe is and of how his scientific knowing is possible at all He also wanted to answer what role science play in the development of the Cosmos. Emerson was the most influential of those radical thinkers and writers of the New England Transcendentalists in Concordia who were some of the first to integrate Eastern philosophy in their thinking). But there was a split between the empiricist and intuitionist view of knowledge among them. Peirce through his pragmaticist semiotics suggested a way to unite these two hostile epistemologies. Peirce attempts a new way of answering Kant's basic question in the Critique of Pure Reason: What can we know? and What may we hope? Peirce saw as his primary task to develop a comprehensive metaphysical and epistemological system in which a theory of categories was defined in a completely new way **C2**

51 Unified Physics and The Information Network of Awareness William Brown, Nassim Haramein <william@toraeon.com> (Life Sciences, Toraeon LLC, San Clemente, CA)

It is demonstrated how strong correlation of the dipole moments (of charge and spin) of residues in biological polymers, such as deoxyribonucleic acid and microtubulin, are involved in the information processing of awareness, particularly memory, and are entangled across spatial and temporal

domains (spacetime). Coherent electromagnetic emissions may modulate the electronic properties and thus behaviors of supramolecular systems, representing a significant signaling and regulatory mechanism functioning in tandem to the strong correlation of the spin and electromagnetic dipoles of polarizable structures in biological macromolecules. Strong coherence across macromolecular structures of the biological system and extension through spacetime via entanglement resolves the "hard binding problem" associated with the generation of conscious awareness by the brain, as it is not only the result of supposed computational activity of neuronal networks, but the integration of information from multiple reference frames across the entanglement network of spacetime. The entanglement network of spacetime, herein referred to as the unified spacememory network, emerges as a component of some of the recent elaborations of quantum spacetime architecture in the holographic mass solution to quantum gravity and unification. This is taken in consideration with the Susskind-Maldacena conformal field theory holographic equivalence conjecture that demonstrates the correspondence of micro-wormholes of Planck-scale dimension with quantum entanglement, resolving the information loss paradox and providing a physical and ontological explanation for nonlocality observed in quantum behavior. Together, these concepts describe an architecture of spacetime that is built from information and quantum entanglement through a micro-wormhole network. It is shown how the unified spacememory network is pivotal to engendering fundamental characteristics of awareness that are actively utilized in the macromolecular information systems of the biological organism. **C14**

52 Positional Symmetry (Requisite Mirror Image): The Fundamental Principle of Consciousness and Being Ashley T. Joseph <iamtjoseph@gmail.com> (Atlanta, GA)

Duality confounds our understanding of reality. We need and seek a clear lens that reconciles our understanding. This new lens utilizes ideas from science (Chown, M., Greene, B., Gribbin, J., Hawking, S., Whittle, M., Zeilinger, A., etc.), ancient philosophies (Parmenides, Pythagoras, Heraclitus, etc.) and, with a smidgen of spirituality concerning the specific type of mirror image poles utilized; the result is a holistic conceptual framework that accounts for spacetime, explains consciousness, being, and the forms of our perceptions. Positional Symmetry (Requisite Mirror Image) is a new holistic concept developed in the book, "Our Curious World of Mirror Images: Reflections on How Symmetry Frames the Universe, Empowers the Creative Process, and Provides Context to Shape Our Lives" (available at www.titusjoseph.com). This new concept defines a torus-shaped circuit, anchored by mirror image poles; from which the universe and existing things are formed via the quantum entanglement processes that unite the poles into one (Maxwell's famous equation). The efficacy of this new concept is that it explains the beauty and universality of symmetry everywhere in nature, clarifies the paradox of duality, bridging it using mirror image poles, provides a comprehensive account for dark energy, dark matter, and, the arrow of time; discloses the design of the working relationship between relativity and quantum mechanics, sheds light on the nature of universal consciousness, and introduces and demonstrates how 'meaning' is an essential and necessary dimension of consciousness and reality. **P1**

53 Grounding, Conceivability and the Mind-Body Problem Hasen Khudairi <hk44@st-andrews.ac.uk> (Arche, University of St. Andrews, St. Andrews, United Kingdom)

This paper challenges the soundness of the two-dimensional conceivability argument against physicalism (cf. Chalmers, 1996; 2010). I argue that the conceivability argument can be circumvented, when the relationship between the truths about fundamental physics and the truths about phenomenal consciousness is analyzed in a hyperintensional logic of ground (cf. Fine, 2012). The philosophical significance of the hyperintensional regimentation of the ontology of consciousness is at least three-fold. First, the regimentation permits one coherently to formulate a Phenomenal Realist Type Identity approach to the ontology of consciousness. According to the Phenomenal Realist Type Identity proposal, phenomenal properties are identical to biological properties, while phenomenal properties are in some sense non-reductively real. Thus, in the modal setting, Phenomenal Realist Type Identity belies Leibniz's Law, on the assumption that the latter can be applied to intensional entities. One virtue of the hyperintensional regimentation is thus that it avoids this result, by providing a framework with the expressive resources sufficient to formulate the non-reductive Type Identity proposal. Second, the hyperintensional grounding regimentation evinces how functionalist approaches to the ontology of consciousness can be explanatory, because the identification of phenomenal properties with functional organization can be defined via the foregoing ground-theoretic explanatory properties. [Block (forthcoming) suggests that – by contrast to Phenomenal Realist Type Identity – identifying phenomenal properties with functional roles cannot sufficiently account for the ground-theoretic explanation of the identity. The hyperintensional regimentation provides a counter-example to the contention. Of pertinence to the foregoing is another distinction drawn by Fine (2015), between material and criterial identity conditions. While material identity conditions imply the identity of the objects in question, criterial identity conditions explain in virtue of what the objects in question are the same. In order to countenance criterial identity conditions, Fine avails of his earlier work on arbitrary objects (op. cit.; cf. Fine, 1985). According to the approach, variables in the identity-conditions are interpreted as maximally generic, arbitrary objects, and relations of ontological dependence between arbitrary objects constrain the admissible valuations of variables ranging over determinate individuals. Fine's approach thus departs from the one proffered in this paper.] Finally, the regimentation demonstrates how metaphysical relations between consciousness and physics cannot be witnessed by epistemic constraints, when the latter are recorded by the conceivability thereof. Propositional epistemic modality is blind to the hyperintensional, metaphysical dependencies holding between phenomenal and physical truths. Thus, the two-dimensional conceivability argument against the derivation of phenomenal truths from physical truths risks being invalidated by a hyperintensional regimentation of the ontology of consciousness. **C1**

54 Phenomenal Sorites and Unconscious Qualia David Pitt <dpitt@calstatela.edu> (Philosophy, California State University, Los Angeles, CA)

I argue that the existence of subjective sorites series - series of color experiences such that no two adjacent ones are distinguishable, but some non-adjacent ones are - shows that there are unconsciously instantiated phenomenal properties. In brief, the argument is this. Consider an objective case in which adjacent pairs of chips a and b and b and c are colorwise indistinguishable, but non-adjacent a and c are. It cannot be that the color of b is identical to the color of a, since by hypothesis b is indistinguishable from c, but a is not. Thus, b has a color that (in these circumstances) is not consciously experienced. Now consider a subjective case in which in place of chips we have for example afterimages, of which the same indistinguishability and distinguishability facts hold. By parity of reasoning we can conclude that the b image has a phenomenal color property that (in these circumstances) is not consciously experienced. Hence, the phenomenal property instantiated by b is unconscious. **C9**

55 The Mystery of Consciousness and Quantum Enigma Hasmukh Taylor, Msc.D <hasmukh_taylor@hotmail.com> (Director of Yoga, Philosophy a, Pranava Yoga, Orlando, FL)

Consciousness and Quantum enigma are not just two mysteries; they are part of the same mystery. The first, the experimental demonstration of Quantum enigma, presents us with the mystery of the objective physical world "out there," and the second, Consciousness & Awareness, presents us with the mystery of the subjective world "in here." We experience an enigma because we believe that we 'could have' done other than what we we actually did. A denial of this freedom of choice requires our behavior to be programmed to correlate with the world external to our bodies. The quantum enigma arises from our 'conscious perception' of freewill. This mystery connecting consciousness with the physical world displays physics encounter with consciousness. Quantum theory provides a mathematical description that correctly predicts the results of the experiments that we choose to make. However, the existence of an enigma is not a physics question. It is metaphysics in the original sense of the word. The Divine Hologram appears to connect or form the interface between the two mysteries. According to David Bohm, the mathematics of quantum mechanics, if you look at it carefully, corresponds to this enfoldment. It is very similar to the mathematics of the Hologram, you see. David Chalmers put it quite succintly: When there are two mysteries, it is tempting to suppose that they have a common source. This temptation is magnified by the fact that the problems in quantum mechanics seem to be deeply tied to the notion of observership, crucially involving the relation between a subject's experience and the rest of the world. Observation collapses the waviness, the probability, to a specific actuality. But what constitutes an observation? Observation is ultimately not explained within quantum theory. What constitutes 'observation' is controversial. How does Nature decide on a 'particular' result when quantum theory, our most basic description of Nature, gives only probability? It is unexplained. John von Neumann rigorously displayed quantum theory's inevitable encounter with Consciousness. Could this really be so? Is a conscious observer 'needed' to collapse a wave function? Do you believe there are still paradoxes in the question of measurement and the role of the observer? Yes, I believe that there certainly are paradoxes. The problem of measurement and the observer is the problem of where the measurement begins and ends, and where the observer begins and ends. These issues haven't been fully resolved. Divine Holographic theory can insert a very definite division between the observer and the observed because I invoke the Pure Awareness as a completely

separate entity, from the Consciousness, which is somehow projected or coupled to the world and I say that it is the entry into the Awareness of the observer that resolves the paradoxes. It is a profound fact that's worth exploring. All we know is that, someplace on the scale between big molecules and human awareness, there is this mysterious process of observation and collapse. Conceivably at least, it is at the last step, at interference of awareness and consciousness. **P2**

56 Modeling The Brain Via Conscious Realism: A Preliminary Investigation Logan Trujillo <logant@txstate.edu> (Psychology, Texas State University, San Marcos, TX)

Idealist approaches to the Hard Problem - unlike physicalism - first presume the existence of consciousness, then ask how consciousness itself gives rise to physical phenomena. One such approach is Conscious Realism, which assumes that reality is fundamentally composed of "conscious agents" whose interactions create our intersubjective experiences of physical objects [Hoffman, D. D. & Prakash, C. (2014). Objects of consciousness. Frontiers in Psychology, 5, 1-22]. These experienced objects amount to "icons" within our species-specific "user interface" with reality. The rigorous mathematical formalism of Conscious Realism makes several predictions with respect to the fundamental nature of consciousness and the combination problem for panpsychism, while also suggesting a deep relationship between physical laws and consciousness. A major implication of Conscious Realism is that brains are not "physical objects" per se and do not create consciousness. Instead, consciousness creates brains: species-specific "icons" we experience when interfacing with human (and higher animal) systems of conscious agents in a particular way (e.g. via neuroscientific investigation). If this is the case, then the structure and function of such "neuroicons" may provide hints to the structure and dynamics of the underlying conscious agents. This presentation will explore the potential links between Conscious Realism and the structure/function of the human (mammalian) brain by examining the similarities and differences between systems of conscious agents and neurons as modeled by artificial neural networks. A key point to be considered is whether a neuron may be considered an iconic representation of a single conscious agent or an iconic representation of the interactions among multiple conscious agents. This investigation will take place in the context of the modeling of cross-modal audiovisual perceptual phenomena, in which the simultaneous perception of incongruent auditory and visual information produces an audio or audiovisual percept distinct from the contributing percepts. These phenomena imply the combination of multimodal perceptual experiences into a unified whole - a fundamental characteristic of systems of conscious agents. **C18**

57 The Unreduced Subject: An Exploration of Haecceital "For-Me-Ness" Keith Turausky <ket_austin@utexas.edu> (University of Texas at Austin, Austin, TX)

Over the past couple decades, the "what-it's-like-ness" of experience has been discussed at great length––yet comparatively little attention has been directed to "for-me-ness," the property that differentiates one subject's "what-it's-like-ness" from that of any other subject. In other words, the study of consciousness has focused far more on the nature of experiences (a.k.a. qualia) than on the nature of experiencers (a.k.a. subjects). Some have even suggested––following the quasi-Humean "transparency thesis"––that qualitative "what-it's-like-ness" simply exhausts our phenomenology, leaving no room for any proprietary subjective contribution/component. In effect, such views reduce subjects to collections of qualia, just as metaphysical "bundle theories" reduce objects to collections of properties. However, such reductive approaches are deeply and fundamentally flawed: they do not provide adequate identity or persistence conditions for subjects, for they cannot accommodate the theoretical possibility of two indiscernible "qualia bundles" that nevertheless correspond to two discrete subjects. Just as Chalmers has implored us to "take consciousness seriously," I believe we are in need of a theory that takes subjects seriously, rather than futilely attempting to reduce individuative "for-me-ness" to duplicable "what-it's-like-ness." To that end, I will explore and defend a new theory of phenomenal subjectivity. Just as it is alleged by some that every object possesses a unique haecceity––an essential, individuative, non-qualitative, non-duplicable physical property shared by no other object in this or any possible world––I argue that every subject also possesses a unique haecceity: an essential, individuative, non-qualitative, non-duplicable phenomenal property shared by no other subject in this or any possible world. **C10**

58 The Extended Mind Without Functionalism: The what and the where of mental states Karina Vold <karina.vold@mail.mcgill.ca> (Department of Philosophy, McGill University, Montreal, Canada)

Andy Clark and David Chalmers' (1998) extended mind thesis provides an answer to the question 'where is the mind'? The thesis maintains that while minds may be centrally located in one's brain (and body) they can sometimes 'extend' to be located in objects beyond their core biological shells.

Most believe that the extended mind thesis requires functionalism or at the very least the multiple realizability thesis. This is unsurprising since the 'parity argument' Clark and Chalmers use to advance their thesis, according to them, relies on a very weak functionalism. And the examples they give all require a commitment to the multiple realizability thesis. But because there are serious philosophical objections to functionalism (and multiple realizability), most critics of the extended mind thesis attack it on just these grounds. And these functionalist-related debates have dominated the discussion of the merits of the extended mind. In this paper I show that the extended mind thesis does not need functionalism or the multiple realizability thesis. Instead, the view needs what I call the 'multiple localizability thesis', which says that mental states are multiply localizable and thus cannot be 'strictly' or 'uniquely' located in any particular place, e.g. to one region of the brain. This is because the extended mind thesis is about the location of mental states, while functionalism and multiple realizability are about their composition; and the matters of location and composition come apart entirely. Thus the extended mind thesis does not need to make any claim about the composition of mental states and therefore does not need functionalism (or multiple realizability). I present a new argument for the extended mind thesis using the multiple localizability thesis and a novel thought experiment that appeals to what I call 'iCogs', devices that realize mental states external from the biological body. My argument shows how both consciousness and non-conscious mental states can extend without functionalism. By severing the allegedly necessary connection between the extended mind and functionalism, I hope to clear it of nearly all the standard objections. **C12**

1.05 Qualia

59 Hidden Reality and the Acausal Foundations of Sensory Experience Carlos Acosta <c_acosta@sbcglobal.net> (Process Philosopher, Nipomo, CA)

Qualia are holistic phenomenal spatiotemporal categorizations subjectively perceived by a conscious observer. General examples of qualia include: color, sound, touch, taste and smell; specific examples include, the fragrance of a rose, the taste of chocolate and the various manifestations of pain. The question as to whether subjective experience can be empirically understood forms one important facet of the "Hard Problem" (Chalmers, 1996, p. xxii). It is the position of this paper that we cannot know how qualia and phenomenal awareness are generated unless we first comprehend how they may have evolved in the very distant past. This analysis explores the evolution of qualia and phenomenal experience. In doing so, it puts forth the idea that at the level at which physical reality interfaces with sensations and perceptions, the connections that unite the two bring together physiological processes that are stochastic, acausal, and complementary in nature. Therefore, it is proposed that these acausal and stochastic neural connections generate sensations that may not approximate existing properties of objective reality. As such, the investigation endorses the "Conscious Realism" of (Hoffman, 1998, 2008, & 2009), by reiterating that the objective world is largely hidden from sensory experience. In the following supporting investigation, by utilizing plausible evolutionary parallels to the "arithmetization of syntax" (Godel, 1931), sections 2 and 3 focuses Jung and Pauli's thesis further than either one originally intended (Jung and Pauli, 1955). In sections 4 and 5 this modified version of acausality is then employed to examine the acausal but synchronous nature of color perception in particular, and the acausal but synchronous foundations of sensory experience in general. Even though our sensations and perceptions do not accurately represent existing properties of reality, they still covariantly provide a limited amount of true higher-order information pertaining to the nature of external existence. This study concludes that it is the identification, categorization, characterization, and awareness of this higher-order objective information that engenders consciousness. **P1**

60 Beyond Split Brains: Hemispherectomies and the Wada Test James Blackmon <jcblackmon@gmail.com> (Philosophy, San Francisco State University, San Francisco, CA)

Conscious entities sometimes survive the permanent or even temporary loss of a functioning brain hemisphere. We know this because of two medical procedures which have existed for many decades: the hemispherectomy and the Wada test. In an anatomical hemispherectomy, one hemisphere is removed from the cranium and discarded, yet survivors of this radical procedure can emerge with a memory of who they are and what it was once like to have lived with that other hemisphere. We have no medical or scientific reason to believe such patients are not conscious individuals despite the obvious cognitive impairments that result. In a Wada test, hemispheres are alternately anesthetized while the awake hemisphere performs diagnostic language and memory tasks. Again, we have no medical or scientific reason to think that one of the hemispheres lacks consciousness while performing these tasks. In fact, in both the hemispherectomy case and the Wada test, the patients can obviously meet our medical and common-sense criteria for consciousness. And yet, that which

survives the loss of the left hemisphere is obviously not that which would have survived the loss of the right. I argue that these medical realities (and others) are best explained by the postulate that our brains host many conscious entities, some of them deserving to be called minds. I argue further that there is something it is like to be a hemisphere that loses (and, in the case of the Wada test, regains) functional interaction with another hemisphere. **C13**

61 Actual and Hypothetical Phenomenal Contrast Scenarios - A Route To Cognitive Phenomenology? Martina Fuerst <martina.fuerst@uni-graz.at> (Philosophy, University of Graz, Graz, Austria)
In the last century, most philosophers endorsed separatism between phenomenal states that essentially exhibit a phenomenal character on the one hand, and cognitive states that do not essentially exhibit a distinctive phenomenal character on the other hand. This separatist picture is challenged by the cognitive phenomenology-thesis (in short: CP-thesis). The central claim of the CP-thesis is that conscious cognitive states also essentially exhibit a distinctive phenomenal character. There is significant controversy about how to characterize the phenomenal character of conscious cognitive states. Defenders of a strong CP-thesis claim that introspection delivers a sui generis, proprietary, cognitive phenomenology. Proponents of a weak CP-thesis, in contrast, hold that introspection only reveals the familiar kind of sensory phenomenology (such as visual or auditory imagery, emotional or bodily responses, etc.). This disagreement about the introspective deliverances is puzzling, since phenomenology is often seen as being directly revealed by introspection. To convince their opponents, defenders of a strong CP-thesis rely on the method of phenomenal contrast. Arguments from actual phenomenal contrast take the following form: First, readers are invited to imagine two mental states that differ in their overall phenomenal character. Second, by pointing out that the same sensory phenomenology is involved in these two states, it is argued that the phenomenal contrast can only be accounted for in terms of a proprietary cognitive phenomenology. These arguments take the form of inferences to the best explanation. Moreover, they aim to elicit introspective data that support the existence of a proprietary cognitive phenomenology. In my talk, I first analyse arguments from actual phenomenal contrast. I demonstrate they these arguments fail to meet their aims: arguments from actual phenomenal contrast neither establish proprietary cognitive phenomenology via inferences to the best explanation, nor yield introspective evidence for a proprietary cognitive phenomenology. Next, I analyse hypothetical contrast-scenarios such as the Zoe-case developed by Kriegel (2015). I discuss whether such scenarios are coherently conceivable at all. Finally, I argue that to establish a strong CP-thesis, we have to search for arguments that are not phenomenal contrast-based. **C9**

62 What Are Phenomenal States? Nicholas Georgalis <georgalisn@ecu.edu> (Philosophy, Greenville, NC)
Phenomenal experience is one thing, phenomenal state another. Too often discussions in philosophy of mind conflate phenomenal experience and phenomenal state and give no account of the latter. Consciousness alone may identify phenomenal experience but fail to expose the properties of phenomenal state. To speak precisely of a state of a system or body the properties that constitute these states must be specified. Speaking vaguely of 'phenomenal state' reduces the latter locution to no more than an empty place-holder. I do three things in this paper: (1) I discuss what in general is required to specify a state of a system or body, a specification of its constituent properties. (2) I argue that an adequate account of phenomenal state must include subjective properties among its constituent properties. (3) I argue that whatever plausibility there is to David Rosenthal's argument to the contrary conclusion depends upon an unspecified use of 'phenomenal state', and I show that this deficiency in his account undermines a main pillar of his conclusion. My account of phenomenal state is arrived at by examining the well-worn case of Frank Jackson's Mary example-but to a new point. Identifying brain properties which play some role in having a phenomenal experience is a start on specifying the properties constitutive of phenomenal state, but they are not sufficient. I argue that the phenomenal state that underlies having phenomenal experience cannot be adequately characterized without specification of two subjective properties as constituents of phenomenal state, along with brain properties. Thus, there are no non-conscious phenomenal states. Rosenthal's theory is in clear opposition to mine, as he attempts to establish the thesis that phenomenal state does not require consciousness. A crucial step in his attempted justification of this thesis is his reliance on an alleged homomorphism between what he calls 'mental color properties' (phenomenal experiences) and brain properties. I argue that he fails to provide the resources that even would allow a candidate for such a homomorphism to be considered. The question whether similarities and differences in one domain are preserved in another - whether a homomorphism exists - cannot be meaningfully asked if one of the domains (brain properties) is only indeterminately specified and no relations

are defined on it. Thus, his claim that a homomorphism exists is mere hand-waving. Nevertheless, Rosenthal attempts to support his claim that consciousness is not required for phenomenal state by alleging the required homomorphism. In consequence, it is his thesis that drives the claim for the required homomorphism rather than, as he claims, the homomorphism supporting his thesis. Rosenthal does plausibly argue for a homomorphism between mental color properties and spectral reflectances and absorption spectra of cones. Granting the existence of such a homomorphism, I show that it is not sufficient for the homomorphism he requires for his thesis, viz., one between mental color properties and brain properties. Finally, I indicate why my insistence on the necessity of subjective properties for both phenomenal experience and phenomenal state is no commitment to dualism. **C9**

1.06 Machine consciousness

63 The Focal / Non-Focal Paradox: Exploring Architectures of Consciousness Jeffrey Beck <vortex.beck@gmail.com> (Paradigm Research LLC, Gunnison, UT)
As a controls engineer, I view consciousness from a functional perspective. That function seems to be about planning trajectories in an indeterminate or undecided space, the space of our consciously experienced reality. As humans, our evolved bodies bring with them a natural language of qualia which guides our individual evolution and helps us survive to reproduction. If we intend to become the creators of artificial, or synthetic, conscious agents, we will need to get down to the nuts and bolts level of understanding of how consciousness works, including how qualia modify the experience of consciousness. Towards that end, I have been exploring a perspective which I feel will be useful, what I am calling the Focal / Non-Focal Paradox (F/NF Paradox). The idea for the F/NF Paradox comes from the observation that Everything can be divided into two irreducible parts. I use Everything here in a special capitalized form to truly mean everything, including the material, mathematical and conscious domains. The space defined by the F/NF Paradox seems to have the properties needed for functional conscious agents. I will present a current assessment of my work to define boundary conditions of this space, as well as some observations about physical structures that span this space and appear to be carriers of qualia. I will also discuss the F/NF Paradox in interpreting recent research into how the brain encodes meaning via neural networks of differing scales. Lastly, I will outline ideas for further exploration into understanding the indeterminate space of the F/NF Paradox. **P2**

64 Romancing the Oxymoron: The 'Hardware Problem' of Machine Consciousness Stephen Deiss <deiss@appliedneuro.com> (Comp. Sci. & Eng., appliedneuro.com, San Diego, CA)
THE fundamental question is how consciousness relates to mechanistic processes studied in the sciences. Many advocate one of two extremes: either consciousness is not mechanistic at all or it is an emergent property from mechanistic processes of a certain type or order of complexity (e.g., spiritual traditions vs IIT, ORCH-OR, GW). Intuitive philosophers often emphasize the 'aboutness' of consciousness as it refers to something beyond itself while others emphasize the self which is doing the referring, or a high order thought about the two together. A very basic intuition is that conscious experiences involve sensory and cognitive qualia, and without either only a zombie remains to sing the blues. The presumption that engineers cannot give such qualitative sensations to machines is a reason many refuse to entertain the possibility of machine consciousness. They argue that such systems simply execute rules or algorithms following natural laws devoid of sensation, and they are automata devoid of reflexive self experience in doing so. In contrast neuroscientists use the word 'mechanism' probably more than any other to describe the complex but approachable biochemical, genetic and cellular interactions that make a conscious mind possible, often avoiding the need to explain why a blob of fat should hear itself think or feel anything at all. Theories of consciousness grow ever more sophisticated and quantitative. But this fundamental gap in the explanations remains. I have maintained for over a decade that the crux of the problem is the assumption that there are laws operating on nature from a higher mathematical or divine realm. If one is able to abandon this view for a radically secular view of nature, the question becomes how natural systems do what they do from intrinsic principles and constraints rather than as externally directed. I will present this viewpoint using counterintuitive arguments precisely because what is giving us the hard problem is our intuitions about what a mechanism is accompanied by a lack of clarity about what consciousness is. Neuroscience is unraveling the so-called mechanisms that accompany living systems experience. Methods such as neuromorphic engineering and deep learning, and models such as free energy theory and Bayesian inference are inevitably leading to the ability to engineer machines that can do more

than we can. I will argue that all manner of systems, from atoms to brains and beyond, are conscious with highly variable perceptual skills and a spectrum of self-reference. **C22**

65 The Structure of Consciousness: Insights from Gestalt Psychology, Jungian Analytical Psychology and Shankara's Nondualism Morey Kitzman <kitzmanm@msudenver.edu> (Psychology, Metropolitan State University of Denver, Denver, CO)

There is an overwhelming vagueness that permeates any discussion of consciousness, as though we should just understand what is intended without articulated the dynamic nature of consciousness. All kinds of outlandish claims are bandied about prophesying the rise of A.I. and how the human species confronts imminent demise at the hands A.I. Certainly it is peculiar how for most of the last century humans were denied consciousness and free will and now all of sudden machines can have both. So much so that A.I. will choose to dispense with its creator. It my be advisable to take a few steps back and consider the cognitive advantages human cognition has over its A.I. counterparts or should we say counter parts. What seems to be ignored in all the virtues of A.I. is the complexity of human thought. For all the determination of American behaviorism to blur the distinction between human and subhuman, they never succeeded in teaching our nearest relatives in the animal kingdom how to calculate square roots. Like it or not there is something qualitatively different about the human mind. We embody a complexity that has no rival in the animal kingdom. We see the complexity expressed in every aspect of our lives, from mathematics to engineering, from philosophy to art and music. Even though no one would question the astonishing advances in A.I., they are mere child's play when compared to our ability think, conceptualize in mathematical terms and innovate. One could argue that a more proper test for A.I. to demonstrate some equivalency to human cognition would be for computers to develop mathematical concepts like calculus, algebra and geometry. So the paper argues that we should shift the discussion away the almost entirely meaningless concept of consciousness in humans or machines, to a consideration of modeling complex cognitive dynamics of humans in machines. We have several decades where we are arguing and debating on whether machine consciousness is possible without the slightest clue or agreement of what consciousness means. This is tantamount to setting a prize for who can build the first 'gobbledegook' without specifying what exactly a 'gobbledygook' is. If our efforts were directed toward understanding the basis for complex thought in humans, we see considerable advantage. In this respect we should consider the often ignored research of the field of Gestalt Psychology, in particular as it relates to problem solving and creativity. As well ideas about the architecture of the mind from Jung to Shankara. In effect, we need a model of the architecture of the human mind. Clearly the human mind exists and therefore an architecture or model to describe it must exist. The social sciences might benefit from emulating physics in their ability to model extremely abstract and complex dynamics of the universe. Why is it that consciousness research is so devoid of models? Surely, the human mind cannot be more complex than the universe itself? **P2**

66 The Conscious Machine Niti Prasad, Prem Sewak Sudhish, Dayalbagh Educational Institute <prasadni@msu.edu> (Michigan State University, East Lansing, MI)

It is widely debated whether it would be possible to create machines that would by and large have characteristics similar to conscious beings. While there isn't sufficient evidence in the present to put the question to rest either way, this research, while making a clear distinction between intelligence and consciousness, critiques the current practices in advancements towards conscious machines and proposes a novel paradigm to approach the problem. Most current models derive from the progressions in computer science and neuroscience, attempting to replicate a physical model of the human brain on computers. This approach, while working with encouraging results in artificial intelligence through the use of artificial neural networks, deep learning and other brain-mimetic techniques is argued to be essentially reductionist in nature. We propose that innovations in machine consciousness can be expedited by adopting a more holistic approach that incorporates a framework to also consider the metaphysical aspects of consciousness. This would first require development of a common ground along with suitable methods for modelling metaphysical attributes. While deliberating on David Chalmers' argument in 'The Hard Problem of Consciousness' and Dean Hamer's extraordinary claim of the God gene that is ascribed as a physical indicator for inclination towards God, we explore a more inclusive approach towards future developments in machine consciousness. **P1**

67 A Solution and Turing-like Proof to the Problem of Human Consciousness: The Commercial Design/Development of Highly Intelligent, Verbally Communicative, Human-like Conscious Machines. Yosef Rosen, Alan Rosen; David Rosen <y.rosen@mcon.org> (Machine Consciousness, Inc., Westlake Village, CA)

1. Consciousness is a subjective mental activity or experience. Technically it's the subjective experience of humans known as the modality of human tactile receptors, auditory receptors, visual receptors, etc. Non-technical definitions of consciousness will be discussed in the presentation. 2. It is impossible to objectively prove the existence of a mental subjective experience, except by statistical questioning of a large number of humans. 3. MCon has designed and obtained patents (see www.MCon.org) on a human-like verbally communicative, highly intelligent humanoid robot. The Auditory RRC-Humanoid Robot is designed with a controller that allows the robot to be programmed with subjective Artificial Intelligence (AI). The AI is subjective because it is related to the 'self' of the Robot. The 'self' is a self-location and identification coordinate frame that is the centralized repository of all the data learned by the Robot. The controller also gives the robot a volitional (free will) capability, an experiential capability to see, hear, and intelligently talk, and a capability to record and remember all its subjective experiences. 4. This human-like robotic machine is a perfect vehicle for the conduct of a Turing test of consciousness. We prove the existence of the consciousness phenomenon within the robot's controller-brain, by a Turing-like test; namely we ask the robot to recount its conscious-subjective experiences and compare its response to human responses (humans who were exposed to the same experiences). Note that, as Francis Crick postulated, if the robot 'sees' the same colorful external world as humans, then the robot is, with high probability, visually conscious. 5. The same response obtained from the volitional robot and from humans may prove (statistically) that the robotic sensations are equivalent to the conscious experiences of humans. Furthermore, the robotic design of the Electronic Correlate of Consciousness (ECC)-circuit, designed into the robot, may be functionally identical to the hypothesized Neuronal Correlate of Consciousness (NCC)-circuit in the human brain. 6. The discovery of the design of the NCC-circuit, and the design of conscious-awareness into a highly intelligent humanoid robot leads to two innovative breakthroughs: a) In biology, the role that the Consciousness Mechanism (CM) plays in the study of human emotions, human motivation, and human learning/education. And b) a potential revolution in the field of commercial robotics. 7. Revolution in the field of commercial robotics: The Auditory RRC-Humanoid Robot is a conscious android machine with a human-like body and brain, that feels pleasure and pain, can see, hear and talk like a human, and evokes the empathy one feels for a household pet or a living child. These robots are generally designed and trained to an Artificial Intelligence (AI) level of a human High School graduate. The robot is a 'selfie' android, in the sense that it has a self identity, and all its life-experiences are gained and remembered relative to the self-circuit within the controller. When commercialized (mass produced) the units will be sold at under $100,000 per unit. A proposal to build a prototype robot is shown at www.mcon.org. **P2**

68 5-Technological Breakthroughs that Lead to the Design-development of a Conscious Artificial Intelligent (AI)-Android Robot that "Sees," "Hears," and Speaks Like a Human Alan Rosen, David B. Rosen <arozu1@gmail.com> (Machine Consciousness Inc, Redondo Beach, CA)

Human-like AI*: Since the advent of the field of AI there has been confusion between machine-like AI and human-like AI. Because human-like AI involved "thinking-conscious" processes that were clearly beyond the state-of-the-art, the whole field went in the direction of developing objective machine-like AI into android robots. The presentation will show that subjective human-like intelligence is a pre-requisite for the design of a "conscious" machine. A robotic controller that operates like the human brain*. The brain controls the human body based on sensory data received by its 6-sensors. It also gives the human a volitional capability, often called a "free will"-capability. This capability allows the human to change its control function within one frame period of receiving "emergency" type data. The human brain does not compute, calculate, measure, or display data, as most modern day digital computers do. The human brain relates, co-relates, prioritizes, and remembers the data obtained from its sensory system. A RRC-robotic system that operates like the human brain will be described. A robotic self identity coordinate frame-system*: Humans have a self identity system that gives each human proprioceptive "knowledge" of the location and identification of each part of its body and the approximate location of all points in the near space surrounding the body. In humans, the self-identity system is the central hub of intelligence for all the data gathered during its lifetime. A robotic "self" identity system will be described. A robotic visual system that forms a 3-dimensional photometric image within the self identity coordinate frame*: The human visual system converts two 2-dimensional retinal images into a 3-dimensional image that is a high fidelity representation of the viewed objects. There is no computer vision system in existence today that forms a 3-dimensional image in the "self" coordinate frame. Furthermore, in the field of visual neurobiology, it is not yet known how the visual cortex reconstructs the two 2-dimensional retinal images into a single 3-dimensional image that is a high fidelity representation of the objects that gave rise to that

image. A robotic visual-technological and neurobiological breakthrough will be described. A robotic auditory system that "hears" and understands verbal speech, and responds intelligently by means of a verbal sound generator*: In a robotic auditory-talking system there are two problem that must be solved, a hearing problem and a talking problem. In hearing, the problem is of mapping the perceived acoustic spectrographic (a-f-t) properties of language into an identifiable phonetic structure. State of the art speech processing systems have not solved the acoustic mapping problem. A behavioral programming methodology was developed for "unpacking" the highly encoded, context dependent speech signals. "Unpacking" is performed in a robotic interface circuit by programming the robotic controller to repeat and remember the heard words and sentences of multiple speakers. In "talking," a phoneme based verbal sound generator was developed wherein all phoneme control signals emanate from the "self"-circuit within the controller, and wherein all the heard phoneme words are processed in the same system. * References to published data: www.mcon.org **P2**

69 The Effect of Music Listening on Concentration, Consciousness and Work Efficiency: A Case Study Majer Singh, Charan Prasad; Meenu Singh <majersingh@gmail.com> (Technical College, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Creating an effective environment and proper utilization of human resource is the main target of human resource management of organizations. Music has been found to have profound effect on the brain. Psychologists and scientists have been looking at the link between music with mood, concentration and better production for years. Playing background music is taken into consideration by most of the organizations with the expectation that it will reduce the work place stresses, control the annoying thoughts develop self confidence, inner strength and ability to study and comprehend more quickly. It will also develop the creative visualization, psychic power and peace of mind. This allows the person to peek beyond the material plane and know things that remain hidden to other people. The study was aimed at examine the effect of background music on the concentration which will improve the production in an automobile industry manufacturing two wheeler. The hypothesis has been developed to fulfill the major objective of identifying the effect of music listening on concentration for better production and mental satisfaction. The sample size was 50 workers from assembly line and 50 workers from magneto shop out of 70 each and the data was calculated by distributing well structured questionnaire for same sample of employees before and after music listening, so that sample listened to the relaxation music for two weeks. Mean comparison test and regression analysis was used for the analysis of the data. It was found that background music has a profound effect on developing concentration and improving consciousness of the respondents. Correlation before music listening concentration: 0.590, after music listening 0.796; correlation before music listening concentration 28.742 after music listening 34.945 and mean before music listening consciousness 27.87 after music listening 32.945. Also the percentage of rejection reduced from 15% to 6% after listening music. The study proved the fact that better production and good performance can be improved by creating a light, friendly environment with background music in which the employee concentrate on work whole heartedly keeping in mind the main objective of life. **P1**

70 Why Self Driving Cars Must Believe in God and the Oil-Change Fairy John Small <jds340@gmail.com> (Mindoro Marine Ltd, Faversham, Kent United Kingdom)

Driving is a social skill, autonomous vehicles will have to develop social awareness if they're to be really successful. That means they'll have to develop an awareness of other independent agents with intentions of their own, and also awareness of themselves as other cars see them. But that holds a curious implication. Research workers in neural networks for image recognition have found they can induce the networks to see things that aren't there. In addition human beings are adept at finding agents in amongst the random noise in the world outside and deducing their motives and intentions. But that results in cognitive hallucinations of independent agents with motives and intentions that aren't really there. Human beings are wired to believe in gods because our brains are set up to process social information and find agencies in the world around us. To be adept at moving about in crowded cities, self driving cars will also have to have neural networks capable of processing social information. That means they'll be subject to the same kind of cognitive hallucinations that we are. Autonomous vehicles will hallucinate independent agents and ascribe motivations to them, even though none exist. Self driving cars will believe in gods. When self-driving cars start believing in gods it will help people to gain insight into their own mistaken perceptions of gods. **P2**

71 10 Things an Artificial Intelligence Can't Do. Non-computability, Its Limits on 'Artificial Intelligence' and What a 'Real Intelligence' Machine Might Look Like James Tagg <james@taggs.com> (Crockham Hill, Kent United Kingdom)

Are brains digital computers - Turing machines formed of flesh and blood - or are they a more powerful class of mechanism? Brains are good at creative problem solving but bad at mathematics, yet this does not prove the underlying computational frameworks are different. A word processor behaves differently to a computer game, but this is simply an adaption to the tasks it is solving, the computational mechanics underlying each is the same. We will explore the distinction between brains and computers and examine the ability of brains to solve non-computable problems. In particular, we will examine Hilbert's 10th problem, which is known to be non-computable, and demonstrate that finding a proof of Fermat's Last Theorem (FLT) is a non-computable arbitrary problem for a general purpose machine. Andrew Wiles proof of FLT presents a paradox: He is thought to be a computer, yet he has solved a non-computable problem. This means that Wiles cannot be general purpose computer but must be special purpose machines with at least the ability to solve FLT encoded within him. Such an encoding puts constraints on the construction of the Universe. It must be able to encode information reliably from the big bang to the moment the proof is transcribed. However, such reliable encoding is at odds with the Bell inequality and the Conway-Kochen free will theorem. We, therefore, conclude that Wiles is not a digital computer and by induction neither are humans in general. We further argue that the Universe itself is not a computer. If the Universe and the brain are not computers what physical - and mathematically valid - non-computable mechanism could provide a model for human thought processes. We examine the potential for the human brain to be a topological quantum-gravity computer in accordance with the Penrose-Hameroff Orch-OR thesis. **C22**

72 The Distributed Adaptive Control Theory of Consciousness: A Robot Based Model of Unitary Sequential Consciousness Processing and Parallel Action Generation. Paul Verschure <paul.verschure@gmail.com> (Center of Autonomous Systems, University Pompeu Fabra - Catalan Institute of Advanced Studies, Barcelona, Spain)

The Distributed Adaptive Control Theory of Consciousness (cDAC) starts from the hypothesis that the acting brain must optimize 5 fundamental objective functions in order to solve the How of action: Why, What, Where, When, Who or H5W. These objectives are satisfied through the robot based multi-layer control architecture comprising the body together with reactive, adaptive and contextual control systems [1]. This approach has been taken to advance biologically grounded models of rodent foraging [2] and cognitive architectures for social robots [3]. It can be shown that DAC and its robot instantiations capture the main tenets of current theories of consciousness including: the embodied self, sensorimotor contingencies, prediction, integration, the global workspace and higher order representations. However, this is not sufficient to fully resolve the H5W problem, in particular the 'Who' objective. DAC proposes that real-time behavioral control by necessity is realized through parallel feedforward and feedback control systems. This parallelization, however, in turn creates a credit assignment problem both in terms of the selection of the relevant perceptual and internal states, actions and their outcomes. Resolving this credit assignment problem requires an autonomous transient memory system that facilitates the maintenance of a unitary yet virtualized description of the task(s) the agent engages in with the function of extracting norms for optimization. These norms are not to be confused with reinforcement signals per se, the latter being directly coupled to unambiguous states of the environment. Rather norms must be inferred from the actions of other agents and/or distributed internal processing. Here I will provide supporting evidence for the cDAC proposal from a number of sources. First, using a dyadic interaction paradigm with a humanoid robot I will demonstrate how the DAC theory functions and accounts for the H5W challenge. Second, using a biologically grounded foraging robot I will show how the subjective state of mind travel can be unraveled in objective causal terms of the dynamics of behavior and the simulated neuronal substrate. Third, I will present a novel extension to the cDAC model comprising the dynamic regulation of feedforward, recurrent and top-down processing in the thalamo-cortical system supporting the notion of the cDAC transient norm generating memory system. Based on these results we can thus hypothesize that the function of consciousness is to optimize an H5W solving agent's future performance based on inferences on the quality of current parallel real-time control. This leads to the suggestion that agency and free will serve future performance propelling the agent into the future rather than controlling its present. References 1. Verschure, P.F.M.J., et al, Environmentally mediated synergy between perception and behaviour in mobile robots. Nature, 2003. 425(620–4). 2. Maffei, G., et al., An embodied biologically constrained model of foraging: from classical and operant conditioning to adaptive real-world behavior in DAC-X. Neural Networks, 2015. 72(88-108) 3. Lallee, S., et al., Towards the synthetic self: Making others perceive me as an other. Paladyn, Journal of Behavioral Robotics, 2015. 6(1). **C22**

1.07 Mental causation and the function of consciousness

73 Consciousness in Theory of Mental Activity Donelson Dulany <ddulany@illinois.edu> (Psychology, Department of Psychology, University of Illinois, Champaign, IL)

Fundamental to a science of consciousness is the explanatory role of consciousness in mental activity. It is especially important for further understanding of phenomena central to current research in cognitive psychology and social cognition. For both theory and methodology there are conceptual challenges and answers, coming not only out of psychology and its history, but also out of philosophy of mind and of science. This talk will sketch basic challenges, as well as answers provided in a Mentalistic Metatheory and a Logic of Competitive Support (as e.g., in Dulany, 2014, 2012, 2011, 2009). [1] Conceptual Challenges for Theory of Consciousness in Mental Activity: Place of symbolic representation, "intentionality" in mental activity. Specific roles for conscious contents in representing present, past, and future, in the external world, and for representing conscious states and in mental activity metacognitively. Adaptive significance. Kinds and forms of conscious modes and contents: Literal and identity contents. Modes from sensing to imagining. Propositional and sub-propositional contents. Interrelations in mental activity: Deliberative and evocative (associative activational) mental episodes - and their interrelations. Quantitative variations. The non-conscious: Mental operations, inactive memory networks, sensory and motor transduction systems. The status of volitional control: Volition with causal antecedents, in contrast to "free will" in the sense of indeterminism. Relation of Mentalistic Metatheory to others (Global Workspace, Computational Models, Higher Order Thought). [2] Conceptual Challenges for Methodology Investigating Consciousness in Mental Activity: Mapping of conscious states to empirical variables. And kinds of phenomenal reports that are defensible. Third-person data, for conscious state constructs, with validity standards, and specification of their roles in theory examination. Standards of theory confirmation and disconfirmation: Theory, mappings, and auxiliaries within a Duhem-Quine aggregate, Bayesian rationality and richness of theoretical and data network for competitive support. Causality for consciousness constructs. Theoretical and Experimental Examples: Inferential causal learning, volitional control. **C3**

74 Consciousness an Afterthought: The Sixth Sense Keith Elkin <tsc@webetize.com> (Frederick, MD)

Consciousness an afterthought: the sixth sense The central point is that the consciousness is an advanced information channel, a sixth internal sense. Consciousness is not the seat of the self or free will. Consciousness is defined as «state of being awake and aware»; Consciousness «feels» the senses and «hears» the «just-so-story» that was collected and correlated into sequential events. The function of consciousness is to provide a new information channel between other brain systems. The pre-consciousness communication between brain systems evolved and is limited by the earlier pathways; these pathways did not provide the possibility of a historical correlation or integration with a high level pattern of cause and effect at a significantly abstract but focused level. Consciousness provides this pathway, allowing perception of previously unperceived cause and effect. Consciousness is the pathway that provides a method for the brain to take its existing impressions both visual and auditory and re-create a time line of experiences and conversations that are then re-presented to the rest of the brain through the existing sensory channels at the level of the brain. This is not a feedback loop in the simple sense, but a feedback loop of a rarified and extremely intensely processed, correlated and organized remembering. This allows the brains different functional entities to process the information a second time and through different pathways which are not fully integrated under pre-consciousness evolution. In a similar simplification, we can add to the traditional reptilian brain, limbic brain and neocortex brain we could add the Consciousness brain. While I am using the concept of a «processing assembly» I do not want to imply a collection of neural connections located on one place, but as the brain evolved a processing assembly could evolve that is more widely distributed than the older assemblies. To use a modern phrase, the brain evolved as the inter-net of things. The sub- consciously produced presentations are used by the other brain systems in a manner similar to any sensory input. So the just-so-story is not a simulation or model like other lower level brain systems, but a re-created imagined reality. The advantage of the story-line is to give a communication channel between otherwise non-linked brain systems and to help correlate across a longer time period and sensory modalities. I do not want to imply that consciousness is dependent verbal language abilities, consciousness has syntactic and semantic elements, but these are pre-linguistic multi-modal elements and closer aligned with cinematic language The purpose or function of Consciousness if I may use that term, is the channel for presenting a story-line combining our internal and external experiences. The rest of the brain can then experience this story-line using the loosely coupled per-consciousness brain systems technology. Central to understanding Consciousness is to understand the «story-teller» and the central aspects of «feeling» thought. **P2**

75 The High Cost of Mental Causation Horace Fairlamb <fairlambh@uhv.edu> (Arts and Sciences, University of Houston-Victoria, Briarcliff, TX)

Since Hume's denial that reason had any causal force of its own, mental causation has been a problem. Intentional thought feels like it has causal heft, but the leverage of mind over matter runs afoul of the apparent causal closure of the physical: the mind seems to do things without being able to explain how. Why not trust the mind's feeling that it causes events? Even if the mind were a higher form of matter or energy, mind would still appear to be epiphenomenal if, as reductive materialists suggest, all the real causal work is done by lower level matter: atoms, molecules, chemical reactions, physiological operations, etc. If physical causation is already closed at levels below mind, there is nothing for it to do. Complex systems theory can solve that pretty-hard problem. Systemic attractors function as did Aristotle's final causes. Likewise, computer scientists and cognitive psychologists explain cognitive operations in terms of high-level formal rather than low-level material properties. High level systemic properties do explanatory work after all. Whether one deigns to call such higher level formal properties 'causal' is merely a matter of semantics. In any case, the Cartesian interaction gap proves bridgeable: mind doesn't push matter; it steers it. Even Hume allowed that. But consciousness may not enjoy the mind's causal salvation. Insofar as consciousness suffers the hard problem, it may not reduce to nothing but AI's information flows. Computers may mimic human consciousness by (re)programming themselves; but that is not evidence that they experience qualia. Mind may be just a function, but not consciousness, given the surplus of qualitative experience. So solving the interaction problem comes at a price: ironically, under the complex systems regime, mind may regain its causal powers at the expense of the higher forms of consciousness, whose functions remain mysterious. Furthermore, distinguishing mind and consciousness raises a crucial semantic problem. Why confine consciousness only to the highest, most self-aware properties of mind? Why not allow that blind sight and animal behaviors are conscious as well, albeit less so? Why not follow the panpsychists and push consciousness all the way down? Perhaps nature is a scale of degrees of mind/consciousness. However liberal one decides to be, the distinction within our own minds between reflective thought and unconscious mental operations allows that our higher order consciousness may actually be epiphenomenal after all. Given that most of the actual steering of the organism is done at a lower level than consciousness, perhaps all steering is. What we experience as intentional consciousness may just be the effect of mental operations that we do not see. Taking a page from materialistic reductionism, perhaps it is the unconscious mind that is doing all the body's steering work, and the experiencing ego just enjoys its fantasies of agency. This view does not reduce either mind or consciousness to matter. But its distinction between thought and experience does cast doubt on the causal efficacy of consciousness as experience. **C3**

76 The Alchemy of Consciousness: Roots of an Experimental Science of Consciousness in Renaissance Alchemy Dennis Hauck <dwhauck@gmail.com> (Alchemergy, Sacramento, CA)

Alchemy is not only the origin of formalized experimentation and the scientific method but also the first systematic attempt to create a science of consciousness. As documented by Dr. Carl Jung and others, the alchemists were the first psychologists, and their balanced empirical approach to the mental realm offers modern researchers a wealth of intimate raw material that sheds new light on the hard problem of consciousness. Those early philosophers of nature treated the contents of consciousness as objective phenomena. The Hermetic philosophy guiding their research taught that our thoughts and feelings are the thoughts and feelings of the whole universe, and that intrinsic perspective generated deep insight into the structure of mind. They viewed consciousness as a force of nature that could only be understood through a sacred marriage of logic and intuition, through a merging of objective and subjective realities. Like modern seekers of a unified field theory, the alchemists sought one true philosophy of universal principles that were as valid in the laboratory as they were in their own minds and souls – and in the One Mind of the cosmos. Alchemists expressed mental states and levels of consciousness in terms of the basic substances of their world – elements and metals, acids and caustic solutions, compounds and gases. Although they spoke of metals, chemicals, furnaces, and retorts, they were really talking about changes taking place in their own minds and souls. The weird creatures and complex symbols pictured in the alchemists flasks were attempts to identify the archetypal forces churning in the hermetically sealed vessel of the brain. In this article, we apply the principles of alchemy to the very instrument of our understanding. A powerful, centu-

ries-old science of consciousness will be revealed based on the works of such respected practicing alchemists as Gottfried Leibniz, Isaac Newton, John Locke, Robert Boyle, Robert Fludd, Francis Bacon, Giordano Bruno and John Dee. **P2**

77 Does Quantum Ontology Enable the Causal Efficacy of Consciousness? Paavo Pylkkanen <paavo.pylkkanen@his.se> (Universities of Skovde and Helsinki, Skovde, Sweden)

In recent debates in cognitive neuroscience it has been common to claim on the basis of neural experiments that conscious experiences are causally inefficacious (see Pockett et al. eds. 2006). However, as van Gulick (2014) notes, these arguments are controversial and many theorists regard the empirical data as no real threat to the causal status of consciousness. Philosophers of mind, too, often argue that there is no room in the causally closed physical world for a genuine causal efficacy of non-physical conscious experiences. However, the trouble with much of analytical philosophy of mind (and the physicalism associated with it) is that it often has a very weak connection to our best theories of physics (Ladyman and Ross 2007). To properly tackle the problem of consciousness and its causal efficacy we need a truly scientific metaphysics, a general framework that is implied by our best theories in physics (quantum theory and relativity) and the special sciences (cf. Hameroff and Penrose 2013). Ladyman and Ross's ontic structural realism with its 'rainforest realism' is one such framework, but it is not clear to what extent it can tackle the problem of consciousness. Another candidate for such a framework is Bohm and Hiley's implicate order programme, which includes an ontological interpretation of quantum theory (Bohm and Hiley 1993; Pylkkanen 2007; Pylkkanen, Hiley and Pattiniemi 2015). This interpretation implies some radically new ideas about the nature of quantum mechanical processes. In particular it proposes that a new type of holistic active information plays a key role at the quantum level (Bohm and Hiley 1987). This involves a radical change in what we mean by 'physical', thus opening up new ways of tackling the traditional mental-physical problem (Pylkkanen 1992, 2007). In particular, information can now be seen as a new fundamental category that connects the physical and mental domains, as these latter have been traditionally conceived. This is similar to the proposals of Chalmers (1996) and Tononi et al. (2014) which likewise give information a key role in the theory of consciousness. The advantage of the Bohm-Hiley scheme is that it gives a key causal role for information in the quantum theory, by suggesting that information is encoded in the wave function, and guides physical processes at a fundamental level. If a hierarchy of levels of information is postulated in complex systems such as brains, then consciousness could arise through a higher-order relation between the levels (cf. the proposal about 'deeper-order thought' by Hameroff, Gennaro and Pylkkanen 2014). Once there, conscious experience could activate information and in this way find its proper place in the causal order of things. Reference: Pylkkanen, P. (2016), Is there room in quantum ontology for a genuine causal role of consciousness?, forthcoming in Khrennikov & Haven eds. The Palgrave Handbook of Quantum Models in Social Science. Palgrave Macmillan. **C3**

1.08 The "hard problem" and the explanatory gap

78 The Hardware of the Brain as a Focusing Lens for Intrinsic (Universal) Consciousness Morgan Giddings <morgan@scifoundry.com> (MYS, LLC, Boise, ID)

There are many similarities between the brain's hardware and computer hardware. Both have a memory system that gives access to accumulated information and a referential "frame" for contextualizing present experiences. Both have a "CPU" that performs logical reasoning such as if/then analyses, to assist in navigating and surviving in the world. Due to those similarities, many have pursued the "brain as a computer" theory of consciousness. However, that theory has faced various challenges, the greatest of which is the failure to build a self-aware, creative computer system despite extensive efforts by many brilliant minds. Here, we consider the question: what if there is a third leg to the brain's "operating platform" that is missing from present computer systems? In this third mode, the brain would perform more like a wifi transceiver that tunes into an intrinsic "field of awareness" that gives it operating potential far beyond the inherent limitations of its own CPU and memory systems. Such a hypothesis can simplify many conundra that have faced modern science, including: - The observer paradox in quantum mechanics, i.e. what (or who) exactly counts as an observer enough to collapse the quantum wave function? - The difficulty unifying quantum phenomena with gravity, aka a "unified field theory" (or lack thereof). - The difficulty re-creating consciousness in our current digital machines. - The debate of how pure randomness in the evolutionary process has led to higher functioning beings like humans on a relatively "short" timescale. Hameroff and Penrose as well as others have proposed quantum action in the hardware of the brain, such as coherent states in the microtubules as a source of consciousness (1). Additionally, research from

other fields has pointed to quantum coherent computations occurring in biological systems such as photosynthesis (2). We propose and elaborate on a model of brain function that includes three legs in order to create the platform of human consciousness. Two are present in computer systems, with the "third leg" being the proposed quantum coherence as a sending/receiving function for intrinsic awareness. In this model, it is the balance of the three legs from which human consciousness arises, and with any one missing, consciousness as we know it does not occur. This model may assist in progress forward towards uncovering the roots of consciousness in the human experience. It may form a basis for a new kind of "AI" that additionally incorporates the presently missing third leg, and I will describe several real-world experiments that can be practically performed to test this theory. (1) Penrose, Shadows of The Mind (1996), Oxford University Press, 480 pages. (2) Lee et al., Science 316, 1462 (2007), DOI 10.1126/science.1142188 **C18**

79 The Quest to Solve Consciousness: A Skeptic's View John Horgan <jhorgan@highlands.com> (Stevens Institute of Technology, Hoboken, NJ)

In 1994, I reported on the first Tucson 'Science of Consciousness' meeting for Scientific American in an article titled "Can Science Explain Consciousness?" Ever since, I have continued to track research into how matter makes minds–or, more specifically, how physical objects generate subjective mental states. This is what philosopher David Chalmers, at that 1994 conference, described as 'the hard problem' of consciousness. In this talk, I'll assess major ongoing approaches to consciousness. Do they represent genuine progress, or do they corroborate the mysterian position that the hard problem is intractable? **C18**

80 Solving the Hard Problem May Be Fundamentally Blocked by Godel's Incompleteness Richard Johnson <rictungsten@cox.net> (Free Thought Arizona, Tucson, AZ)

More than three million years ago our early evolutionary ancestors were not self-aware. Consciousness, then, is an evolutionary trait appearing in hominids as recently as 100,000 BCE. The evolutionary benefit of consciousness, says Adam Carley, an information scientist, is that we "see ourselves as a monolithic spirit different from the material world." This led to understanding that our fellow humans are like us. Humans, in probably less than 10,000 years, developed language and then writing, which allowed us to conceive of strategies for survival. The development of consciousness also had a downside - we asked how and why we think; we puzzled over our identity and purpose. Over time, religion emerged to address this problem. The rise of various supernatural concepts was the outcome of these rhetorical questions. But religion is entirely a product of intuition. Can we trust an untested approach? Science begins with intuition, but ultimate answers "theories" are usually counterintuitive. Religion fails to correctly address our pressing existential questions, such as why do we exist? Cognitive science has studied consciousness, and may ultimately present a neuronal mechanism that objectively represents the sensation of being self-aware, but the subjective aspect - why we experience ourselves as individuals - may be ultimately elusive. Alfred Tarski, a cognitive scientist, has pointed out there is no universal language that does not involve us as subjective creators. This disappointing outcome is the basis of Godel's incompleteness theorem, which basically states that no system we devise - including number theory - can be completely understood using its own rules. The fundamental problem is self-reference. Attempts to describe a system that refers to itself leads to paradox. Fundamentally, we are blocked from describing ourselves because we are unable to objectively factor out reference to ourselves as the investigators. Thus, the Hard Problem remains philosophically dense, defying further elaboration. Our efforts to find the source of 'me' or 'I' frustrate us and remain lost in an exceedingly complex maze of neurons and synapses. **P2**

81 The X-Structure: The Solution to the Hard Problem of Consciousness and Reality Steen Loeth, Arnold Therner; Per Bruus-Jensen; N-B Therner <ncp@newcosmicparadigm.org> (and New Science, NCP X-AIONS New Cosmic Paradigm - Advanced Institute of Ontological Principles, Skoevde, Sweden)

Traditional science and the current paradigm cannot provide us with a description of reality as it is, because all human experience is subjective; resulting in a transformed subjective and limited understanding of reality. Primarily we are limited by our sensory organs and the specific way they operate. It is notable and very clear that everything described by traditional science is an interpretation of how we perceive it: a subjective view and understanding of reality, an image we ourselves have created through our sensory organs. In 2014 at the TSC conference, Deepak Chopra, Menas Kafatos and Niel Theise also highlighted this problem in a conference paper headed: "Can Current Science Give Us Access To Reality?" emphasizing that: "Empirical evidence is a description of species specific (human) mode of observation in a specific planetary system". The above mentioned

highlights a "hard problem" of current science and a significant barrier to scientific development. The first steps to a new and greater understanding of reality are facilitated by the recognition of this obstacle combined with an open and humble mind. According to The Cosmic Worldview we can only fully understand reality as it is via intuition and this understanding is independent of our ordinary perception and sensory organs. The aforementioned worldview is based on the knowledge conveyed by the Danish intuitive philosopher and mystic Martinus Thomsen, systematized and developed into a "top-down model" bridging to traditional science by his collaborator Per Bruus-Jensen. The Cosmic Worldview presents a new ontology - a conscious, infinite multiverse and the basic nature of life and reality; "the X-structure". This fundamental X-structure is in principle the same for all living things and its main function is continuous creation of consciousness. Very briefly: The initial reality "X0" is an all-embracing unmanifested, virtual world of emptiness and stillness, containing infinite potential of creative possibilities. This X0-nature is continuously activating an indivisible, integrated Triune Operating Principle with three functional aspects: X1 Creator and Experiencer (the subject/I, emptiness, stillness); X2 Creative and Experiential Ability (energy, morphogenetic effect constants); X3 the Created and Experienced (energy conversion, objectively represented by movement, the material illusion and subjectively represented by life-experience/consciousness). The result of the interaction between the Subject (X1) and its Creative/Experiential Ability (X2) is represented by the Created (X3); namely the material illusion as objective reality on one side - and - the experience of it as subjective reality on the other, "the subjective reality complex". Summarily: The triune operating principle is activating and transforming the emptiness and stillness into energy, force, movement, matter and the subjective side of it all, namely; experience/consciousness. If we go deeper into this structure and process we will also find a solution to the hard problem of consciousness by exploring and understanding the immortal structure of life and the transformation process of objective reality into subjective reality/consciousness - and thereby an insight into reality as it is ... The X-research project by NCP X-AIONS, New Cosmic Paradigm with Advanced Institute of Ontological Principles and New Science, www.newcosmicparadigm.org **P2**

82 Embodied Abstraction - A Road Map from "Structure and Function" to Consciousness, Exposing the Hard Problem as a Brilliant but Seductive Misconception Pradeep Mutalik <pradeep.mutalik@yale.edu> (Medical Informatics, Yale University, Orange, CT)

Chalmers' characterization of the Hard Problem two decades ago was a brilliant appeal to intuition that captured a seeming discontinuity between physical processes and consciousness (meant here as internal experience or qualia or "what it is to be"). Structure and function in a cognizing brain, the mantra went, can only give rise to more structure and function, and therefore can never generate anything remotely like consciousness. The fallacy in the above statement is that structure and function can give rise to something more: it can give rise to Embodied Abstraction. Imagine a physical system such as an orchard with 4 rows of 3 trees. This orchard has structure and function, but it also embodies the idea of "4x3". A cognitive network (a natural or artificial brain), can detect and represent such a concept regardless of what physical entities embody it. This internal representation is constrained to be true to the concept whenever it is encountered, reflecting its abstract properties. This abstract behavior can be monitored by other parts of the cognitive network, generating internal meaning or intentionality, established by consensus in the networks at the same level and elaborated in a hierarchical cascade. The physical causality in the network (neural firing) is now constrained to follow the abstract properties of the concept by means of its structural connections, just as the current flows in a calculator chip by virtue of its design are constrained to invariably show that 4x3 is 12. In a brain, this is internal embodied abstraction, reflecting external embodied abstraction. We are still a long way from consciousness, but we have bridged the first gap - from structure and function to embodied abstraction and are on the road to the internal meaning of concepts and intentionality. A similar hierarchical cascading process can take place among networks that assign value: networks that embody the abstract idea of things being good or bad (for the organism). The lowest level consensus for this can be easily established through genetically determined wiring, and higher levels can elaborate the value system and link it to more complex concepts and situations. In fact, the internal meaning embodying value is far more basic and primitive, and is the place where the most important aspects of consciousness are created: qualia. All the most interesting things in the evolution of consciousness took place hundreds of millions of years ago. An injured worm writhing in pain perhaps expresses a most basic quale, the internal recognition of something bad. Qualia are thus internal value being communicated in "insistent broken value-laden mentalese" that cannot be fully parsed by the highest levels of the networks that assign precise conceptual meaning. In contrast, higher

functions such as memory recall and language do not have any "feel" to them, because the internal conceptual meaning can be fully parsed. Thus, what is it to be a bat is dependent on the layers of internal meaning that has evolutionarily and historically been realized in the bat brain. **C1**

83 Attneave Was Wrong: The Infinity of Homunculi Iftikhar Nizami <nizamii2@att.net> (Palo Alto, CA)

Remember Homunculus? An imaginary personage resides within the brain, "decoding" neuronal spike-trains in order to infer stimuli. But Homunculus needs legs, to roam; arms, to isolate neurons; and eyes, to observe spike firing. Coordinating these capabilities is Homunculus' brain - and within it a Homunculus, and so on ad infinitum. Attneave (1961) sought to dismiss this infinity, in an oft-cited but remarkably brief paper, crucial to others (e.g., Crick & Koch 2000, 2003). In Attneave's words: "If a homunculus exists it must certainly be composed of neurons ... We fall into a regress only if we try to make the homunculus do everything ... The moment we specify certain processes that occur outside the homunculus, we are merely classifying or partitioning psychoneural functions; the classification may be crude, but it is not in itself regressive ... Indeed, one might even hypothesize a series of concentric or nested homunculi without falling into a regress, provided each contained an outer layer of functions not contained in the next smaller one ... For any given behavior there must be at least one neuron that 'decides', on the basis of activity in receptors and other neurons, whether to initiate that behavior or not ... There may be as many 'homunculi' of this sort as there are coherent behavior patterns". That is Attneave's scheme. Does it work? First, imagine "homuncular layers" of functions. External to each layer is its own Homunculus, controlling a subset of that layer's functions. Let the "Top Layer" have "n" number of functions, presumed sufficient for a "mind". Topmost Homunculus only controls m < n functions. Topmost Homunculus contains a sub-Homunculus, controlling L functions, L < m. Within sub-Homunculus is a sub-sub-Homunculus, controlling k functions, k < L, and so on. The Second-to-Lowest Layer has b functions (b << k), of which Second-to-Lowest Homunculus controls only two. Those two comprise the Lowest Layer, with Lowermost Homunculus controlling only one. If this altogether is Attneave's scheme, then it is untenable, as follows. Customarily, we presume the brain to be sufficiently "stupid" to need a prime Homunculus to coordinate it - a Homunculus which, requiring coordination of its own capabilities, contains a Homunculus, and so on ad infinitum. To overcome the infinity, Attneave redefines Homunculus, requiring that successively-nested Homunculi be successively "stupider". Attneave ignores that any Homunculus necessarily contains an infinite nesting of identically "stupid" Homunculi. And of the functions controlled by [redefined] Second-to-Lowest Homunculus, one would actually be controlled by Lowermost Homunculus, leaving Second-to-Lowest Homunculus to control fewer functions than imagined. This effect propagates up the homuncular layers, leaving Topmost Homunculus controlling as few as one single function. We might assign separate Homunculi to groups of Top-Layer functions; but now a Homunculus is needed to coordinate those Homunculi. And who (on any layer) would coordinate Homuncular-controlled functions with non-controlled ones? An outside-the-scheme Homunculus. Altogether, Attneave (1961) merely ignores the infinity of Homunculi, rather than ending it. To do that, we must stop assuming that the mind is "stupid", and instead assume emergent brain-self-coordination. **P1**

84 Emotional Sentience and the Nature of Phenomenal Experience Katherine Peil <ktpeil@comcast.net> (EFS International, Kirkland, WA)

When phenomenal experience is examined through the lens of physics, several conundrums come to light including: Specificity of mind-body interactions, feelings of free will in a deterministic universe, and the relativity of subjective perception. The new biology of "emotion" can shed direct light upon these issues, via a broadened categorical definition that includes both affective feelings and their coupled (yet often subconscious) hedonic motivations. In this new view, evaluative (good/bad) feelings that trigger approach/avoid behaviors emerged with life itself, a crude stimulus-response information loop between organism and its environment, a semiotic signaling system embodying the first crude form of "mind". Emotion serves the ancient function of sensory-motor self-regulation and affords organisms - at every level of complexity - an active, adaptive, role in evolution. A careful examination of the biophysics involved in emotional "self-regulatory" signaling, however, acknowledges constituents that are incompatible with classical physics. This requires a further investigation of the fundamental nature of "the self" as the subjective observer central to the measurement process in quantum mechanics, and ultimately as an active, unified, self-awareness with a centrally creative role in "self-organizing" processes and physical forces of the classical world. In this deeper investigation, a new phenomenological dualism is proposed: The flow of complex human experience is instantiated by both a classically embodied mind and a deeper form of quantum consciousness that

is inherent in the universe itself, implying much deeper - more Whiteheadian - interpretations of the "self-regulatory" and "self-relevant" nature of emotional stimulus. **PL8**

85 Conscious Agents and the Invention of Space: Two Theorems Chetan Prakash <cprakash@csusb.edu> (Mathematics, California State University, San Bernardino, CA)

The Interface Theory of Perception states that perceptual experiences do not approximate properties of the objective world, but instead provide a simplified, species-specific, user interface to that world. Conscious Realism states that the objective world consists of mathematically defined 'conscious agent' and their experiences. Under these two theses,consciousness creates all objects and properties of the physical world, leading to a solution to the mind-body problem. In support of Interface Theory, I use evolutionary games to present a mathematical theorem saying that perceptual strategies that see the truth will, under natural selection, be driven to extinction by perceptual strategies that are tuned to fitness. Our perceptions have evolved to guide adaptive behaviors, not to report the tru. I then give a mathematical definition of 'Conscious Agnet," and introduce a non-dualistic dynamical theory of conscious process in which both observer and observed have the same mathematical structure. In support of conscious realism, I then demonstrate two more theorems showing that a conscious agent will consistently see structures, in particular the geometric and probabilistic structures of space, that are not necessarily in the world but exist in the structure of the conscious agent itself. The world simply has to be amenable to such a construction on the part of the agent; and different agents may see the world as having different (even incompatible!) structures. This again supports the idea that the truth of the world is likely quite different from what we see. Thus we claim that the "objects" of Physics are akin to icons on the perceptual interface of human conscious agents; "phenomena" appear as "interactions" of those icons. I finish with a provocative interpretation of the asymptotic dynamics of two conscious agents as a quantum wave function. **C18**

86 The Final Closing of the Explanatory Gap and the Solution of the Hard Problem Michael Prost <info@michaelprost.com> (Bottrop, Germany)

The explanatory gap is part of the philosophical mind-body problem, which asks about the specifics of the human mind and its interaction with the body. This problem is closely related to the hard problem of consciousness, which is the question how and why humans have phenomenal experiences such as qualia and in general what the self-reflective I is and how it is generated. The key to all these questions is a proper definition of consciousness. Consciousness is the ability of the brain to act based on a complex set of sensations after processing these sensations in complex, maybe lengthy processes. That shows that all animals with brain possess consciousness. If we analyze e.g. the hunting of a leopard we see that the leopard combines different kinds of sensations, included feelings like hunger, to initiate an action. Actually this kind of animal behavior must be considered thinking. It is rational and logical. Because it involves mostly pictures we call it 'pictorial thinking'. We can summarize that animals with brain have consciousness, have feelings and can think. The brain realizes conscious processing via neural connections. Sensations create special neural connections, which we call neural patterns. These neural patterns are categorized based on similarities. Different sensations create different patterns. A learning process establishes neural connections between neural patterns, which can eventually lead to an action. The neural connections between neural patterns caused by sensations and the initiation of some actions we call a neural process. Experience and knowledge, including phenomenal experience, are realized in the brain as neural patterns and neural processes. Again, everything applies to animals with brain as well. The uniqueness of humans is the developed declarative language. Actually, the decisive factor for the development of language by Homo sapiens was not a modification of the brain, but it was an evolutionary mutation of his speaking apparatus, especially the lowering of the larynx and the enlargement of the pharynx. Now Homo sapiens was able to produce enough memorable sounds to start to develop a sophisticated language. Now in human brains an additional level of neural patterns is created, which we call language-representing patterns. These language-representing neural patterns are connected to the primary neural patterns, mentioned above. But more: Homo sapiens was able to develop a second level of abstraction, where terms are not connected to direct imaginations anymore. The second level of abstraction gave Home sapiens the ability to develop numbers, time as element of language and the concept of causality. Abstraction enhanced human abilities by developing neural processes not only based on sensations, like in animals, but based on abstract neural language patterns as well. This capability we call 'verbal thinking'. As conclusion we can say that the human mind and human consciousness is our language-representing neural network. In the case of individual experiences like qualia there are not only the primary patterns, which animals have as well; there are additional language-representing neural patterns. This leads eventually to the self-reflective I, which also is a network of language-representing neural patterns. **P1**

87 Presentational Experiences: a Terminological Proposal Roger Christan Schriner <revschriner@aol.com> (Independent scholar, Fremont, CA)

David Chalmers has discussed philosophical zombies, hypothetical creatures that function as we do without being conscious. Zombies never experience qualia or phenomenal character. However some philosophers use the terms qualia and phenomenal character to indicate states that a zombie could possess. Some say, for example, that thoughts can be qualitative and/or phenomenal, but Chalmers emphasizes that zombies can think (i.e., can engage in the sort of thinking that cognitive science investigates). Some also maintain that it is, in Thomas Nagel's sense, "like something" to think. But there is nothing it is like to be a zombie. Thus the very same words can denote either states that zombies lack or states that zombies possess. This terminological inconsistency also muddles other puzzles about consciousness such as Joseph Levine's explanatory gap and Frank Jackson's Mary. We need less ambiguous ways of saying what's missing in zombieland. This presentation proposes using terms such as presence, presentationality, and phenomenal presence, supplemented by the word "manifest," to zero in on this crucial feature of consciousness. After defining these terms, the paper shows that they are conceptually separate from qualitative character, phenomenality, and what-it's-like. We can draw a distinction between states that do and do not seem present, regardless of whether they are qualitative, phenomenal, and/or like something. We can also consider the possibility that consciousness has both presentational and non-presentational aspects. The paper concludes by showing that certain intractable problems about consciousness – zombies, Mary, the hard problem, the explanatory gap, and Nagel's what-it's-like-ness – pertain only to presentational states. Thus the concept of presence helps clarify some of the most controversial disputes in philosophy of mind. **P2**

88 The Explanatory Gap and Epistemic Feelings Benedicte Veillet <veillet@umflint.edu> (Philosophy, University of Michigan, Flint, MI)

The Explanatory Gap remains one of the central epistemic arguments against physicalist accounts of phenomenal consciousness. The Gap highlights what Joe Levine (2001) calls a core contrast between two types of identity claims: 'ordinary' scientific identity claims - e.g. water is H2O - and psycho-physical identity claims - e.g. what it's like to see red is neurological property such-and-such. Here is the contrast then: learning ordinary scientific identity claims is importantly explanatory; it yields understanding. Being told that what it's like to see red in fact identical with some neurological property, on the other hand, leaves something important unexplained; the identity claim itself seems arbitrary. The existence of this contrast presents the physicalist with, at the very least, a prima facie challenge: for according to the physicalist, the two types of identity claims are exactly analogous. The goal of this paper is to defend a novel physicalist response to this challenge by appealing to so-called epistemic feelings. The idea is to maintain that the identity claims are indeed exactly analogous but elicit, for perfectly physically explicable reasons, different epistemic feelings. Epistemic feelings are, roughly, those feelings directed at epistemological objects (beliefs, for instance). Indeed a belief can elicit a feeling or sense of understanding, or a feeling of significance; it may be give rise to feelings of curiosity, doubt, surprise, etc. In the case of the Gap, coming to believe ordinary scientific identity claims elicit a feeling or sense of intelligibility and understanding; whereas coming to believe psycho-physical identities elicits instead a feeling of arbitrariness, or as Levine (2007) himself writes, 'a sense of bizarreness' (148). I argue that what we need to address the Explanatory Gap adequately is a better understanding of epistemic feelings themselves, of what elicits them and under what conditions. This is rather timely: there has been, of late, a growing interest in epistemic feelings and more broadly in epistemic emotions in a number of areas: in epistemology, in philosophy of science and in philosophy of metacognition (see for instance Tappenden (2005), Trout (2007), Brun & Kuenzle (2008), Morton (2010), Dokic (2012), Arango-Munoz (2014), Meylan (2014)). Still, there has been almost no attempt at connecting these various discussions of epistemic feelings to debates in philosophy of mind in which epistemic feelings nonetheless play an important role (including discussions about the Explanatory Gap). The paper aims to remedy this situation, with a special focus here on the feelings of understanding and intelligibility. **C1**

89 Is Consciousness to Matter as Wave is to Particle? When Looking for Analogies to the Hard Problem, Bohmian and Bohrian Interpretations of Quantum Theory Lead to Different Results. Nikolaus Von Stillfried <stillfried@uni-trier.de> (Department of Philosophy, University of Trier, Trier, Germany)

Regarding a possible relationship between quantum theory and consciousness, many different

proposals have been made. There are some that suggest a rather ontic mutual relevance, such as consciousness playing an essential role in quantum processes or resulting from them. Others have thought it more likely that there is a connection of a more epistemic nature, in the sense that even though a complete ontic description of either can be given without referring to the other, there are nevertheless parallels between these descriptions which can help us to formulate an adequate theory of consciousness. Loosely speaking, quantum theory, or parts thereof, could provide a structure that, if filled with adequately different ontic content, could be applicable to consciousness. The most elaborated version of this latter approach is probably the one proposing a more or less far reaching isomorphy between Bohr's concept of the complementarity of wave and particle and the relation between consciousness and the physical world. This avenue of research dates back to the very origin of the concept of complementarity, with not only Bohr but also Heisenberg, Pauli, Jordan and others voicing suggestions along the lines of "it would be most satisfactory of all if physics and psyche could be seen as complementary aspects of the same reality." (Pauli, 1955, p. 207-208). In this paper, I briefly recapitulate the early as well as more recent versions and analyses of this proposal (by e.g. Brody and Oppenheim, McKay, Hoche, Fahrenberg, Atmanspacher), which leads to an overall rather disappointing conclusion: Although some similarities between the phenomenal-physical relation and wave-particle complementarity can be identified, there are also very substantial disanalogies. The most important one probably being the lack of a comparable uncertainty relation in the realm of consciousness and matter. The complementarity framework suggests that when particle properties are precisely known, wave properties are not only not knowable but in fact non-existent, and vice versa. This does not seem to match well with the situation where e.g. the body seems to persist relatively unchanged irrespective of the degree of consciousness that goes along with it. In a next step, I then point out that there exists another conceptualization of wave and particle which might be more promising, but has not been explored very much in this respect. This conceptualization goes back to the pilot-wave model by DeBroglie and later Bohm. In this model, wave and particle retain their ontic status (whichever one that might be exactly), irrespective of the effects of any uncertainty relations at work between them. Thus, there might be a closer analogy with the relationship between consciousness and the physical. I make an attempt at further fleshing out this proposal as well as analyzing to what extend it does or does not differ from Bohm's own ideas regarding consciousness, and their elaboration by Pylkk?nen. Pauli, W. (1955) In: The Interpretation of Nature and the Psyche, C. G. Jung and W. Pauli (Eds.). New York: Pantheon Books **C5**

1.09 Philosophical theories of consciousness

90 Sensual Technology and Liminal Aesthetics, Beyond Dialectical Consciousness Blanka Domagalska <4blanka@gmail.com> (Otis College of Art and Design, Los Angeles, CA)

Our culture is engaged in a process of dismantling the traditional processes of producing individuation and meaning. The borders between the engineered and organic, human and technological are dissolving as the individual is reaching for the integrated experience. While liminality, in anthropological sense, initiates the dissolution of the traditionally constituted subject, it introduces a new kind of individuation. The body with its capability to sense meets technology, which extends and stimulates the organic sensorium. There is a potential in developing a new ontology centered in the experience of the sensing body. Viewed from this perspective, we can talk about consciousness moving beyond the dialectical worldview, which was initiated during Enlightenment. In this article, I will provide an overview of the processes, which shaped the idea of a subject as a means of conceptualizing and communicating consciousness. These processes will be viewed through the lens of scientific and aesthetic pursuits. I will follow with a short introduction of object-oriented ontology, which came to rise with the development and popularization of computers. Further, I will explore the border between the two ontologies and a possibility for crossing over through the use of the sensing body or bare life. In effect, I am arguing for aesthetics as a new form of language capable of bridging the different manifestations of being in the technological and biological life to create a new way of conceptualizing consciousness. **P2**

91 Experiences as Arrangements Richard Gill <richardgills@googlemail.com> (Researcher, Cheltenham, Gloucestershire United Kingdom)

I have previously suggested that all things are arrangements, including the fundamental objects of science, and all objects of great complexity such as humans and their minds. This is not physicalism as it does not require the concept of supervenience, which could be regarded as disguised form of dualism. Arrangements cannot always be split into their constituents as the arrangement is the

thing. Events are a succession of arrangements determined by the initial arrangement and the laws of science. In this paper, I want to explore the relationship between direct and indirect experience conceptualised as arrangements with the motivation of trying to understand some of the limitations of thought. Suppose I see a cat. Essential parts of this event are me, a cat, my eyes, and neural activity. Take away one of these and there is no experience of seeing a cat. These are all necessary elements, and their complete arrangement is an essential part of a direct experience. Remove one of them and the experience dissolves. The nature of the experience is also substantially dependent on the interaction between the direct experience and the fixed hidden neural structures as the direct experience is affected by these. A child's experience of seeing a cat for the first time will be quite different from that of a champion cat breeder. Direct experiences are arrangements of things in the world and things in our heads, but we cannot talk of them with complete clarity as we cannot reconstruct them. In contrast, when the cat walks away I can visualize him, or talk about him to others, but these are not an adequate substitute for the direct experience, and are examples of indirect experiences that are but a pale intimation of the original. The reason for this is that the direct experience is an arrangement that has, as parts, arrangements that cannot be reduced to neural signals and structures. Indirect experiences can also occur when a person is essentially isolated from her sensory experiences and allows her to recall the past or invent the future. Not all of these experiences need involve things in the external world and could be mythical or fictional creatures, or even the dead. The conclusion must be that there are direct and indirect experiences, and the first of these requires things outside my mind that I cannot create. Abstract thought is entirely in the world of indirect experience, and this gives a guide as to why it is so difficult to understand direct experiences and consciousness. It is simply that these are partially outside the head and the scope of our thoughts. This means that we cannot fully understand them or reconstruct them. **C24**

92 On the Straight and Narrow Road to Consciousness? Jakob Hohwy <jakob.hohwy@monash.edu> (Philosophy, Monash University, Melbourne, Australia)

There are now several main theories of consciousness. Integrated information theory, global neuronal workspace theory, orchestrated objective reduction, higher order thought type theories, and a newcomer, predictive processing, all vie for explanatory power. I will describe the considerable divergences and intersections of these five roads to consciousness. Then I will suggest principled ways to constrain the route taken; here, I appeal to considerations, mainly from the philosophy of the science of consciousness, pertaining to explanatory unification, the neural correlates of consciousness, and the dimensions of conscious experience. A sustainable theory of consciousness would benefit from weighting theoretical integration, from operating at both mechanistic and computational levels, and from offering a unified account of levels and contents of consciousness. On this basis, I will suggest which of the five roads look most likely to lead to consciousness. The newcomer, based on notions of prediction error minimization, appears promising on several fronts. **PL4**

93 A Critical Analysis of Pain and Pleasure and its Consequence at Different Levels of Consciousness Sohang Mathur, Gazal Mathur; Bhakti Mathur; Mrityunjay Mathur <msohang@gmail.com> (Dayalbagh Educational Institute, Mumbai, Maharashtra India)

The challenge of every living being seems to be aimed towards the acquiring of pleasure and avoidance of pain. Futile efforts are made which result in half pleasures and partial protection from pain. Like sheep in a herd, some may steer towards money, power and fame in order to conquer everlasting happiness whereas others may renounce social life altogether in order to prevail upon true bliss. The effort must be lauded for there seems to be an innate tendency in all living beings to search for true contentment, yet how many of us have taken a recess from this seemingly infinite endeavor to first question the fundamental concepts of pain and pleasure. Pain - is defined as a form of grief, ache or anguish. Pleasure on the other hand is not only the absence of pain but the complete opposite of it. The perception of these however, is restricted to two media - the body and the mind. So pleasure and pain can be ascertained at two levels - the mental or the physical. Since living beings consist of the body and mind - does it stand to reason that when the body and mind cease to exist - pain and pleasure also desist? Afterlife or post-death narrations seem to demonstrate that even after the mind ceases to exist - perception continues. There are innumerable incidents where death has been pronounced but the person views his own body from afar and even sees his relatives around him. This introduces the element of a spirit entity. This paper aims to establish that true pleasure lies at the seat of the spirit entity and nowhere else. The body and mind are covers which dim or obscure our true essence or spirit force. Pain is a result of the diffusion of this spirit energy. On the other hand, when there is a concentration of spiritual energy at any sense organ - we derive pleasure. One

may consequently assume that if we rid ourselves of the body and mind - we are left with only the spirit (the true source of pleasure) but contrary to this belief - the body is the instrument given to us to commune with higher levels of perception. It is equipped with nodal centres in the body as well as ganglia in the brain which help us to connect to elevated planes of consciousness. These higher planes move towards spirit intensive regions where the existence of pleasure is on a constant upward trajectory. Thus the body mind and soul are a package deal awarded to human beings in order to attain the much alluded awareness of pure bliss. **P1**

94 Could the "Purpose of Consciousness" be the Frontier and Final Purpose of the Existence? Perhaps Beyond the "Hard Problem" Might Exist "The Main Problem" Daniel Munoz-Jimenez, Dr. Luis Javier Camargo Perez, Ana Fernanda Piquer Jimenez <daniel.emjou@gmail.com> (Theoretical Research, Center for Frontier Research and Theoretical Philosophy, Ciudad De Mexico, D.F. Mexico)

As is well known, the "Hard problem" is questioning about how and what consciousness is; since always and from many fields and postures of the knowledge, such questions are been tried to be answered, nevertheless, till now, an accurate answer has not been afforded by science or philosophy. Dualism postulates that consciousness possess something non-material, but how something without altering thermodynamics of the system could, somehow, interact with such system? However, by means of volition and free will (in case it exist) and matter (the body), consciousness is altering the system and thermodynamics as well. In the other and, quantum consciousness (as an example of monism-materialism) is depicting only how matter can interact and react with more matter at infimum levels of space and time, but not how those endless "particles" conceive themselves as a single and unified one being, aware of its own being and existence as one existing being. Such question may not be answer by quantum science, philosophy or another. Despite how consciousness be described (or not described), it will always be as it is, because language seems to be a poor tool to describe the universe, its components, or the being, therefore, any description of any thing, will not alter or describe at the most its being. It means that something already perfectly answered by its own being can not be answered again. Thus, the hard problem is completely answered by consciousness per se without the necessity of another answer, hence consciousness is and will be as it is despite our description, despite whether is answered or not. The question of the closing panel discussion of the TSC held in Helsinki (Are we ready for The Science of Consciousness?) is underpinned on the "what" and "how" of consciousness, something that is already answered by its being; nevertheless, if the goal of such science is aimed to respond something beyond the being of consciousness, the answer might be affirmative. The purpose of the being is by which it exist and for what it exist, then, the purpose is before, during, and after the being. Without information consciousness might not exist and vice versa through the calculus of matter that afford information. If the gathering and unification of the whole information (the summatory of the total of information) is called Truth (or the objective information), and matter can be turned into information by consciousness, perhaps the purpose of consciousness is to reach, achieve or assemble the Truth, by which the entire universe could know about if self and itself as an existing entity. Ergo, the purpose of consciousness could be the same of the whole existence (or could not). What for, matter, has to know that is and to know that know of itself? Which is the purpose of the presence or existence of the self awareness in matter called consciousness? Therefore, we propose that the only problem of consciousness is "The main problem", which is to know which is its purpose. **P1**

95 Extending Extended Consciousness David Silverman <davsil@gmail.com> (Laboratoire Psychologie De La, Paris Descartes University, Paris, France)

It is often assumed that if you are a physicalist, you are thereby committed to the view that consciousness depends on nothing more than the brain. In common with non-physicalists, endorsers of the Extended Conscious Mind hypothesis (ECM) argue that the explanatory gap casts doubt on this view. But rather than abandon physicalism, proponents of ECM instead suggest that the substrate of consciousness includes parts of the external environment. ECM is standardly motivated by the 'comparative' explanatory gap: the problem of explaining why a given conscious experience has one phenomenal quality rather than another. ECM claims that some phenomenal qualities supervene on loopy dynamical interactions between the brain, body and outside environment. Hurley has suggested that the extra-bodily parts of the loop must be considered part of the substrate because they are required to establish type identities between phenomenal qualities and physical events, and because the relevant neural activity could not occur in the absence of the relevant extra-bodily activity. Recently, Ward has argued that ECM is best motivated by a personal-level conception of perceptual experience in which its particular phenomenology suggests it is a kind of skilful embodied

interaction with the environment. I propose a new version of ECM. Instead of claiming that particular phenomenal qualities supervene partly on the external environment, I propose that conscious in general does. As with Ward?s approach, this claim is motivated primarily by what I propose is the best way to characterise consciousness at the personal level. Consider that to account for the physical substrate of consciousness, we first need some coherent idea of what consciousness is. In accordance with a certain functionalist idea of consciousness, I claim that mental episodes, such as episodes of perception, are conscious when they are cognitively accessible, i.e. available to thought. Standard accounts identify thought, in this context, with the deployment of neurally-encoded representations. However, another explanatory gap occurs here, since no one has yet shown how mere neural activity can have the property of bearing content, i.e. truth or correctness conditions. Adopting a modified version of Maturana?s position, I instead conceive of thought as depending on linguistic meaning, where this inheres in the communicative practices of embodied agents rather than the brain. This motivates my new version of ECM. My account of state consciousness merely requires that we are currently embedded appropriately within a linguistic community, and not that we are actually interacting with it. But state consciousness can only occur if you possess creature consciousness, construed as an in-general aptness for having conscious experiences. Creature consciousness, I propose, requires not only the ability to take part in a linguistic community, but actually taking part in it. I conclude that my proposed version of ECM offers an interesting extension of the present ECM proposal, and has the advantage, for reasons I will explain, of offering a more secure case for ECM. Most importantly, the version of ECM I offer has the advantage of helping make not merely the character but the very existence of consciousness intelligible. **C12**

96 Is Externalism Defeated by the Case of Autistic Artists? Hsin-ping Wu, Ying-Tung Lin, Allen Y. Houng <snakecorpio@gmail.com> (National Yang Ming University, Institute of Philosophy of Mind and Cognition, Taipei, Taiwan)

Some autistic artists have shown their remarkable 'photographic memory' by drawing detailed sketches of novel places or objects based on their memory of short-term exposure alone (Sacks, 1995). This case seems to support the internalist view that internal representations are rich in detail (e.g., Block, 2007, 2011, 2012) and thus sufficient for the reproduction of the scene. On the other hand, they provide an objection toward externalism, which holds that our mental states are at least partly dependent on external context, and there is no complex and detailed internal representation (e.g., Noe, 2010; O'Regan & Noe, 2001). Is externalism defeated by the case of autistic artists? This paper aims to undermine this judgment and suggest a new picture to reconcile the debate between externalists and internalist and offer a new understanding to the cases of eidetic memory. First, I will examine the empirical studies used respectively to support internalism and externalism and show that they concern pictorial forms of recollection: Cases supporting internalism, e.g., the autistic painter, involve the capability to recall detailed pictures, whereas those in favor of externalism are tasks that challenge the normal ability to reproduce scenes or pictures (e.g., Noe, 2010). Then, the debate on the pictorial format of mental representations is briefly reviewed (Fodor, 1975; Fodor & Pylyshyn, 1988; Lewis, 1971; Smolensky, 1988, 1989), and I endorse the view that there are pictorial formats in addition to symbolic formats. This debate is relevant because here I introduce a spectrum one end of which are subjects whose mental representations are predominantly pictorial, and the other symbolic. This spectrum corresponds to the continuum of an aspect of autistic characteristics and performances: It shows the gradual decline in linguistic skills accompanied with an increase in abilities to remember visual details in individuals ranging from the ordinary (people with low AQ scores) to the diagnosed autistic. Accordingly, we have good reasons to make a further speculation over a trade-off relationship between these two kinds of representational abilities in human beings. Since ordinary people build up the ability to manipulate symbolic representations at the expense of pictorial representational ability, they tend to have content-poor pictorial memory and hence depend on the information provided by the environment, while the situation is reversed in autistic cases. Based on the case analysis and this spectrum, I propose a framework to understand the dispute between externalism and internalism, in which they can be viewed as consistent, and as accounting for human's different sorts of abilities to manipulate representations. Finally, I show that externalism is not defeated by the case of autistic artists. The case of eidetic memory, instead of defeating externalism, in effect, sheds light on the seemingly opposing views of internalism and externalism. **C12**

1.10 Epistemology and philosophy of science

97 Where Is Language? Dwight Holbrook <hdwight10021@yahoo.com> (School of English, Adam Mickiewicz University, Poznan, Poland)

If asked where is language located, most people would probably consider the answer obvious and respond in the head or in our cognitive faculties. The answer becomes not so obvious if one treats, for example, mathematics as a language. For Galileo, nature was a book of mathematics. The whereabouts of that language is debated to present times, as witnessed in a paper by three physicists – Piet Hut, Mark Alford, and Max Tegmark – entitled "On Math, Matter and Mind". Furthermore, if one should ask a cognitive linguist such questions as whether there is a way the world is, irrespective of how we take it to be, or whether an articulable world is anything but the product or construct of human thought and attitude, the answer most likely will be no, resting on the assumption that knowable nature is what language interprets it to be. This paper will propose a different take on the presumptive reach and scope of human language, starting with neuroscientist Antonio Damasio and his binary distinction between core consciousness and the cognitively extended consciousness. In place of the notion of cognitively extended consciousness we propose, as our re-interpretation of that concept, the cognitive core, because it derives from the brain. And in place of core consciousness we posit a self-other extension that includes a territorial reach into world and nature by the very fact of our being awake to the world, a circumstance which distinguishes one's existence from mere cranium-enclosed dream or illusion. The paper, in other words, takes a direct realist approach on key questions: contending, for one thing, that there is a way the world is, irrespective of our interpretations through language, and that our being awake to the world is other than simply a human artifact, construction or interpretation, and that the constructivist premise as to the contrary leads to self-contradiction, an impeachment of knowledge itself. Hence, the underlying theme is that nature comes to us as part of a self/other composite, rather than we ourselves imposing a language conformity on nature that gives the definitive version of knowable nature. **C4**

98 What Exists and How Do We Know? Can An Epistemology Based on the Science of Consciousness Resolve the Paradoxes of Dark Matter and Dark Energy? George Potter <billpotter@uq.net.au> (IP Comm, Clothiers Creek, NSW Australia)

Since the earliest investigations of western philosophy the dual enquiries of ontology, what exists, and epistemology, how do we know, have been developed, sometimes in harmony but often in ontological confusion. The latter is so in the case of the paradoxes of dark matter and dark energy where according to current cosmology only a fraction of the matter and energy which calculation predicts makes up the universe, can be observed. This cosmological theory is based on the physicalist epistemology of an observer independent universe. I will argue that if we transition to a fully conscious epistemology as is emerging from the science of consciousness, it is possible to arrive at a cosmology in which consciousness is integrated in the physical universe and these paradoxes are resolved. As Chalmers* puts it "The laws of Physics might ultimately be cast in informational terms, in which case we would have a satisfying congruence between the constructs in both physical and psycho-physical laws. It may even be that a theory of physics and a theory of consciousness could eventually be consolidated into a single grander theory of information." The understanding of matter energy and information I propose does just this. * Chalmers, David J "The Puzzle of Conscious Experience", Scientific American, December 1995, p67 **P2**

99 The Origin of Consciousness: A Research Program for the Science-Theology Interaction Scott Ventureyra <scott_ventureyra@hotmail.com> (Theology, Dominican University College, Ottawa, ON Canada)

First I would like to set the stage for the science-theology interaction by beginning with a brief examination of Pierre Teilhard de Chardin's (1881-1955) thought. Throughout his voluminous writings Teilhard expounded, what he understood as a scientific position to account for the universe's possession of complexity and consciousness. I believe Teilhard's research program should be more properly understood as a "scientific theology" since it is not strictly scientific. It is overall a theological construct informed by science, philosophy and a hermeneutics of nature/personal experience. Whatever one's thoughts are revolving around Teilhard's program, he was the first major thinker to integrate evolutionary notions with Christian theology. Any meaningful theology of nature must make sense of these operative evolutionary principles throughout the universe's history. Although science and technology have significantly advanced since the time of Teilhard, we must nonetheless acknowledge that Teilhard's emphasis of cosmogenic development was one of the great fruits of his research program which is highly relevant to the current trajectory of the field of science and theology. His law of complexity/consciousness - even if outdated - serves as a useful platform for critical methodological reflection and further development regarding evolution, complexity and consciousness. A broad understanding of evolution in terms of development from simplicity to complexity and eventually consciousness is what seems to be the most plausible explanation at hand (regardless of the specific mechanisms involved to explain such phenomenon). This paper will take this broad sense of evolution as a starting point. Since the time of Teilhard, there have been various typologies of the science-theology interaction including one belonging to the pioneer of such interactions, nuclear physicist/theologian, Ian Barbour. Various other thinkers have proposed their own typologies. One which I seek to explore in greater depth is Robert John Russell's (a physicist/theologian) 'Creative Mutual Interaction' (CMI). In this model, Russell, proposes that not only does science speak to theology but vice versa. What is of great importance is also the role that philosophy plays in mediating between these two great disciplines. Philosophy plays a vital role in the assumptions utilized in scientific theories. Science also raises fundamental philosophical questions, i.e., why is the universe intelligible and understandable through mathematics? Theology deals with religious experience, and text (scripture) and tradition - from a philosophical standpoint one can ask why these function as data for a theory, or of how they relate knowledge. Russell provides 8 paths to this interaction; 5 pathways where science informs theology and 3 by which theology informs science. Russell has typically applied his 'CMI' to concepts in cosmology, eschatology, resurrection and time. I seek to focus on the origins of consciousness. This paper will briefly sketch out the pathways that theology can potentially inform science with respect to such an endeavour. Indeed, science and theology form a continuum that can inform one another bidirectionally rather than being opposed to one another. **P2**

1.11 Personal identity and the self

100 The Prospectual Field: Dissolving the Persistent Illusion of Inner Voice Whit Blauvelt <whit@csmind.com> (Bellows Falls, VT)

There is no science without prediction; no art without anticipation. There is no separation between our knowing a thing and knowing its prospects; we achieve both or neither to the same degree. This is true even of the self and consciousness. Grasping any occurrence essentially involves prospects, but confusing a prospect arisen in consciousness with its occurrence in our world is an illusion. This danger of illusion exists for prospects which are linguistic acts as much as for other types. The world's prospects, our prospects, include abundant language. In our culture we commonly base self-expectation on the illusion of an occurrent inner voice, despite lack of any dependable mark to distinguish it from vocal prospects. Is listening to "the" inner voice a short cut to self-knowledge, or a short circuit of consciousness? Is talk in mind a helpful instrument (as prospect), which when grasped in a less-helpful way (as inner voice) leads to misidentification of ourselves, restricting our possibilities? Is inner voice, taken as real, truly "thought," or something short of thought, a sort of thoughtlessness? When we retune our reception, providing all "inner" speech acts a prospectual frame and resonance, does consciousness take new paths, arise transformed to any advantage? If "inner" voice is prospectual rather than actual, it still serves, among other roles, a reflective one: it belongs to the range of prospects in which self is represented. And it can serve a logical role: in working out what we might say, we sometimes follow paths to consequential conclusions. (However, the best Platonic logic proceeds through multiple voices, rather than a singular one.) Where the role of inner voice diverges here is in its authority, in its saying what we'll do. This produces a gap when the self that speaks and the self that listens are viewed as if separate, so that one should obey the other. With intentions defined by "the" voice, alternative prospects which arise become framed as temptations in opposition, to be resisted or repressed – a polarization. When a subset of prospects, those presumed the inner voice, is uniquely taken as actual and privileged, prospects "merely" foreseen, anticipatorily felt, or of other voices are demoted to a lesser standing, weighed less in resolving our direction, and consequently underdeveloped. This diminishment of vision and feeling, this reduction of mind to univocal verbal (in)formation, is for some the very ideal of science (as well as of those religions which put "the Word" first) despite that science and wisdom both at root mean "to see." Dissolving the persistent illusion of inner voice into a unified visual-auditory-feeling field of prospective common sense should improve both scope and clarity of consciousness. We are left then with a single self, more broadly and diversely reflected in a unified prospectual field, anchored in bodily presence rather than the false presence of an illusion, with which to predict, anticipate and act. **P2**

101 The Metaphysics of Substance and Selfhood/Personhood: A Non-Theory Laden Approach Mihretu Guta <mihretup@aol.com> (Arts, Sciences and Philosophy, Biola University; Azusa Pacific University, Hacienda Heights, CA)

In this paper, I will attempt to show the advantage of substance ontology in providing us the most preferable framework, both on methodological as well as philosophical grounds, to have a better grip on the diachronic problem of personal identity. In this case, substance ontology plays multi-faceted roles in terms of allowing us for example, to make sense of the persistence of persons over time, intrinsic changes persons undergo while maintaining their identity over time, etc. (see e.g., Loux 2003; Lowe 1996; 1998; Wiggins 2001). However, substance ontology has not been taken seriously by the majority of philosophers. This is because there is a deep-seated but mistaken assumption among contemporary analytic philosophers that given the advances in modern science (e.g., quantum physics), the traditional substance ontology is irrelevant or at the least, it cannot enjoy primary ontological status over other entities, say tropes (see Hoffman and Rosenkrantz 1997; Simons in Oderberg, ed., 1999). It is also not uncommon to see philosophers questionably appealing to Locke's extremely controversial theory of substratum (i.e., "something we know not what") to justify their rejection of any notion that goes by the name substance. Of course, Hume's criticisms of substance ontology adds even more impetus for those who reject substance ontology to try to undermine its centrality for our conception of selfhood/personhood (cf. Dennett 1991). However, with close examination, at the heart of such a rejection of substance ontology lies the naturalistic ontology, according to which everything in the universe has to be explained in purely physical terms as dictated by the physical sciences (see e.g. Jackson 1998; cf. Papineau 1993; 2002). But as I will argue in this paper, when it comes to the metaphysics of the self and its identity over time, the naturalistic ontology suffers from a serious lack of explanatory adequacy. I argue that ultimately, the controversy over the nature of the self is a metaphysical issue, in that it is not for science to adjudicate what the nature of the self has to be. In light of this, the conception of substance ontology I defend in this paper is Aristotelian in spirit as opposed to Lockean or Humean. The category of substance has a fundamental ontological primacy over any other non-substantial entities such as events, places, time, properties (or tropes) and so on. I will argue that substance ontology understood in this way is indeed the most plausible and sustainable conception. Finally, I will point out the relevance of the conception of substance ontology I will defend in this paper to two interrelated issues, namely mental causation and consciousness. **C18**

102 A Universe of Qualities: Accounting for Meaningfulness, Creativity, Values, the Desire for Relationship in The Science of Consciousness Edmund Helminski <khelminski@gmail.com> (Threshold Society, Louisville, KY)

Consciousness is usually conceived in terms of self awareness, consciousness of something, and the dynamics of attention. The contemporary science of consciousness, including quantum physics, remains more of a quantitative science than a qualitative one. When consciousness is viewed as a merely mental phenomenon we have not adequately accounted for experiences of meaningfulness, wonder, delight in relationship, and compassion. Mystics of all traditions contribute not only to a theory of consciousness, but also to an 'applied science' of consciousness. They are aware at first hand that consciousness is more than awareness, it is also causative, effective, and qualitative. The applied science found within mystical traditions like Vedanta, Buddhism, and Sufism, involves purification from personal distortions, developing presence, the ability to shift consciousness to subtler levels of reality and to perceive a universe of qualities. Kabir Helminski (M.A., PhD.) is a translator of the works of Rumi and others, a Shaikh of the Mevlevi Order which traces back to Jalaluddin Rumi, co-director of The Threshold Society (Sufism.org) and director/founder of the Baraka Institute (barakainstitute.org). The focus of his work is contributing to a new language of spirituality to express the fundamental psychological and metaphysical truths of the spiritual process. His books on spirituality, Living Presence and The Knowing Heart, have been published in at least eight languages. Among his recent publications are: Love's Ripening, Rumi on the Heart's Journey (Shambhala 2010); and The Rumi Daybook (Shambhala 2012). In 2009 Kabir was named as one of the "500 Most Influential Muslims in the World". He has toured North America as Shaikh with the Whirling Dervishes of Turkey bringing Sufi culture to more than 100,000 people. **P2**

103 Self Without Identity Richard Lenon <lesrick@comcast.net> (Woodside, CA)

Consciousness seems to require a self as its recipient, and it is difficult to imagine a self without consciousness. Consciousness includes a pre-reflective sense of its belonging to that recipient self, a mineness. That recipient self can feel somehow separate from the host, the person taken as a whole. It also feels unchanged over time, from childhood into old age. Consciousness matters more to us than any other capability. Imagine being the supremely capable zombie proposed by philosophers, that passes for human, but has no consciousness; or a mediocre but conscious human being, much less appealing to peers than the zombie. It is the recipient self that is present in dreams, often without many of the properties and capabilities it has in waking life. Kafka has Gregor Samsa waking up as a giant beetle, and still himself. Ghosts are disembodied, but have conscious selves. Intoxications can leave us with little or no judgment, even unable to stand; but the same conscious self as witness. The same preservation of consciousness and the sense of self is often seen in cases of severe amnesia, and in advanced dementia. Because this recipient self and its consciousness seem so unaffected by what is learned or lost, it seems likely they are experienced as very much alike in all of us. If universally present, and unchanged in the face of radical alteration of the host, then this recipient core self and what it feels like to be conscious are most likely hardwired products of evolution. And if that is the case, then they are more than likely experienced as feeling very much the same in all of us. We should no more expect radical differences in how self and consciousness feel to one person versus another, than in how arms and legs do; or for that matter, in how the qualia of colors are experienced. **C19**

104 On the Presence of Others and the Seconding of Self Josh Stoll <js34@hawaii.edu> (Philosophy, University of Hawaii-Manoa, Honolulu, HI)

As we go about our lives we are, of necessity, tied to others in some manner. But those others are still very much other no matter how close to oneself they are. Though you are here with me at some place, you can never be here, in my place. As suggested by the 10th century Kashmiri polymath, Abhinavagupta, the world itself, the place where we meet, grows out of and through what occurs between us. As social creatures perpetually in each other's presence, perhaps even in solitude, we are intimately, albeit subtly, involved in the development of everybody else, indeed of the world itself. But despite this multiplicitous occurrence of people in the world, things seem to only ever be present to me - whoever that is. In light of this paradoxical juxtaposition of myself and others which opens up a world, this presentation will investigate the question of not just who I am - i.e. who is the one to whom things are present - but how your presence is that on which my understanding of myself depends. To this end, I will look at Jonardon Ganeri's recent «ownership view» of selfhood, the idea that a self is the embodied endorsement of and claim to clusters of intentions and preferences, conscious or not, regulated by normative emotional responses to the environment. Although Ganeri, following Peter Strawson, takes it that such a self is necessarily social, he doesn't delve much into sociality itself. In our sociality, we understand another's perspective, that is, we are aware of a presence that isn't merely present, a phenomenology that we can't experience. Recent work on our sociality has linked phenomenology with cognitive science. In this presentation, this link will be expanded by bringing in hermeneutic considerations. Thus Paul Ricoeur's discussion of the relation between phenomenology and hermeneutics will be juxtaposed with the recent interactionist proposals of Shaun Gallagher. Next, considerations of intersectional and relational selves will be addressed in order to emphasize how, considered hermeneutically, the self is extraordinarily multidimensional and can therefore never understand itself without the context of others that influence its identity. These points will culminate in the idea that the self is in an embodied mind's being viscerally prompted by another. Thus, if for Ganeri the self is the place (adhara) - irreducible to the body though necessarily grounded in it - where the mind occurs and is thus owned, then this can only be because of the way we are perpetually already implaced (to use a term of Edwin Casey's) in the world that opens up between us in social engagement. In order for there to be a «first person stance,» to use Ganeri's phrase, one must always already be seconded by the other, that is to say placed, by others, among the array of social possibilities. **C19**

105 Consciousness Explains Human Altruism and Cooperation Burton Voorhees, Dwight Read, Anthropology, UCLA; Liane Gabora, Psychology, Univ. of British Columbia <burt@athabascau.ca> (Center for Science, Athabasca University, Victoria, BC Canada)

In this paper we present arguments that the unique nature of human consciousness plays a major role in the evolution of human cooperation. Empirical evidence indicates that human behavior is more altruistic and cooperative than can be explained by current gene-culture coevolution theories. Our proposal is that this gap is bridged by including social and cultural factors that depend on the human ability not only to be conscious of the world and of the biological self in this world, but to abstractly reflect on this self (reflective self-consciousness), thus taking on a social identity as a psychological identification. We first review work that attempts to account for humans 'anomalous altruism' as an individual trait through theories of direct and indirect reciprocity, strong reciproc-

ity (with punishment of defectors), and group selection. We then discuss the role of cultural idea systems, indicating the way that group level norms, expressed within such a system are encultured as part of a group members social identity. This social identity is not just a position in a social hierarchy or dominance network, as is the case with other great apes, it is a self-conscious identification in the sense that the individual not only fills a social niche, but consciously identifies with this niche and its associated symbolic markers. The possibility of such a social identity is founded on reflective self-consciousness because it is only by having the capacity to, as it were, step back and reflect upon ones self that an individual is able to take on cultural identities as aspects of that self. While animals may have a sense of self, this is only of their biological and social self, as it exists within their here and now milieu. They are unable to abstract from this to know this self as an individual with a unique understanding of their world and their place within it. One cannot say, "I am an X" without first having the concept of an independent "I" that is characterized by "X". This sort of self-reflection arises through the cognitive capacity to think about one thing in the context of another (self-triggered recall), such as the relation of self to an other, thereby allowing the weaving of individual experiences, attitudes, and ideas into a coherent culturally grounded worldview that includes, as an essential element, a representation of the individual as an agent. In this way, individual perception and experience gains meaning in terms of cultural ideas and the social self that is integrated into this network of cultural ideas. As anthropologists have long recognized, individuals take their culturally constructed social identity as real, natural, and the only way that things can be. Thus, the social self becomes identified with the biological individual and biological survival instincts are exapted to serve survival of the social identity. This enabled a second evolutionary process above and beyond biological evolution, acting not through natural selection at the individual level but through cultural processes such as self-organization and communal exchange between cultural idea systems. **C13**

106 Why Knowing "You" Matters: Address in the Formation of Our Sense of Self Matthew Williams <mw2012@hawaii.edu> (Philosophy, University of Hawaii at Manoa, Honolulu, HI)

'You' is just as central as 'I' to some of our most important philosophical problems; perhaps even more so than the so-called essential indexical in some ways. And indeed, in contemporary philosophy a great deal of attention is given to the role of the indexical pronoun. It is an undeniable hot topic, one very seriously considered as being central to notions of consciousness, personal identity, and the complexities of reference. Yet it would seem that, in our hast to understand the phenomena behind the use and emergence of 'I,' we have overlooked the fact that it is not the only indexical. In this paper I will argue that, for as much attention as we give to 'I,' the second-person indexical 'you' plays a role that is just as important, if not more so, to the formation of personal identity. My analysis is divisible into two distinct parts. First, there is the examination of the foundations for address that under-girds 'you.' By examining these semantic foundations of address, I seek to demonstrate how the interpersonal nature of address is the basis of first-person thought by bridging the gap between purely phenomenal frames of experience with linguistic renderings of them. However, privileged access to our own experiences blinds us to this addressing structure of the first-person perspective. Consequently, this mistake becomes the basis by which we understand agency and the nature of the self. While this is all well and good, an examination of the self through the lens of language alone is limited in what it can reveal about consciousness. The second part of the paper addresses this deficiency. In this section, I attempt capture the embodied cognitive structures behind address, namely the role of the proprioceptive sense in our engagement with the world. The proprioceptive sense is organized to recognize both an individual's own extensive limits and similarity of structure in others. In effect, it organizes an organism as an addressing machine: one that can address like organisms and in turn be addressed by them. I argue that the interactive character afforded by proprioception is important to both (a) explaining how an individual's sense of self is formed and (b) the means by which said sense of self blinds us to its addressing structure and creates the self-and-other distinction. The semantic structure of address offers an important window into our understanding of consciousness and the nature of the self. By understanding the second-person indexical as quietly binding together our sense of subjectivity with that of others, we can gain further insight into the function(s) address plays to consciousness in general. **P2**

1.12 Free will and agency

107 Picking Out Actions Mihailis Diamantis <mihailis.diamantis@gmail.com> (Philosophy, New York University, New York, NY)

Action theory is built on a bedrock of philosophers' intuitions about when people are responsible for what they have done. But philosophers' intuitions are notoriously theory-laden, and frequently out-of-synch with commoner common sense. This chapter draws on everyday examples and cognitive science to develop a comprehensive account of when people actually do hold each other responsible. The account of responsibility attribution that this chapter proposes ties our attributions of responsibility to other to our understanding of our own responsibility. Like most any social practice, our practice of responsibility attribution is governed by norms of consistency - we generally treat like cases alike, or try to do so. When we find ourselves holding one person responsible but not another in relevantly similar circumstances, we identify the attribution that better conforms to the bulk of our practice and revise the outlier going forward. But strange things can happen when an attribution of responsibility to oneself is on the deviant side of the inconsistency. The central observation of this chapter is that in such cases we are much more inclined to revise the bulk of our practice to conform it to the self-attribution. The chapter raises the possibility that this is because we engage in a projective exercise when determining whether to attribute responsibility to someone for something he has done. In effect, we consider whether we would hold ourselves responsible in relevantly similar circumstances, and attribute responsibility to the other accordingly. This sort of projective exercise must be cognitively demanding, which raises the question whether it really could be how we attribute responsibility each of the hundreds of times we do over the course of a typical day. Drawing on literature from cognitive science, the chapter argues that humans may have personal level and sub-personal cognitive mechanisms that are up to the task. The chapter closes with several potential counter-examples from philosophy, law, and psychology - cases in which responsibility attribution to others routinely departs from self-attribution. It is a further merit of my simulationist account that it not only avoids these counter-examples, but can explain why they occur. **C11**

108 On the Phenomenology of Joint Agency: A Command Abandonment Account of the Feeling of Acting Together James Dow <dow@hendrix.edu> (Philosophy and Neuroscience, Hendrix College, Conway, AR)

Suppose that you and I kicking a field goal together. I am the holder and you are the kicker. Beyond mere coordination and simple acting together, we are sharing the intention to send the ball through the uprights. When asked, we say "We are kicking a field goal," to express that our shared activity is an intentional joint action. Some action theorists suggest that an awareness of joint agency is the core of intentional joint action: a "feeling of acting together" or a "sense of 'We' agency." Research on collective intentionality suggests that joint actions require shared intentions that do not reduce to a mere summation of individual intentions (Gilbert 1989, 1990, 2009; Tuomela 2005, 2010; Searle 1990, 1995; Bratman 1992, 1993, 2009, 2014; Velleman 1997). However, little work has been done on the phenomenology of the awareness of joint agency. Current views concerning 'We'-phenomenology suggest that the experience of subjects engaging in joint actions involves a positive phenomenology of joint coordinative control and "the experience of jointness" is accounted for in terms of a model used for the sense of individual agency: the control congruence model (Elisabeth Pacherie 2011, 2013 and Deborah Tollefsen 2014, Tollefsen et al 2013). In this paper, I argue against the control congruence model (CC) of the phenomenology of joint agency. In S1, I show: A) CC describes an occurrent positive phenomenology of the experience of joint control; B) CC is an extension of Bratman's derivative content model of shared intentions (Bratman 2014); C) CC is based in a thetic perceptual account of the sense of individual agency (Bayne 2011). In S2, I critique three methodologies for disclosing the occurrent positive phenomenology of joint agency: a) the what-it's-like approach (cf. Searle 1990); b) the individual agency joint agency contrast method (Pacherie 2011; 2013 and Tollefsen 2014); and c) the coordinative agency joint agency contrast method, which relies on shared emotions (Michael 2011). In S3, I argue for the command abandonment account, according to which the distinctive experience of joint agency is a negative dispositional phenomenology of the feeling of abandonment of a We-intention. To return to the field goal example, suppose I pull the football away at the last minute, like Lucy does to Charlie Brown in the famous Peanuts cartoon. What is it like for you as the kicker to experience my leaving the joint action? You would feel abandoned in the intentional joint action of kicking the field goal. I outline the view of the phenomenology of abandonment in terms of a telic phenomenal character view of joint agency. In S4, I develop a Sellarsian (Sellars 1963, 1966) framework of We-intentions to investigate the phenomenology of abandonment and argue that the experience of abandonment in joint agency is based in participant reactive attitudes upon breaching of minimal joint commitments. In the conclusion, I outline how the command abandonment account can be extended to experts (van der Wel et al 2012), children (Warneken, F. et al 2006), and non-human animals (Tomasello, M. 2014). **P2**

109 An Experimental Approach to Free-Will Vis-A-Vis Religious Beliefs Srinivas Raghu Raman Gadepally, Prem Sewak Sudhish, Dayalbagh Educational Institute; Rajesh Sinha, Dayalbagh Educational Institute <raghuramam@gmail.com> (Dayalbagh Educational Institute, Secunderabad, Telangana India)

All major religions around the world propound a theory on free-will, generally holding the individuals are responsible for their actions. Free-will presents the framework for morality and the system of justice, differentiating between the right and wrong choices. However, since any documentation on such a profound concept is expected to have underlying ambiguities, the followers of those religions may have their personal interpretations, leading to different practices. In the current study, the variability across the religions and even within a religion based on the specific path and individual beliefs has been investigated through literature to identify the key thoughts encapsulated by each religion their specific variants. An experimental approach has also been adopted to study the understanding as well as behaviour across a cross section of followers of the major religions, including their various denominations. The tools developed provide an insight into the association between religious preaching and practice based on segments of active followers. The results present a correlation between religious preaching and practice based on the various attributes of segments of active and inactive followers, while also alluding to the inter- and intra-religion variability among followers in the understanding and practice of the concepts of free will. **P1**

110 Development of a Theory of Action by Free Will in the Complexity Based Approach to Experience Alex Hankey <alexhankey@gmail.com> (Yoga/Physical Science, SVYASA, Yoga University, Bangalore, Karnataka India)

The complexity-based approach to experience contains a proof that critical instabilities in complex biosystems are capable of objective reduction of wave packets. In particular they annihilate all stabilizing quantum fields by incorporating perfectly Self-Observing feed back loops, or by locating themselves at critical instabilities in networks of neurons. This fact enables them to inject information into the future unfolding of the universe by means of objectively reducing wave packets of their own ideation in their world of experience information, consisting of critical point fluctuations. Using the three fold structure of regulation presented by systems biology, it is easy to show that every biosystem contains a three-in-one regulatory structure of simultaneously optimized functions regulating Input/Output, Turnover and Storage of the organism. Such functions are valid at all levels of an organism, from the whole, through subsystems to organs, tissues and cells. Overall structures of regulation are thus perfectly structured for a downward causative instruction to be sent from the whole to the part. Ideation at the level of the whole organism can thus send commands to specific parts that, by objective reduction (OR) of wave packets, will initiate action in the part on behalf of the idea/will of the whole organism. An important aspect is that this kind of process only makes sense in a quantum universe, where the macroscopic world is supported by information production processes at quantum wave-packet reduction events, as favored by Henry Stapp. The presentation will lay out this development of the complexity approach to consciousness, to make it clear that a three-fold theory of Actor, Mode of Action, and Action, can be supported by the theory as much as a three-fold theory of Knower, Process of Knowing and Known. It also depends on the gestalt theory of cognition that follows from the complexity approach, so that the triune conceptualizations of cognition and action are supported by triune gestalts i.e Rene Thom's butterfly catastrophes. **C11**

111 Correlates Between Free Will and Levels of Spiritual Awakening Anhad Kashyap, Prem Sevak Sudhish; Sumat Nanda ; Murshid Markan ; Vikrant Satsangi <anhadkashyap@gmail.com> (Indian Institute of Industrial Engineering, Agra, Uttar Pradesh India)

The question of free will versus absolute determinism has often been debated. In this paper, we propose the idea of limited free will, with the limit being determined by the level of spiritual awakening of the individual. In support of the model of limited free will, we draw illustrations from several instances from thousands of years of progressive wisdom in the eastern spiritual tradition. In our presentations at previous editions of this conference, viz. "Randomness, Higher type fuzzy sets and models for free will" (TSC'12), "Gods architecture: A comparative representation of Creational and Physical Systems with Special Emphasis on Change Management and Control Mechanisms" (TSC'13) and "A graded approach to free will" (TSC'15), models for the nature of free will were proposed and some inferences and comparisons were drawn between the purported probabilistic nature of creation comparing it to the determinism brought out by individual observers. In one of these papers, it was also concluded that there must be a performance mechanism based on levels of energies for karmic computation. The current work is a natural extension, where we look at individual events and decisions in the life of an individual based on the karmic energy, analogous to domain transformation in integral transforms, for example, conversion from frequency to temporal domain in the Fourier transform. **P1**

112 Paradoxes of Free Will Analyzed by Means of the Field Principle Michael Lipkind, MD <michael@lipkind.info> (International Institute of Biophysics, Neuss-Hombroich, Germany; Kimron Veterinary Institute, Molecular Virology, Beit Dagan, Israel)

Formally speaking, the phenomenon of Free Will contradicts the reductionist basis of modern science and thereby violates the (existing) physical laws. Free Will is thus considered an illusion. However, since Free Will came to be closely associated with the general problem of mental causation, it also relates to everlasting questions concerning the essence of consciousness. Existing experimental evidence indicates that personal experience of Free Will appears at some point in time after the brain has already started the related activity (e.g. appearance of the neuronal readiness potentials). It appears that the brain intracellular processes associated with the Free Will implementation start before the personal decision to act, i.e. the Free Will is not the primary initialising factor but is indeed a kind of illusion. Otherwise, [if] volition exists, then physics stands at a new frontier, in which new principles are yet to be discovered. (J. E. Burns, 1999). The analysis of Free Will suggested here is based on the field principle characterised by physical action-at-a-distance as opposed to a chain-like diffusion-based chemical reactivity. Accordingly, the specificity of various Free Will manifestations is to be determined by the respective geometrical configuration of the postulated integral field. The existing field-based theories of consciousness include those built upon the electromagnetic field (EM) and those depending on supposed concepts of an autonomous field irreducible to the existing physical fundamentals. The EM-based theories cannot resolve the 'Hard Problem' of consciousness - a problem that needs the introduction of an 'Extra Ingredient' (D. Chalmers). On the other hand, in the existing irreducible field-based theories of consciousness (B. Libet, J. Searle, M. Kinsburne) the field is only proclaimed with no regard to its conceptualisation as a working principle. The analysis suggested here is based on the theory of a vectorial biological field by A. Gurwitsch that has been applied to consciousness research (Lipkind, 2007, 2009, 2012, 2013). The key point of the proposed analysis deals with the idea of non-congruence between the geometrical configuration of the postulated field and the structural-molecular distribution of the respective brain cells' molecular continuum. The actual degree of the non-congruence is dynamically fluctuating due to background external stimulation. The non-congruence is 'felt' by the cells ('geometrical feeling', Lipkind, 2012), and the postulated field 'reacts' by re-arranging the molecular background and thus reducing the non-congruence to a minimal level. The achieved minimisation of the non-congruence is considered as a 'rudimentary psychic act'. The concept of 'geometrical feeling' leading to the 'rudimentary psychic act' is postulated as the 'protophenomenal fundamental' (Lipkind, 2007). **C6**

113 Do Newborn Babies Have Experiences of Agency? Claudia Passos <cpassosferreira@gmail.com> (Philosophy, Columbia University, New York, NY / Federal University, Rio De Janeiro)

Recent advances in developmental psychology can help us to address important questions about the nature of the early stages of consciousness. What is the structure of a newborn baby's consciousness? Do they have intentional agency? Do they have experiences of agency: that is, do they have experience of themselves as a conscious agent? In this paper I argue that babies have experiences of agency at birth. Specifically, I argue that while not all actions of babies involve agency experience, some actions do. I present evidence from developmental psychology for this thesis, and I address objections. An important objection to the thesis that newborn babies have agency experience is that this experience involves a higher-order attribution of agency generated by a high-level cognitive mechanism, which requires self-consciousness and a self-concept, and that babies lack the capacity for self-consciousness and a self-concept. In the absence of these capacities, babies can be at best aware of certain actions they perform and not of their own agency in those actions. I will argue for a view on which the experience of agency requires nonconceptual self-representation but not a self-concept. More specifically, it requires what Peacocke (2014) calls "degree-1 self-representation", involving mental states with nonconceptual de se content (nonconceptual representation of oneself), but not "degree-2 self-representation", which requires conceptual first person thought (conceptual representation of oneself). I will also argue that although newborn babies may lack "degree-2 self-representation" (conceptual self-consciousness), they have "degree-1 self-representation". If these claims are right, the lack of conceptual self-consciousness is no obstacle to the claim that babies have agency experience. On this view, the sense of agency requires more than the action awareness enjoyed by a creature at "degree-0 self-representation", where the conscious subject represents the world but does

not represent itself. I argue that some actions involve only "degree-0 self-representation" while others involve "degree-1 self-representation", and that consequently some but not all actions in babies involve the experience of agency. I present empirical data suggesting newborns have experience of agency and that they have these experiences before they develop the ability to entertain first person conceptual thoughts. Recent data concerning agency in newborns – mainly research on neonatal imitation, action systems oriented to goals, agency representation – suggest that agency experience is present at birth, but there is no evidence for first-person conceptual thought at birth. This seems to support the claim that newborns' agency experience occurs independently of the capacity for first person conceptual thoughts. I will use this developmental data to reject the view that agency experience requires conceptual self-consciousness. **C11**

114 The Homunculus Solution of Nested Consciousness: A Theory of Neural Oscillation Justin Riddle <riddler@berkeley.edu> (Psychology, University of California, Berkeley, Berkeley, CA)

It has long been appreciated that the brain is oscillatory. Early measurements of brain electrophysiology revealed rhythmic synchronization unifying large swaths of the brain. The study of neural oscillation has enveloped modern cognitive neuroscience and neural systems. The traditional belief that oscillations are epiphenomenal of neuron spiking is being challenged by intracellular oscillations and the theoretical backing that oscillatory activity is fundamental to physics. To account for subjective consciousness, neuroscience has struggled with the binding problem of how bits of information in disparate brain regions are unified into a gestalt experience of the present moment and the slow time-scales of the human mind. Pascal Fries, Gyorgy Buzsaki, and Ole Jenson are a few of the scientists promoting oscillations as such a binding mechanism. The idea that cognition is rhythmic dramatically revolutionizes the neural sciences. Electroencephalogram (EEG) is now seeing a comeback as scientists search for a direct correspondence between our rhythmic thoughts and macroscopic electric fields. My own research at University of California, Berkeley suggests that subjective experience oscillate! s at three particular frequency bands in a cognitive triad: perception/memory at 5 Hz, action/decision-making at 2 Hz, and attention/awareness at 0.1 Hz. This human cognitive triad operates at the level of the entire brain, but coordinates with faster oscillations via phase-amplitude-coupling and resonant harmonics. A similar triad at the level of local brain regions is found in 10 Hz, 20 Hz, and 50 Hz. This oscillatory triplet corresponds to a faster cognition triad that integrates with our own experience via emergence and submergence. Evidence of this interactive subjectivity fractal implies what I call the Homunculus Solution, named after Daniel Dennett's Homunculus Problem. Your mind is composed of minds at a faster timescale. Each of these "voices in your head" is composed of minds to increasingly microscopic scales. This theory is motivated by a cognitive ontology of neural oscillations together with recent evidence presented by Anirban Bandyopadhyay of oscillatory triplets found in microtubule bundles, microtubules, and tubulin proteins. **C17**

115 The Consequence Argument Penelope Rowlatt <penelope.rowlatt@gmail.com> (London, United Kingdom)

Many philosophers have signed up to Peter van Inwagen's Consequence Argument, which he summarizes as (1983): "If determinism is true, then our acts are the consequences of the laws of nature and events in the remote past. But it is not up to us what went on before we were born; and neither is it up to us what the laws of nature are. Therefore the consequences of these things (including our own acts) are not up to us." I argue that the conclusion does not follow from the premises. The issue is a change in the interpretation given to the personal pronoun 'us'. The reasoning goes as follows: 1. One way in which people decide what to do next is called practical reasoning. Practical reasoning is a deliberative process in which the likely effects associated with choosing each of a number of available actions are examined and assessed by the chooser. As well as immediate effects relevant to the chooser, the chooser might take account of the likely effect on other people's welfare and on events likely to occur in the future. The choice a person makes is therefore determined by their values, what they care about, along with their past experience which will affect their knowledge about relevant facts and probabilities, that is, their choice is determined by their values/experience. 2. When we refer to a person by using their name or a pronoun, information relating to that person's values/experience is generally taken to be associated with the name or pronoun. Thus we might say "he likes tomatoes", or "she is about to visit India", or "Jane feels strongly about climate change" and the name or pronoun that we use calls to mind a whole lot of other information, known with varying degrees of certainty to the speaker and/or to their companion, about the values/experience and other characteristics of the person referred to, as well as the particular fact at issue. 3. If the two occurrences of the pronoun 'us' in the second sentence of the consequence argument are replaced by the particular aspect of us that is relevant, because it is what determines the choice, 'our values/experience', the sentence remains true. But if the same maneuver is performed on the occurrence of 'us' in the conclusion, the third sentence, that sentence is no longer true. Some of our actions are determined by our values/experience, which, in turn, have been determined by the laws of nature and events in the remote past if determinism holds. With determinism the person's decisions concerning their acts, which are determined by their values/experience, are an integral part of the unfolding of the predetermined future. The consequence argument, which implies that if our values/experience are the consequences of laws of nature and events in the remote past then our acts are not up to 'us', is therefore not correct. **C11**

116 Is Compatibilism Compatible with the Existence of EPR-like Quantum Correlations? Javier Sanchez-Canizares <js.canizares@unav.es> (ICS. Mind-Brain Project, University of Navarra, Pamplona, Navarra Spain)

Compatibilism affirms that free will is compatible with determinism, the thesis that the facts of the past, in conjunction with the laws of nature, make possible only one future at any moment in time. The most influential compatibilist approaches rest on different conceptions of free will. On one hand, "leeway or forking path compatibilism" accepts that "being able to act otherwise" belongs to the essence of free will. But, if that is the case, each forking path should also be determined by antecedent causes and the question of the ultimate origin of determination arises. On the other hand, "sourcehood compatibilism" seems to reject the understanding of free will as "being able to act otherwise" and focus on the ultimacy of the control source, which might be both determined and free. The agent is the source of the action because its final determination is caused within the agent: some condition necessary for the agent's action cannot be located in places and times prior to the agent's freely willing his or her action, even though this action must be causally determined (by causes inner to that agent). One may ask up to what point both compatibilisms cope with the existence of EPR-like correlations in nature. In an EPR-entangled pair of particles the experimenter can decide at will, for instance, what spin component of a particle is going to be measured and can instantaneously determine the same spin component of the other particle due to quantum non-locality effects. Recent experiments have ruled out loopholes related to biased samples or subluminal physical communication between EPR-entangled particles, making untenable any explanation of the phenomenon based on models of local hidden variables: either nature is ontically undetermined or is non-locally (globally) determined. In this situation, leeway or forking path compatibilism cannot obviously survive: acceptance of ontic indetermination is incompatible with both (leeway or forking path and sourcehood) compatibilisms, while acceptance of global determination is incompatible with "being able to act otherwise." But the case is not much better for sourcehood compatibilism: acceptance of global determinism means acceptance of non-local hidden variables as the ultimate source of determination in nature. Since length scales of such non-locality are typically much bigger than human body's length scales, human action would not ultimately stem from the agent's own interiority, but would necessarily be determined by non-local (beyond human scales) hidden variables. Hence, what ultimately explains the action need not make reference to the agent. The conclusion is thus inescapable, the existence of EPR quantum correlations rules out both kinds of compatibilism. Finally, it should be stressed that, whereas acceptance of non-local hidden variables as the ultimate source of determination in nature excludes what is usually assumed by human free will, quantum indeterminism does not, provided properly understood. Human actions are determined by human free will in a way physically compatible with quantum indeterminacy. But quantum indeterminacy is not the cause of free will inasmuch as free will may determine human actions in a way ultimately unfathomable by scientific theories. **C3**

1.13 Intentionality and representation

117 Narrow Content and Self-Knowledge Krzysztof Swiatek <swiatekk@macewan.ca> (MacEwan University and Athabasca University, Edmonton, Alberta Canada)

In this paper I am going to analyze the role of narrow content in intentional psychology. The narrow/wide distinction is drawn in two separate ways; it was originally based in Putnam's principle of methodological solipsism but later re-established on Stich's autonomy principle. Focusing on Putnam's argument, I shall argue that the wide and narrow content of methodological solipsism parallel the referential and explanatory functions that are usually associated with the notion of content of mental states. I shall claim, however, that the narrow content of methodological solipsism does not fully satisfy the explanatory function of content, as it is beholden to the categories of public language

and ignores the agent's actual psychological processes. In my search for explanatorily adequate concept of psychological content I will, first, re-examine Putnam's argument against methodological solipsism. In fact, Putnam's rejection of narrow content of methodological solipsism results from the repudiation of its corollary, the principle of mentalism, according to which "knowing the meaning of a term is just a matter of being in a certain psychological state". It is when the latter is combined with the Fregean principle that the extension of a term is determined by its intension that the Twin-Earth argument ensues. In my argument I am going to take a lead from the principle of mentalism: I shall examine a concept of content that results from the premise that the explanatorily relevant meanings are those individuated through psychological states. Basing psychological acts in the subvening neurophysiology, I shall argue that the explanatorily adequate account of narrow content must be based in the principle of autonomy. The individualist narrow contents defined in this way will prove significantly distinct from the narrow contents of methodological solipsism: very fine-grained, evanescent and largely ineffable. Finally, I shall prove that the explanatory adequacy of individualism has an unexpected downside; namely, it threatens the agent's knowledge of the contents of his own mental states. Paradoxically, a similar objection has been raised by Putnam and Davidson against the wide content. When properly reinterpreted, Davidson's argument attempts to prove that wide content is cognitively externalist in that the agent is not aware of the true contents of his beliefs. I am going to argue that in spite of the wrong reasons Davidson gives, he is right in attributing cognitive externalism to Putnam and the concept of wide content. He does not note, however, that a similar conclusion holds of both kinds of narrow content. Actually, I am going to argue that solipsistic content is similarly externalist in a strong, metaphysically necessary form of cognitive externalism. Such a conclusion is a consequence of the analysis of Davidson's argument presented by Boghossian in "Content and Self-Knowledge", a consequence implied by Boghossian's argument but not recognized by him. In contrast to the narrow content of methodological solipsism, individualist content will prove cognitively externalist in a weak, metaphysically contingent sense. This kind of externalism implies that the explanatory contents are not fully known by the agent and likely will never become so. **C12**

1.14 Philosophy of perception

118 No-conceptualization Paradigms of Perceptual Consciousness Ying-Tung Lin, Allen Y. Houng <linyingtung@gmail.com> (Institute Philosophy of Mind, National Yang Ming University, Taipei City, Taiwan)

The distinction between phenomenal and access consciousness is a subject of a vigorous debate between the overflow (Block, 2007, 2011; Lamme, 2006) and anti-overflow views (Cohen & Dennett, 2011; Dehaene, 2014; Kouider & Sackur, 2014; Kouider, 2010). The two sides disagree on whether there are one or two types of consciousness (Kouider et al., 2010), whether experience overflows cognitive access, and whether perceptual consciousness is rich or sparse. One tenacious argument of the anti-overflow view is the difficulty or even impossibility of measuring phenomenal consciousness and its richness (Kouider, 2010; Kouider & Sackur, 2014). This has been opposed with no-report paradigms and a critical examination of the methods used (Block, 2014; Tsuchiya et al., 2015). We argue that the limitations of the methods used in favor of the anti-overflow view do not only result from the requirement of report, but also from the requirement of conceptualization, which is what results in the failure of measuring the phenomenal aspect and the richness of perceptual consciousness. As such, a "no-conceptualization paradigm" allows richer phenomenal contents be accessed and can shed light on the current unresolved debate. The methods used by the anti-overflow view are subject to limitations that are attributed not only to its requirement to report, but also to its requirement for symbolic report - a report that requires a process of conceptualization or abstraction from phenomenal content. The process of conceptualization turns pictorial representations into symbolic representations. In the process, the change of representational format is accompanied by a decrease of richness in detail as well as by an increase in combinatorial manipulability. Whereas the richness of perceptual consciousness is a matter of controversy in the debate, the "conceptualization-paradigm", demanding symbolic reports, is destined to fail in such measurement. As such, the "no-conceptualization paradigm", in which non-conceptual elements are the targets of measurement, can reveal the richness and the phenomenal aspects of perceptual consciousness that are inaccessible using a symbolic-based paradigm (e.g., the traditional Sperling paradigm). Bronfman et al.'s (2014) use of color diversity is an example of the new paradigm. As the no-report paradigm has stirred up some concerns (Dehaene, 2014; Kouider & Sackur, 2014), measuring phenomenal access - that is, accessed richness - allows us to resolve the disagreement between the opposing views. **C9**

119 How Can Visual Topographical Structure Be Captured Via Tactile Phenomenology? Shao-Hsien Yen, Allen Y. Houng <yenshaohsien@gmail.com> (National Yang Ming University, Taipei, Taiwan)

Tactile-visual substitution systems (TVSS)-systems that translate images captured by a video camera into vibratory stimulation applied to the skin of the body-raise the question: If a sensory brain state plays a novel functional role, does the phenomenology go with the role or the brain state? Hurley and Noe (2003), who hold that phenomenology in general is constituted by the dynamic sensorimotor interactions between the perceiver and the environment, claims the phenomenology of TVSS is not exclusively tactile, and its spatial content is visual, not tactile. Nevertheless, they seem to presuppose that visual phenomenology accompanies the spatial function of TVSS. In contrast, according to Block (2003), given that TVSS users keep on feeling tactile sensation, his perception with such devices remains in the substituting modality since brain areas involved determines the phenomenology. I agree with Block and argue against Hurley and Noe that non-visual phenomenology can be shown by the spatial function of TVSS. In this paper, I address the question of how tactile phenomenology can capture visual topographical structure. I argue that TVSS is a case of spatial perception via tactile phenomenology which is realized by an isomorphic relation. Nevertheless, this kind of visual substitution is only functional, that means visual phenomenology is not involved. I develop an account based on an isomorphic relation between tactile phenomenology and visual topographic structure. The isomorphism maps tactile phenomenology onto points in a 3-dimensional topographical space such that relations among tactile phenomenology (more denser than, softer than, etc.) is preserved by corresponding relations among corresponding points in visual topographical space (e.g., "further than", "smaller than"). This approach allows access consciousness of the topographical space of visual perception to map to not only visual phenomenology that normally presents spatial arrays at a distance but also to tactile phenomenology. **P2**

1.15 Miscellaneous

120 The Virtual and the Real David Chalmers <chalmers@anu.edu.au> (Philosophy, Australian National University; New York University, Canberra, Australia)

I will discuss the relationship between virtual reality, physical reality, and consciousness. **PL3**

121 Extended Empathy in the Context of Ethical Practice of Medicine Kaylee Davis <daviskk@hendrix.edu> (Philosophy Department, Hendrix College, Conway, AR)

Recently the use of empathy in ethical behavior, particularly in the ethical practice of medicine, has come under question and rightly so. Empathy, by views such as those presented by Jesse Prinz and Paul Bloom, promotes bias, can lead to empathetic fatigue, and is not necessarily useful when it comes to comforting those in distress. Though these are valid concerns, I argue that they stem from defining empathy in terms of affective matching of emotions, which need not be the case, or that the objections are irrelevant in cases of couple interactions (where there is only a single target of empathetic engagement). Most contemporary conceptions of empathy have been based on limited internalist views of mind - namely, stimulation theory and, to a lesser extent, theory theory. However, when we extend empathy - as extended mind theorists such as Joel Krueger and Evan Thompson do - where consciousness is seen in an open and holistic way, we can create a fuller view of empathy's role in interpersonal understanding. A patient's pain, then, is not curtained of as something only experienced internally. When we view our mental states as not only in our head but also in our bodily expressions, we are able to gain knowledge about the patient's situation, even in cases where a patient's pain is nonconscious, by cultivating the attention to bodily mental states that is necessary in the practice of extended empathy. I give and example of how this externalist theory affects the perception of pain and suffering, and I conclude the paper by examining the possible problems with using extended empathy for morality and, specifically, for the ethical practice of medicine. **P2**

122 Cogito: Radio Astronomy and Neuroscience in Art Daniela De Paulis <selavyrose@gmail.com> (ASCA, University of Amsterdam, Rotterdam, Netherlands)

'Cogito' (short title for 'I doubt therefore I think, I think therefore I am') is an art project speculating on the creative and philosophical possibilities of exploring the cosmos by means of radio waves. The title of the piece, inspired by Cartesian philosophy, aims at linking the project to the ongoing debate on mind-body-consciousness, of which Ren? Descartes was an important figure for his dualistic vision on the mind-body matter, which greatly influenced the development of modern Western philosophy. Recent experiments in quantum physics seem to suggest links between the matter of the mind and that of the cosmos, raising profound questions on the nature of consciousness and percep-

tion. Sending thoughts into outer space is thus a symbolic action for shifting our consciousness from the earth-centred perspective, to the cosmos-wide perspective, while questioning the mathematical notion of intelligence, as conceived by some relevant SETI (Search for Extraterrestrial Intelligence) researchers. Thinking is more than logical reasoning and can communicate much more about our nature to a potential extraterrestrial life, should it be able to decode our EEG signals. The project is being developed at the Dwingeloo radio telescope in The Netherlands and through informal conversation with Frank White, author of 'The Overview Effect', where he talks of his long term research on the consciousness of astronauts who had the opportunity to witness the global sight of the Earth from outer Space. A brain lab will be permanently installed inside the cabin of the Dwingeloo radio telescope, in order to be used by visitors who will be able to send their thoughts into outer space, while experiencing the immersive view of the Earth seen from Space through a visual reality headset. 'Cogito' will allow people to experience virtual space travel and shift their consciousness into outer space. The project aims at fostering a global awareness of our planet, raising questions on timely political and geographical issues. **P2**

123 A Novel Conception of Mind Yilai Li <eliliyilai@outlook.com> (Independent, Suzhou, Jiangsu China)

In this presentation, I propose a fundamentally new conception of mind that denies the existence of cognition and other mental abilities associated with it while claiming that what it is to have a mind is not much more than just having raw feels. I will first try to establish the viability of this novel conception of mind by making sense of a view in consistence with rejecting perceiving, reasoning, language learning etc, namely, that raw feels play an important role in causing human actions, whose viability, I believe, is relatively easy to prove. If it is conceded that the possibility of raw feels being part of the cause of human actions being true cannot be reasonably dismissed, then it is not nonsensical either to deny the existence of cognition, considering that rejecting mental abilities such as perceiving and reasoning would be a natural step forward from the raw feel explanation of human actions. After proving that it is not ridiculous to suggest a fundamentally new way of conceiving mind, I will then explain what I think the mind does other than exhibiting raw feels by developing a new understanding of human beings based on the new conception of mind. Once the seemingly inevitable commitment to the natural way of understanding human beings (i.e., the way that depends upon the postulation of mental abilities such as perceiving, reasoning and language learning) is relieved, an argument in favor of the new conception of mind automatically surfaces, as many perennial philosophical issues suddenly turn into difficulties the natural way of conceiving mind faces. I think it is not unreasonable to believe that we have so many unsolved philosophical problems because we are wrong at the very beginning. Another point against the natural way of conceiving mind, which is equally evident with an alternative understanding of human beings in place is that my way of conceiving mind can easily be extended to cover other animals whereas the natural way of conceiving mind indicates a sort of exceptionalism, if we agree that human beings are just animals. And exceptionalism is usually considered unappealing. A different way of supporting the new conception of mind that depends upon showing that the new understanding of human beings is a better theory when it comes to explaining and predicting certain human phenomena will also be presented. **P2**

124 Spontaneity, Consciousness and Intrinsic Brain Activity. A Critical Look at the Kantian Brain Hypothesis Tobias Schlicht <tobias.schlicht@rub.de> (Philosophy, Ruhr-University, Bochum, Germany)

Kant has argued that object representations presuppose the contribution of intrinsic features of the mind, namely a faculty of spontaneity, which structures and regulates sensual input. Is there a way of incorporating the idea of spontaneity within a broadly naturalist framework? What could an analogue notion from within contemporary cognitive science be? A number of scientists and philosophers have recently drawn attention to Kant's notion of spontaneity and claimed that it can be associated either (a) with chaotic bursts of self-generated neural activity along the lines of Kelso's work on synergetics (Hanna & Thompson 2003, Fazelpour and Thompson 2015), or (b) with resting state activity (Northoff 2012). The brain is conceived of as a complex, self-organised system with nonlinear dynamics (Singer 2013), capable of spontaneously generating patterns of activity that form the basis of mental phenomena. According to one view, such activity is supposed to be able to decide between two versions of a multistable figure, which is then associated with Kant's notion of spontaneity. According to another view, Kant's notion of spontaneity can supposedly shed light on specific features of the brain's resting state or default network activity. A closer look at Kant's notion of spontaneity and its alleged role for cognition shows that these empirical hypotheses rest on a misunderstanding

of Kant's theory. The neural activations at issue are not fit to stand in for Kantian spontaneity. Hence, the notion of a Kantian brain is as yet unjustified. **C10**

2.0 Neuroscience

2.01 Neural correlates of consciousness (general)

125 Exploring Neural Correlates of Consciousness with Connectome-specific Harmonic Waves Selen Atasoy, Isaac Donnelly; Gustavo Deco; Joel Pearson <selenatasoy@gmail.com> (Center for Brain and Cognition, Universitat Pompeu Fabra, Barcelona, Spain)

A fundamental characteristic of human brain activity is spontaneous coherent oscillations among spatially distributed cortical areas. Remarkably, the topography of these correlation patterns, termed resting state networks (RSNs), closely resembles the functional networks identified by various sensory, motor, and cognitive paradigms. Recent evidence revealed that while correlated activity is preserved during loss of consciousness (LoC) in deep sleep, substantial changes occur in the anatomical configuration of RSNs. However, mechanisms underlying the emergence of the RSNs from the primate connectome and their relationship to neurophysiology remain unknown. In this talk, I will demonstrate that the spatial correlation patterns of the RSNs are predicted by the harmonic standing waves; i.e. resonance patterns, emerging on the human connectome. These harmonic waves, estimated by extending the Fourier basis to the particular topology of the human connectome, provide a new analytical language for cortical activity. In this new frequency-specific representation, RSNs significantly match harmonic wave patterns of certain frequencies. A neural field model of excitatory-inhibitory neural activity provides a biologically plausible neural mechanism behind the self-organization of these resonance patterns. Remarkably, the critical relation between the simulated patterns and the delicate excitation-inhibition balance fits the neurophysiological changes during LoC. In particular, the frequency of coherent oscillations in neural filed simulations decreases for decreasing excitation or increasing inhibition. Recent neurophysiological evidence also suggests gradual decoupling between the posterior and anterior midline nodes of the default mode network during LoC. This decoupling is also observed in seed based correlation analysis of the neural field patterns for the exact parameters, which resulted in slower cortical oscillations. These findings demonstrate that the fundamental principle underlying resonance, ubiquitous in nature (e.g. acoustics, electro-magnetic interactions, electron orbits and morphogenesis), likely underlies macro-scale cortical dynamics and provides a new tool to investigate the neural mechanisms underlying LoC. **PL2**

126 EEG Brain Dynamics and Altered States of Consciousness During Sub-anesthetic and Anesthetic Ketamine Dose Administration in Healthy Adults Tarik Bel-Bahar, Colmenero, A.; Vlisides, P.; Picton, P.; Janke, E.; Tarnal, V.; Mashour, G.A. <tarikb@umich.edu> (Ctr for Consciousness Science, University of Michigan Medical School, Ann Arbor, MI)

Ketamine is a NMDA and serotonin receptor antagonist that has anesthetic, analgesic, psychedelic, and antidepressant properties with important implications for consciousness research. Ketamine dosing in clinical and recreational contexts leads to a range of altered states of consciousness (ASC) including anxiety-reduction, dissociation, disembodiment, complex imagery, audio-visual synesthesia, unity, oceanic boundlessness, and ego-dissolution. The few existing studies of ketamine-induced brain dynamics in healthy humans highlight ketamine's role in the modulation of default-mode activity, fronto-parietal connectivity, and subcortical and sensory-temporal cortical activation. Little is known about the associations between brain connectivity and specific kinds of ASC during sub-anesthetic ketamine doses. We explored brain dynamics and ASC (N=8 healthy adults) by examining EEG spectral power and functional connectivity (phase-lag index) at different frequency bands (delta, theta, lower alpha, upper alpha, beta) during baseline, sub-anesthetic dose (D1), and anesthetic dose (D2) periods. Participants completed an ASC questionnaire after D1. EEG activity was characterized by high occipital-parietal alpha power during the baseline period, and large increases in anterior theta power during D2 and to a lesser degree during D1. Spectral power results showed, relative to the baseline period, that 1) delta decreased at parietal and occipital channels during D1 and decreased further during D2, 2) theta decreased at parietal and occipital channels during D1 and increased at frontal, parietal, and occipital channels during D2, 3) lower alpha decreased at parietal and occipital channels during D1 but increased during D2, 4) upper alpha at parietal and occipital channels decreased during D1 and decreased further during D2, and 5) beta power at central and parietal channels increased during D1 and then increased much more during D2. Connectivity results showed, relative to the baseline period, that 6) fronto-central, fronto-parietal, and fronto-occipital delta connectivity increased slightly

during D1 and increased much more during D2, and 7) fronto-central and fronto-parietal upper alpha connectivity decreased during D1 and decreased further during D2. Participants reported high levels of ASC associated with complex imagery, ineffability, disembodiment, and transcendence of time and space during the D1 period. Preliminary correlational results link 8) more complex imagery with increased fronto-parietal theta connectivity, increased central alpha power, and decreased frontal alpha power, 9) more bliss, unity, and transcendence of time and space with increased occipital delta power, and 10) more ineffability with increased central alpha power. In the current study we confirmed and extended current neuropsychological findings regarding EEG and ASC dynamics during sub-anesthetic and anesthetic doses of ketamine. We found that delta and alpha power decreased, theta and beta power increased, alpha connectivity decreased, and delta connectivity increased. These effects were dependent on frequency band and often more pronounced in D2. Our results also suggest ketamine-induced ASC might be associated with theta-based wide-range connectivity, as well as regional changes in alpha and delta power. Future work in this area should lead to eventual enhancements in the neuropsychological tracking and control of altered states of consciousness in basic research, anesthesia, and psychiatry. **C20**

127 Excitable Cells Make Sentience Possible, Their Synchronization Produces Consciousness Norman Cook, Isaac E. Krabbenhoft; Takefumi Hayashi <nc_876@usc.edu> (Informatics, University of Southern California, Osaka, Japan)

Living cells are classified as either «excitable» or «non-excitable» depending on the ion flux properties of their cellular membranes. Although all cells have ion channels and ion pumps that allow them to maintain homeostasis in the face of variable (often extreme) extracellular environments, only excitable cells have evolved mechanisms for generating rapid motor responses to external stimulation. The principal excitable cells in animal organisms are (i) sensory receptor cells, (ii) neurons and (iii) muscle cells. Clearly, these are the cells responsible for (i) sensation/perception, (ii) cognition and (iii) motor behavior - the three organism-level functions that most unambiguously distinguish animal life from plant life and are totally absent in all forms of inorganic matter. The relevance of excitable cells to consciousness studies lies in the fact that the unusual properties of biological sentience can also be explained in terms of excitability. Specifically, there is one unique process - the coordinated influx of positively-charged ions into the cellular cytoplasm during the action potential - that initiates sensory reception, neuronal information-processing and muscle fiber contraction. What has not previously received attention in consciousness studies is the fact that, during the process of excitability, excitable cells undergo transient changes in the cytoplasm from the normal «physiological condition» of alkalinity to the inherently dangerous state of acidity and salinity associated with high concentrations of cations (rapid cell death being a consequence of the failure to close sodium or calcium channels). We therefore maintain that the positive electrostatic «shock» of cation influx is the most primal phenomenon underlying whole-organism psychology, i.e., awareness of the (biochemical state of the) external world. By triggering cellular responses within several milliseconds, such awareness is literally the mechanism by which the animal organism feels its extracellular world and initiates behavior. Because of the difference in the concentration of ions between the intracellular and extracellular environments, the excitable cell senses the danger of the high cation content of the external «seawater» - and immediately takes steps to return to the more appropriate physiological state of alkalinity. That entails closing cation channels, repairing gaps in the cell membrane, releasing neurotransmitters, and/or contracting muscle fibers - as the whole organism coordinates behavior to ameliorate its biochemical circumstances. We conclude that 21st century neurophysiology has provided insights (unknown in the 1950s) into cell functions that essentially explain biological sentience. Those insights obviate the need to descend to the level of quantum mechanics in search of the origins of animal psychology: sentience begins at the level of the excitable cell. In this view, the information-processing of neuronal circuitry allows for all forms of cognition, but the phenomena of sentience, awareness, and ultimately self-consciousness can be explained in terms of the synchronized activity of excitable cell membranes. Cook, N.D. (2008) The neuron-level phenomena underlying cognition and consciousness. Neuroscience 153, 556-570. Cook, N.D., Carvalho, G.B., and Damasio, A. (2014) From membrane excitability to metazoan psychology. Trends in Neurosciences 37, 695-708. Cook, N.D., Krabbenhoft, I.E., and Hayashi, T. (2015) Proticity (not electricity) and the sentience of excitable cells (in preparation). **C15**

128 The Physics of Consciousness Eva Deli <eva.kdeli@gmail.com> (evadeli.com, Nyiregyhaza, Hungary)

In the material world, decoherence (i.e. the collapse of the wave function of elementary particles) produces measurable changes in physical properties, such as speed or position. The features of elementary particles in recent years have also been exposed in conscious phenomena (Khrennikov, 2015). The mind's particle- and quantum- like behavior is already being exploited in fields as diverse as search engine optimization, psychology, economics, and even social sciences. We believe in free-will, but we have virtually no power over our own thoughts, which ultimately determine our actions and behavior. Moreover, the constantly changing, complex and elaborate mental world can only be accessed from the inside; for outside observers it is a holographic projection, which appears strangely constant from childhood to old age. In the brain, electromagnetic activity moves energy and information in opposite directions between the cortex and the limbic brain. Stimulus triggers high frequencies, which moves information towards the cortex, where neuronal activation extinguishes the frequencies, but reverses information flow by low-frequency oscillations (Buzsaki, 2011). I propose that an energy imbalance of the brain, which generates emotions, reverses information flow. In turn, emotions force actions that, through decoherence, change mental energy. Low brain frequencies accumulate energy (trust and confidence), whereas high brain frequencies accumulate information (leading to insecurity and fear). Thus, in its constant interaction with the environment, the mind, the brain's neuronal landscape, constantly changes. In this way, the mind is a temporal gyrocompass, which over time restores its energy-neutral state (called the default mode network). This automatic process allows the brain to remain true to the local temporal field (i.e. the current environment) and forms the basis of the brain's discrete processing of stimuli. Energy neutrality and discrete energy processing endows the mind with quantum characteristics. I will show that consciousness is based on particle- and quantum-like behavior. Such homeostatic self-regulation is possible because, through causal experience, the mind identifies itself with the body. The suggestion that matter fermions and the mind have identical structures and identical operations becomes an important step toward opening the book of human motivation and behavior (Deli, 2015). References: Buzsaki, Gy (2011). Hippocampus, Scholarpedia, 6 (10): 1468. Deli, E. (2015). The Physics of Consciousness. Frontiers in Neuroscience, Systems Biology, Submitted. Khrennikov, A. (2015) Quantum-like modeling of cognition. Frontiers in physics, http://dx.doi.org/10.3389/fphy.2015.00077. **P2**

129 Quantitative Models for Field Dynamics of Cerebral Cortex Based in Ecog/Eeg Walter J Freeman <dfreeman@berkeley.edu> (Molecular and Cell Biology, University of California at Berkeley, Berkeley, CA)

Neural correlates of consciousness (NCC) were found in the ECoG of animals and in the EEG of humans after training to discriminate conditioned stimuli (CSs). The NCCs had the form of 3-5 cycles (~50-100 ms) of beta or gamma oscillation recurring at theta rates. When data were recorded from high-density arrays of 64 electrodes, the Hilbert transform of the signals revealed spatial patterns of analytic amplitude modulation (AM) and phase modulation (PM) of the beta-gamma carrier wave. Each spatial AM pattern defined a1x64 feature vector that fell into a category correlated with intentional behavior [1] from which consciousness was inferred. The NCC implied that the fields of neural activity were cinematic, because the categorizing information in each AM pattern was stationary, and the density distribution was spatially uniform as in a holographic display [2]. Most importantly, the AM patterns manifested memories of CS meanings, not CS representations. Multiple AM patterns occurred in each action-perception cycle (a-p)[3], by which subjects planned a search, predicted CSs, tested for them by sampling, and accommodated to the test results by reinforcement learning and accommodation. By experimental design an a-p cycle occurred in a window between the onsets of the CS and the conditioned response (CR) of each trial in sessions of 40 trials. Brains being open thermodynamic systems, a complete description must include the environmental sources, whence come life-sustaining matter and energy, and the environmental sinks for wastes, heat and entropy. From the point of view of the environment every source in the brain requires a sink in itself, and every brain sink must manifest a source in itself. In mathematics one generically models the environment by doubling the degrees of freedom in a brain model, making a copy of the AM pattern (a symbiont), and reversing time to adapt to the environmental point of view, thereby simulating a closed system. Every source in the brain puts a sink in the Double and vice versa. EEG data reveal that brains perform the same operations [4] with the same intention: predicting the environment by modeling its point of view. PM patterns of wave packets show that half the AM patterns are accompanied by an explosive phase gradient during formation of a wave packet by a phase transition by spreading outwardly from a site of nucleation [5]. The other half is accompanied by an implosive phase gradient, indicating

time reversal as predicted by dissipative quantum field theory [6]. This imagined construct must begin as the mirror of a condensation. We propose that code of cortical dynamics is expressed in image sequences in two entangled streams that create images: one reversed in time that creates hypotheses on the environment for the a-p cycle for perception, and the other forward in time that creates tests of the hypotheses by taking planned action. Together they express the unity of matter (unconscious, in control) and mind (conscious with illusion of control). **PL9**

130 Unity of Consciousness Zoran Josipovic, Travis Desell <zoran@nyu.edu> (Psychology, New York University, New York, NY)

In contemporary cognitive and neural science, consciousness is understood within the two dimensional space of global states (arousal) and specific contents (qualia). I will propose that the third dimension, that of unity (consciousness-itself), is necessary for a more complete understanding. According to this view, unity of consciousness is due to the background presence of a non-conceptual nondual awareness - consciousness-itself, which is singular in itself, and which, when realized during waking state, acts as an all-encompassing context for conscious experiences. I will compare this view to some current philosophical views on consciousness, and discuss its possible neural mechanisms in light of the major models of NCC and the iEEG data collected with epilepsy patients at NYU Langone Medical Center. **C19**

131 The Unity of Experience Eric LaRock <larock@oakland.edu> (Philosophy, Oakland University, Rochester, MI)

Recent experiments in neuroscience strongly suggest that an object's properties are represented in separate areas of the visual cortex (Felleman & Van Essen 1991; von der Malsburg 1996, 1999; Singer 1996, 1999; Zeki 2003, 2007). Although represented in separate neuronal areas, somehow the representations of an object's properties are brought together as a single, unified object of experience at any given time. These considerations raise an important target question surrounding the unity of experience: (1) how do an object's properties (such as shape, color, and motion) appear as a single, unified object at any given time, if its respective properties are correlated with activity in different areas of the visual cortex? Moreover, our capacity to experience an object over time motivates another problem about the unity of experience, one that I have called the diachronic object unity problem (see my 2007a, 2007b, 2008, 2010). For example, (2) how do an object's properties appear as a single, unified object over time, if its respective properties are correlated with distributed and transient neuronal activities? Finally, we must also confront the problem of subject unity, which is the problem of explaining the singularity intrinsic to experience and how that singularity relates to the unity of experience across modalities of the brain. In addition to phenomenal properties, there is a subject (i.e., "a point of view" or "singularity") in relation to such phenomenal objects. For example, I hear Jason Becker's melodious guitar sound off in the distance (a property of audition) while seeing a star fall from the night sky (a property of vision). I have those two phenomenal properties as part of my total experience. Thus, there are empirically based worries that motivate a foundational target question regarding subject unity: (3) how could distributed phenomenal properties across different modalities of the brain explain subject unity? For my purposes here, I only consider some of the dominantly proposed neuronal mechanisms (e.g., neuronal synchrony and attention) and conclude that, while those proposed mechanisms might be necessary in some important senses, they fail to provide theoretically satisfying answers. Finally, I advocate a nonreductive hypothesis with respect to target question 3, called emergent subject dualism (ESD), which is a species of naturalistic dualism. According to this proposal, once a brain generates phenomenal properties, a new (ontological) subject is also generated; and that subject plays a role of binding what would otherwise be distributed phenomenal properties across different modalities of its brain. Under the hypothesis of ESD, a subject holds an adverbial relation to its phenomenal properties and, on that basis, makes an explanatory difference to the unity of experience (see my 2008, 2010, 2013a, 2013b, forthcoming; see also Chisholm 1969; Eccles and Popper 1993; Jackson 1997; Zimmerman 2011). Thus, the subject cannot be eliminated on parsimonious grounds alone. In the concluding remarks, I spell out some of the further explanatory advantages of ESD, including somewhat speculative thoughts about some possible neural correlates of the subject. **C19**

132 Communication Breakdown: Ketamine and the Mind George A. Mashour <gmashour@umich.edu> (Anesthesiology, University of Michigan, Ann Arbor, MI)

Ketamine is a psychedelic and anesthetic drug capable of inducing various altered states of consciousness. However, the molecular mechanisms of ketamine are distinct from typical representatives of these drug classes. In this lecture, I provide evidence from multiple species demonstrating

that, on the network level, ketamine causes a breakdown of cortical connectivity. Depending on the dose, this "communication breakdown" can lead to psychedelic or anesthetic states. The neurobiology of ketamine is shown to provide critical insight for the science of consciousness. **PL12**

133 The Dual Quadbrain and Modular Consciousness Bruce Morton <bemorton@hawaii.edu> (John A. Burns School of Medici, University of Hawaii, Guatemala City, Guatemala)

Understanding consciousness has been hampered by use of over-simplistic working hypotheses such as: "There is only one consciousness;" "All awareness is consciously accessible;" or "Cerebral bi-laterality does not exist beyond language." These obsolete ideas are here replaced with more accurate neuroscience-informed concepts in order to include the existence and action of powerful behavioral sources found in the preconscious, subconscious, and unconscious. Thus, a modular consciousness model is both required and illuminating. As the first step, McLean's Triune Brain Model was expanded to the Quadrimental Brain Model, due to the discovery of extensive non-motor properties of the cerebellum. However, because of the bi-laterality of the vertebrate brain, this model was insufficient and led to the development of the Dual Quadbrain Model (DQ) with its semi-independent modular consciousness elements (Morton, 2011, 2016). The DQ accommodates multiple elements of consciousness, including those proposed by Freud and others. By rapid access of a temporarily dominant module to the central seat of power, this model can account for essentially all of human behavior from diabolic to divine. In the DQ, the cerebral hemispheres contribute to normal waking consciousness. Module1, the left hemisphere "Reporter" specializes in top-down analysis of important details, including language. Module2, the right hemisphere "Imaginer" specializes in bottom-up analysis of the global view, including spatial imagery. Five evolutionarily earlier brain elements powerfully operate outside of hemispheric consciousness. Module3, the ancient limbic cingulate cortex appears to be the site producing a unilateral executive "Ego." It has been shown to confer individual right or left brain-oriented behavioral laterality in the form of "Hemisity" (Morton & Rafto, 2010; Morton, 2014), Importantly, the executive acts one second in advance of conscious awareness to determine whether to use Module4, the unilateral brain core reptilian "Id" to pursue a win-lose, violent solution, or use module5, the unilateral cerebellar social brain "Superego" to pursue a win-win non-violent solution to the issue at hand. Module6, a mutated-defective developmental arrest repair program ("xDARP") is also housed unilaterally in the cerebellum. Its unconscious activation leads to inappropriate struggles, often between mates, which are the source of common escalating conflicts leading to crimes of passion. This element is similar to Freud's "Thanatos," Hubbard's "Reactive Mind," and Tolle's "Pain Body." Module5, the social brain neocerebellar Superego appears to be the source of the hidden, non- supernatural "Higher Intelligence" or "Holy Spirit," which comes to the fore in life-altering, near-death experiences, including initiations, religious conversions, and psychedelic-induced "Ego death and transcendence." These incidents also appear to have been at the origin of the world religions. Last, besides the "Id," another unilateral element of the brain core, Module7, the "Servant," is a final effector of behavioral output. It selflessly obeys higher brain directional imperatives, be they from a currently dominant internal brain module, or even from an external hypnotic dominator. Thus, we are a "Society of Seven" committee of self-aware elements, most of whom operate outside of cerebral consciousness. The DQ provides a logical and testable framework accounting for all of human consciousness and behavior. **P2**

134 Atomic Neuroscience and Consciousness: Dispatches from The Twilight Zone Elan Liss Ohayon, Ann Lam, University of Toronto Epilepsy Research Program, Physicians Committee for Responsible Medicine <ohayon@greenneuro.org> (The Green Neuroscience Laborat, The Green Neuroscience Laboratory, Neurolinx Research Institute, San Diego, CA)

What are the fundamental features of the physical world that support consciousness? The search for constituent components, correlates and keys to consciousness is somewhat analogous to the proverbial drunk searching under a street lamp. In this analogy the search focuses on the functional, system-level, physiology and other brain observations. Similarly, questions of anatomy, network properties (connectomes) and other architectural features are also central search areas. Certainly, a great deal of important work is being done on these well-lit functional fronts suggesting that looking under the lamp may not be as irrational or lazy as first suggested. In fact, some researchers and philosophers may claim that this is all that is needed. Still, the question remains as to whether the particular physical features connect to experiential elements. Here, neuroscience has largely focused on the molecular and genetic realms which seem to offer, at best, contingent truths. Indeed, there are significant variations in the instantiations and implementations of neurotransmitters underlying very similar classes of consciousness. For example, consider the range of chemicals that can induce

intoxication and hallucinations. Conversely, the contingent nature of the correlation can also be seen in the variability of effects of the same compound across species and even individuals. A chemical that brings pleasure to one brain, may be ineffective, cause seizures, or trigger lethal reactions in another. In addition, successes on the computational front in conjunction with incongruities between mastery of a task and the phenomenology strongly undermine eliminativist narratives. Parallel efforts have tried to identify the factors at the smallest scales. Here researchers have strayed far beyond the light and moved into the dark recesses of quantum mechanics (QM). There are at least four factors that drive this enterprise: (1) consciousness seems to be implicated in some interpretations of QM (i.e., observer). (2) The non-deterministic possibilities offer a purported connection to free action (3) The strangeness of quantum world inhabitants might make them more welcoming, if not altogether isomorphic, to the strange contours of consciousness and (4) the field was underpopulated. However, factors 1-3 can often be shown to be fool's gold and now that the research area has become quite populated (4) no longer holds. As such, we forward the neuro-atomic level as a new locus of search that offers unique possibilities at the twilight zone boundaries between these light and dark domains. We argue that unlike the molecular levels or quantum conjectures, the atomic level offers some strong contenders for universal physical instantiation. In particular, we show why metals are vastly under-appreciated candidates. Focusing, for now, on known biology, we illustrate the ubiquity of metals in the brain and their strong correlation to various cognitive processes. We also present results from our lab using a synchrotron (a particle accelerator) to image metal distributions in the brain ranging from full hemisphere to sub-micron scales. We further discuss how these distributions may be intimately tied to changes in conscious experience in a range of cognitive conditions as varied as typical perception, Williams Syndrome, epilepsy, and dementia. **P1**

135 Relativistic Consciousness Richard Sieb <siebr@shaw.ca> (relativisticconsciousness.com, Edmonton, Alberta Canada)

Conscious experience is defined as the direct observation of conscious events. It makes up the content of consciousness. In humans, knowing the world occurs through spatial-temporal experiences and interpretations. If we examine our current conscious experience, we observe that many conscious events are observed simultaneously, but in different three-dimensional spatial positions. Other conscious events are observed at the same spatial positions, but at different times. Conscious experience is organized in four dimensions. Space is often conceived in three linear dimensions, but modern physicists usually consider it with time, as part of a boundless four-dimensional continuum called spacetime. Spacetime is any model that combines space and time into a single continuum. Consciousness is a spacetime continuum. The most successful model of spacetime is Einstein's special theory of relativity. Spatial and temporal cognition have been found to implement a systematic framework for the association of events and the organization of experiences and special relativity is a complete model of this system. The neural correlate of this system consists of the entorhinal cortex (grid cells), hippocampus (place cells and time cells, computation of spacetime intervals), posterior parietal cortex, and prefrontal cortex (integration of spacetime interval relations and the organization of conscious experiences, assessment of causality, direction of cognitive functions, and implementation of goal-directed actions). A spacetime interval is the separation in spacetime of two events. There are three types of spacetime intervals: light-like intervals account for the experience of conscious events; space-like intervals account for the experience of conscious events simultaneously, but in different spatial positions; time-like spacetime intervals account for the experience of conscious events at the same spatial positions, but at different times. Spacetime intervals are fundamentally involved in the organization of coherent conscious experiences. They account for why conscious experience appears to us the way it does. Spacetime intervals also enable assessment of causality and past-future relationships, the integration of higher cognitive functions, and implementation of goal-directed behaviour. Spacetime intervals in effect direct our conscious life. The relativistic concept closes the "explanatory gap" and solves the "hard problem of consciousness" (how something subjective like consciousness can arise in something physical like the brain). It establishes a place in physics for consciousness. Thought experiments (which are conscious experiences) are behind development of all the great theories of physics. We describe all physical phenomena as conscious experience, which ever level they are described at (quantum or classical). In accordance with Bohr's Correspondence Principle, quantum mechanics is reduced to classical physics in the correspondence limit of conscious experience. Bohr provided a rough prescription for this limit: it occurs when the quantum numbers describing the system are large, ie. classical physics and quantum physics give the same answer when the systems become large. As part of the Copenhagen interpretation, it was accepted that the quantum mechanical description of large systems should closely approximate the classical description. Since spacetime intervals direct the formation of all conscious experiences, the equation formulating spacetime intervals might be considered the expression of a "Theory of Everything". **P2**

136 Mechanisms of Self-Transcendence Following Brief Mindfulness Meditation Yi-Yuan Tang <yiyuanbalance@gmail.com> (Texas Tech University, Lubbock, TX)

Self-transcendence (ST) is one of human experiences often related to harmony with nature or feeling oneness with others or the self as an integral part of the whole universe. Previous studies showed that ST has significant positive correlation with the ventral-subgenual anterior cingulate cortex (sgACC) encompassing a ventromedial portion of the prefrontal cortex (PFC). However, ACC as a part of the brain's limbic system, appears active in many mental processes including self-control, emotion regulation and self-awareness via neuroimaging studies. Are there other brain regions participating ST? Meditation often exemplifies positive emotion, pleasant feeling, introception and ST experience in practitioners. Therefore, it's reasonable to speculate the reward and introceptive system such as striatum and insula also participating the ST following meditation. Studies showed that ST is positively related to meditation practice supported by ACC/PFC, striatum and insula. However, whether brief meditation could improve ST and its underlying mechanism remains unclear. Our series of studies have shown that one form of mindfulness meditation - integrative body-mind training (IBMT) significantly improves ACC/PFC functional and structural plasticity and induces better physiological reactions in heart rate, respiratory amplitude and rate, skin conductance response (SCR) and heart rate variability (HRV) following few hours of training. Differences in HRV and EEG power also suggested greater involvement of the ANS during and after training. Frontal midline ACC theta was also correlated with high-frequency HRV, suggesting control by the ACC over parasympathetic activity. These results indicate that brief IBMT induces better regulation of the ANS by a midline ACC brain system. This changed state probably reflects training in the coordination of body and mind, suggesting that body-brain works together to maintain higher consciousness states such as ST that may be related to better performance and prosocial behavior. Our findings suggest that few hours of meditation training could induce altered states of consciousness through central (CNS) and autonomic (ANS) nervous system interaction. It should be noted that ST as one of human experiences related to harmony with nature or feeling oneness with others, also interacts with nature or universe or others at the same time. Although we don't have the proper equipments for co-measurements of body, brain and environment this moment, the advanced techniques in quantum physics and informatics may provide a tool for exploring these dynamics. Acknowledgements This work was supported by the Office of Naval Research. References Tang YY, Holzel BK, Posner MI. The neuroscience of mindfulness meditation. Nature Reviews Neuroscience, 2015, 16, 213-225 Tang YY, Tang R. Rethinking the future directions of mindfulness field. Psychological Inquiry, 2015, in press Tang YY, Posner MI. Training brain networks and states. Trends in Cognitive Sciences, 2014, 18, 345-50 Tang YY, et al. Central and autonomic nervous system interaction is altered by short term meditation. Proc. Natl. Acad. Sci. U.S.A. 2009, 106, 8865-70 Tang YY, et al. Short-term meditation training improves attention and self-regulation. Proc. Natl. Acad. Sci. U.S.A. 2007, 104, 17152-17156 **P3**

2.02 Methodologies (fMRI, EEG etc.)

137 Comparing Potential Objective Measures of Consciousness: The Perturbational Complexity Index and the Directed Transfer Function Bjorn Juel, T. Bremnes; L.G. Romundstad; P.G. Larsson; J.F. Storm <bjorneju@gmail.com> (Department of Molecular Biolog, University of Oslo, Oslo, Norway)

It can be difficult to determine whether patients are conscious or not in certain clinical situations. The current practice of monitoring behavioral and physiological responses is unsatisfactory, and there is an abundance of evidence for situations in which consciously aware patients end up being treated as if they were unconscious. For example, recent studies reported that more than 40% of patient diagnosed as unconscious with unresponsive wakefulness syndrome are at least minimally conscious (1). Similarly, 2 out of every 1000 patients undergoing anesthesia has been reported to wake up to some extent during the surgical procedure - meaning that on average 26,000 patients in USA alone wake up during anesthesia, unbeknownst to the practitioner (2). A lot of work has been done in the last few decades to find objective measures which correlate with the conscious state of test subjects, in the hope that they can be useful additions to the clinical toolbox for diagnosing the conscious state of patients. Some of the methods are inspired by, or developed to test hypotheses from, promising theories of consciousness. One such method is based on the Integrated Information Theory of consciousness and provides a measure known as the Perturbational Complexity Index

(PCI). Their results indicated that PCI can be used to distinguish reliably between conscious and unconscious states at an individual level (3). Using data from high density EEG to measure the global effects of local transcranial magnetic stimulation, the PCI conveys an indication of the interconnectivity of the cortex at the time of stimulation. The PCI method is reliable, but unfortunately not suitable for monitoring patients' level of consciousness in all clinical situations. Our lab in Oslo is currently attempting to independently validate PCI as a marker of consciousness. In parallel, we are applying the Directed Transfer Function (DTF), another objective measure for characterizing the network structure of brain activity (4). The DTF has the benefit of not relying on external stimulation, and has high temporal resolution since it can be applied to raw data directly, allowing us to assess the dynamics of brain connectivity in real time. In our previous work, we have shown promising results with DTF as a basis for an algorithm generating real-time classifications of patients' conscious state from spontaneous EEG recording during surgical anesthesia (5). In this work, we compare the PCI and the DTF-based methods for classifying humans based on their state of consciousness, and discuss the pros and cons of each method and their applicability in clinical settings. (1.) Schnakers C, et al. Brain Inj. 2008 Jan 1;22(12):926?31. (2.) Sebel PS, et al. Anesth Analg. 2004 Sep;99(3):833-9. (3.) Casali AG et al. Sci Transl Med. 2013 Aug 14;5(198):198ra105-98ra105. (4.) Kaminski MJ and Blinowska KJ. Biol Cybern. 1991 Jul;65(3):203-10. (5.) Juel BE, et al. In Prep. 2016. **P2**

2.03 Neuroscience of vision

138 Efficient Representation of the Objectively Infinite Within a Finite Subjective Space Andrew Duggins, Xin Zhang <andrew.duggins@sydney.edu.au> (Neurology, Westmead Hospital, University of Sydney, Leichhardt NSW, Australia)

Background: The edges of a straight road across a flat plane are seen to converge to a point at a finite distance. However, visual experience forms merely the ventral aspect of an encompassing 3-dimensional virtual reality, within which the road edges must also converge to a point on the horizon behind the subject. What are experienced as straight lines correspond to shortest paths or geodesics through a positively curved subjective space. Methods/Results: We describe a metric for a 2-dimensional curved subjective subspace, and a projection onto it from a corresponding objective plane, which together model distortions of the apparent fronto-parallel plane, of the apparent equidistant circle and of apparent distance bisection in normal subjects. If there is an attentional spatial filter that biases the distribution of event probability in the subject's local environment, we argue that such a representation maximizes the entropy of events in subjective space. Conclusions: The deviation of the virtual world of subjective space and time from objective reality resembles the divergence of objective reality from Newtonian laws of mechanics and gravity, characterized a century ago by Einstein as General Relativity. Our model reveals how the common spatial distortions of neglect and unilateral vestibular failure might be considered a neurologic equivalence principle. We propose that just as gravity is the curvature of objective spacetime by mass, so is attention the curvature of subjective spacetime by information. **C13**

139 Reports of the Death of Dual Visual Systems Theory Have Been Greatly Exaggerated Benjamin Kozuch <bkozuch@ua.edu> (Philosophy, University of Alabama, Tuscaloosa, AL)

The rich, fine-grained content found within visual experience seems well-suited to carrying out precise motor actions, especially those requiring on-line guidance, such as catching a Frisbee or hiking a rocky trail (cf. O'Shaughnessy 1992; Peacocke 1992). Furthermore, the idea that visual experience guides motor action plausibly captures the folk view on how the two are related (e.g., Clark 2001; Mole 2009). However, according to the currently predominant neuroscientific theory of vision, Milner and Goodale's dual visual systems theory (1995/2006), there is a non-conscious dorsal processing stream that guides visuomotor action, and a conscious ventral processing stream that produces those representations feeding into goal-oriented cognition. Milner and Goodale's theory, along with later arguments by Andy Clark (2001, 2007, 2009), seem to undercut what we might call the Typicality Thesis, which says that visual experience is what typically guides skilled motor action. Recently, however, Briscoe and Schwenkler (2015) and Shepherd (2015) have reviewed experimental data seemingly favorable to the Typicality Thesis. In this paper, I argue that such evidence is not as helpful as it might seem. First, in the case of studies in which visual illusions are shown to affect both visual experience and motor action, the effect on motor systems is usually less (or much less) than in the case of visual experience, meaning that there is no match in content between visual experience and motor action. But a match in content, I argue, is what is needed to show that visual experience is driving subjects? motor actions in these experiments. Second, I argue that many of the

cases in which motor actions are affected by visual illusions are plausibly interpreted as instances in which either (a) early visual areas (e.g., V1) are affected by the visual illusion (see Milner & Dyde 2003), or (b) early visual areas are subject to top-down influences from the ventral stream (Murray et al. 2006; Fang Fang et al. 2008). But it is unclear whether either scenario counts as one in which the conscious contents of the ventral stream have guided motor action. Finally, I point out how an instance in which visual attention alters how a motor action is carried out can easily be mistaken for an instance in which visual experience is responsible for that change. This is significant, because many of the studies to which the above commentators appeal (e.g., ones in which an action is novel or performed slowly) are plausibly viewed as instances in which visual attention produces top-down effects in early visual areas, a well-documented phenomenon (see Somers et al. 1999; Tootell et al. 1998; Fischer & Whitney 2009). And while attention and consciousness might be the same (Prinz 2012), this is no foregone conclusion. Overall, it seems that the proper conclusion to draw is that the Typicality Thesis still remains unsupported. **C13**

140 Rabbit Consciousness: The World of Lateral Vision Julie Smith <juliesmith027@gmail.com> (World Languages and Literature, University of Wisconsin, Whitewater, Edgerton, WI)

Do different kinds of vision produce different kinds of consciousness? Animals with lateral vision live in a very different world than those with frontal, foveal vision. Lateral vision lacks visual detail and thus is sometimes associated with a 'murkier' state of mental awareness, even a diminished consciousness. For example, a recent study on human peripheral vision describes it as characterized by lower representational complexity and slower processing. The implication is that it entails reduced awareness generally. The question I am interested in is whether lateral vision has its own kind of consciousness, one not better nor worse than that of foveal vision, but just strangely different.
I will argue that rabbit vision produces a laterally-eyed consciousness that is a specialized form of awareness inseparable from a particular world view. Rabbits lack a fovea and have instead a visual streak aligned with the horizon in eyes placed laterally, with some visual overlap in front that affords depth perception (stereopsis) but no additional acuity. Thus, rabbits probably see the world in a way analogous to our own peripheral vision, which is characterized not by fuzziness nor haziness nor grainyness, but by 'crowding,' that is, the loss of individuated shapes determined by sharp, separating contours. Their lateral, monocular vision affords them a panoramic view but at the expense of fine resolution and sharply separate objects. This kind of vision gives them almost preternatural sensitivity to motion, to groupings rather than distinct individuals, and to a broad swath of the world where much is going on at once. Thus, rabbits' kind of vision promotes a consciousness that is not attuned to separate, unique identities, is not invested in knowing and believing in an exact nature of things, and is very attuned to a constantly changing visual environment. This form of seeing could not be more different than that of humans, who seek to master the environment by visually 'fixing' the subject. One rabbit behavioral mystery that I call 'Friendly Fire' provides insight into this way of seeing as inseparable from their form of consciousness. This is the scenario of two or more tightly bonded rabbits who will suddenly turn on each other when an outsider-rabbit approaches, behavior that has baffled thousands of humans in the rabbit-rescue community. The rabbits seem to lose all sense of who is a friend and immediately go after each other. Once the stranger-rabbit is gone, they return to closeness as if the event never happened. I will argue that the details of this scenario suggest that rabbit consciousness is characterized by a flexible relationship to identity or to 'who-ness' even as, paradoxically, rabbits are also capable of very tightly bonded relationships. It also suggests that they prioritize motion and action over identity, and that for them, negotiating their world requires constantly shifting visual point of view– from one eye to the other eye to both eyes. In sum, rabbits live in a world of uncertainty and flux, and evidence suggests rabbits are conscious of this. **P2**

141 Extramission: The Eye Emits Photons: Are There Controlled Signals from the Retina? Erik Viirre, Thomas A. Furness III, Ross Melville, Mark Hansen, Maria Travaille University Of Washington, RatLab LLC <eviirre@ucsd.edu> (Neurosciences, RatLab LLC, San Diego, CA)

The human eye emits photons. The body in general emits light in a variety of wavelengths (Van, 2006). We wanted to explore the possibility of controlled emissions of light from the eye, ultimately seeking the discovery of signals from the retina. In this first experiment, we describe baseline recordings. With IRB approval and appropriate consent procedures, we have made recordings in a light isolation chamber using a highly sensitive wide area Photomultiplier Tube (PMT) covering the exit pupil of one eye of humans sitting quietly. PMTs can detect single photons and thus are appropriate for emissions at very low rates. In a cohort of 10 subjects, we found that there was an average emission of 161 photons per minute with closed eyes and an average of 219 photons per minute with open

eyes. Eye open and eye closed intervals were a timed 5 minutes. Across the group, there was wide variation of the number of detected photons, and paired T-testing showed that the group open vs. closed values were not significant, with p-values of 0.2208 for raw photon counts. Examination of the raw data of photon counts showed a modestly increasing baseline through the 60 minute recording session. Using within subject t-tests and using the immediately preceding or following eye open vs. eye closed intervals for comparison, we found significant p-values of 0.00002417 and 0.0001388, respectively. Our PMT technology had a sensitivity range from 400 to 1000 Nm wavelengths, so it is unclear whether the photons are purely infrared, or may contain visible or ultraviolet light. Thermal controls were implemented in the chamber to maintain cooling of the PMT sensor, however there was an average increase of about 2 degrees C temperature of the air in the chamber over the 60 minute test interval. Blackbody thermal radiation from surface tissues like the eye may be a predominant phenomenon in our test condition, however, of course, human body temperature is closely controlled. Other confounding conditions may be the eyelids and other anterior structures of the eye and the difficulty of controlling the positioning of the exit pupil of the eye within the entrance pupil of the photon sensors. Our next series of experiments will incorporate wavelength specific detection technology and means of immediately recording photons in darkness after a light stimulus to the fellow eye. We will then be able to better determine if visual stimuli actually result in a controlled emission in non-black body wavelengths and then be able to well characterize those emissions. Our thesis is that the retina's light detecting photopigments or other photoactive molecules in the retina can be reverse driven to emit photons that exit the eye via the waveguide features of the anterior retinal layers. In highly visually dependent social beings such as humans, such emissions may have coded signals such as location information or for other content. This hypothesis coincides with other concepts of retinal photon phenomena (St. Hilaire, 2002, Sun, 2010, Sia 2014 and others) beyond the classical photon capture and energy conversion. **C15**

2.04 Other sensory modalities

142 A Primer Surveying the Convergence of Top-Down and Bottom-Up Models Underwriting Interoceptive Awareness and the Insula Jesse Bettinger, Ishaan Kapoor; Chloe Lee; Sumil Nair; Vaishnavi Phadnis; Jun-Won Franklin Hwang; Jon Hardin <jesse.bettinger@alumni.cgu.edu> (Center for Talented Youth, Johns Hopkins University, Baltimore, MD)

One of the more intriguing theories to reach the horizon of modern neuroscience involves the notion of the brain as a hypothesis-generating machine. Converging evidence in functional neuroanatomy and the "Bayesian brain" hypothesis (Helmholtz, 1860; Dayan, Hinton, Neal and Zemel 1995; Battaglia, Jacobs and Aslin, 2003; Friston, 2010) indicate two models for interoceptive awareness: a conventional, bottom-up approach (Craig, 1996, 2002, 2003, 2014; Mayer, 2011) and a recently developed top-down model (Seth and Critchley, 2013; Seth, 2014; Gu and Hof, 2014; Sel, 2014; Gennaro, 2015; Farb, et al, 2015). While bottom-up approaches explain perception in terms of classical, feed-forward feature detection, top-down approaches operate on the basis of inferential, generative models (Friston, 2003; Chen, et al., 2008). The insula is unique in that it is situated at the interface of the cognitive, homeostatic, and affective systems of the human brain, providing a link between stimulus-driven processing and brain regions involved in monitoring the internal milieu (Bernard, 1854; see also Craig 2009; Menin and Uddin, 2010). Predicated on the uniform, preferential activation of the insula in-tangent-with the neuroimaging of emotions (see e.g. Gu, et al, 2013), Bud Craig (2000; 2002) elaborated the identification of a meta-representation of interoceptive activity fostering the subjective sense of embodied emotional awareness in the right anterior insular cortex (AIC). Extending these results to the top-down model of interoceptive inferential coding, Seth and Critchley (2013) propose that the AIC also represents the convergence zone between top-down and bottom-up processing where a "predictive coding" procedure (Alhazen, 1030/1989; Helmholtz, 1855) actively minimizes surprise by leveraging the "free-energy principle" (Friston 2006; 2010) to elicit a constraining effect begetting interoceptive awareness. To these ends, the goal of predictive coding is for the brain to "abductively" (Wiese, 2015) infer the causes of interoceptive sensations in a Bayesian capacity qua "inference to the best explanation" (Hohwy, 2014). As Barrett and Simmons explain, "the brain's default mode of interacting with the world is via continuous, intrinsic predictive activity that is more-or-less constrained by sensations coming from the world and the body" (2015). In this capacity, a partial revisiting of Dennett's notion of consciousness - or in this case, interoceptive awareness - as the residual of a process of "explaining away" (1992) data in order to minimize surprise and optimize allostatic responses (Gu and FitzGerald, 2014) for the maintenance of survival parameters. Chiefly, such awareness is experienced as affect, or emotion (Seth, 2013). The purpose of this talk is to provide an outline exploring these two models in-light-of interoceptive awareness as the result of converging processing slated to convoke in the anterior insular cortex. **P2**

143 Affective Valuations, Pre-Narrative Fodder and the Narrative Identity Thesis Brook Miller <cbmiller@morris.umn.edu> (University of Minnesota, Morris, Morris, MN)

In this presentation I will consider Richard Menary's account of the relationship between embodied cognition and narrative identity. One of Menary's primary claims is that narratives that circulate in conscious thought emerge from embodied experience. He points to limitations in current definitions of narrative, and to the importance of what he calls 'pre-narrative fodder,' by which he means the shaping of perceptual data by their mode of collection to be narrative-ready. These views lead Menary to posit a 'minimally embodied self' that attends immediate experience, which he distinguishes from the executive, abstracted narrator described in most accounts of narrative identity. Menary's account offers a stronger formulation of the role embodiment plays in generating selfhood than prominent accounts of narrative identity, including those of David Velleman and Marya Schectman. I will explore a possible improvement to Menary's account by considering the implications of research in two areas: 1. the ecological account of experience as skilled, oscillatory perceiving offered by Gibson (1978) and followers such as Alva Noe, Evan Thompson, and Daniel Hutto; 2. viewing affect and emotion as key players in this ecological account, wherein they simultaneously structure perceived experience and provide value markers, per recent work by Dan Goldie and Luis Pessoa. These considerations point to narrative's emergence from aspects of the affective systems active during conscious perceiving (as described in the work in affective neuroscience of Jaak Panksepp and others, and in the 'somatic marker model' proposed by Antonio Damasio and others). Affective valuations refer to the coding of aspects of experience for particular value in relation to the perceiver in the form of emotion. They provide an inchoate link between emotion and the temporal markers that structure raw experience. Narrative-like sequences emerge in an ongoing stitching of valuations in multi-factoral, multi-contextual, temporally extended experiences. While concepts, schema, and scripts may prime the structuring of experience, I hypothesize that affective valuations provide synthetic functions that render experience in proto-narrative forms, analogous to the narrative shapes of episodic memories. This revised model thus specifies the idea of 'pre-narrative fodder' and suggests potential linkages between immediate experience and higher order identity processing. **P2**

144 What Can Brain Aging and Alzheimer's Disease Teach Us About the Mind, Brain, and Self? Rudolph E. Tanzi <tanzi@helix.mgh.harvard.edu> (Neurology, Genetics and Aging, Harvard University, Boston, MA)

Alzheimer's disease is the most common form of dementia affecting the elderly and is characterized by global cognitive decline in learning, memory, reasoning and judgment. AD is strongly influenced by both genetic factors and lifestyle. While certain rare gene mutations, e.g. in the APP, PSEN1 and PSEN2 genes guarantee onset of AD before 60 years old, most cases of AD (>97%) involve genetic susceptibility factors and lifestyle, e.g. diet, exercise, intellectual stimulation and social engagement, stress levels and trauma, as well as sleep patterns. This means that lifestyle choices have a significant effect on our brain health as we age. The effects of Alzheimer's disease on the brain, mind, and consciousness must also be considered. In particular, the question of how the concept of 'self 'can be further refined in view of the effects of Alzheimer's on the brain and mind will be discussed. Further elucidation of the relationship between brain function, mind, consciousness, and the cosmos will also be presented based on the concepts of neuroplasticity put forward in our recent book 'Super Brain', as well as the role of epigenetics in our new book (Nov. 2015), 'Super Genes', both of which were co-authored with Dr. Deepak Chopra. **PL2**

2.05 Motor control

2.06 Memory and learning

145 Memory and Consciousness Carlos Montemayor, Harry H. Haladjian <cmontema@sfsu.edu> (Philosophy, San Francisco State University, Berkeley, CA)

Memory is typically modeled after perception. «Remembering» and «perceiving» are considered to be success terms because if one remembers an event, then the event happened; and if one perceives an object, then the object is accurately represented. Analogously, misremembering an event is similar to illusory perception - there is some perceptual information present, but it is being misrepresented. Hallucinations are analogous to full confabulations because they are not simply misrepresentations but unconstrained mental fabrications in the absence of stimuli. Accordingly, misremembering and confabulating are forms of malfunctioning, the latter being worse. This

analogy between perception and memory is straightforward, but it can't be right. In our presentation we explain why there are empirical and theoretical reasons against this analogy. We will elucidate the implications of these objections for the dissociation between consciousness and attention. A key aspect of our presentation will be that healthy patients systematically distort personal memories - significantly more than patients with memory impairments like amnesia (Schacter et al., 1996). Unlike the perceptual case, memory distortion (at least concerning autobiographical memory) is not pathological or simply a malfunction, but it is very likely beneficial because the purpose of the memory system is not only to store information about past actions and events but also to make sense of the past in insightful ways. If the main function of autobiographical memory is to produce a self-conscious narrative, then the relationship between autobiographical memories and other memories (episodic and semantic) cannot be thought of exclusively in terms of accuracy. One can illustrate this point with Nelson Goodman's (1981, 110-111) example of the difference between a report and a narrative. According to Goodman, reorganizing a set of events (for our purpose, a set of memories) in the interest of accuracy may alter a narrative to such a critical point that it becomes an exposition or report. The difference between a report and a narrative does not depend exclusively on the accuracy or inaccuracy of information. A false narrative can give way to a false report and vice versa, and the same holds for an accurate one. What matters for producing a cohesive personal story is the significance of a set of memories. Narrative is much more than chronometrically organized events, and autobiographical memory, by analogy, is much more than chronometrically organized memories. **C3**

2.07 Blindsight

2.08 Neurology, neuropsychology and neuropathology

146 Synthesis and Secretion of Endogenous N,N,-Dimethyltryptamine (DMT) in Rodent Brain Jon Dean, Tiecheng Liu; Sean Huff; Michael Wang; Jimo Borjigin <jgdean@umich.edu> (Molecular/Integrative Physiolo, University of Michigan, Ann Arbor, MI)

It has been proposed that exceptional states of consciousness in humans may involve the brain synthesis of indoleamine compounds exhibiting potent psychedelic properties. One such compound, N,N-dimethyltryptamine, has been found naturally in several plants and animals including humans. DMT administered to healthy humans elicits vivid visual hallucinations, alternate states of reality, and spiritual exaltation. Biosynthesis of DMT begins with decarboxylation of dietary tryptophan via aromatic-L-amino acid decarboxylase (AADC) to produce tryptamine, which then undergoes a double transmethylation reaction catalyzed by indolethylamine-N-methyltransferase (INMT). Despite a widespread expression in multiple tissues, INMT's presence in the mammalian brain has been scantly reported. We reasoned that for DMT to have a role in naturally occurring exceptional states of consciousness, its production in the brain would be expected. Using immunohistochemistry, we found robust expression of INMT protein and its co-localization with AADC protein in the mammalian pineal gland and cortical neurons. Moreover, in situ hybridization revealed expression of INMT mRNA that overlapped its protein expression in these cellular locations. DMT was concurrently identified in the rodent pineal gland and occipital cortex via microdialysis coupled to high-performance liquid chromatography. Finally, DMT levels increased in the dying rodent brain. Approximately 50% of rodents subjected to experimentally induced cardiac arrest demonstrated a 2-fold or greater rise in DMT levels in the brain ($P<0.0001$; $n=73$); an effect also observed in pinealectomized animals ($P=0.034$; $n=11$). Collectively, these results demonstrate that DMT synthesis occurs in the mammalian pineal gland and cerebral cortex and identify a physiological event wherein DMT release is elevated. These studies further establish a scientific framework from which to investigate a possible link between endogenous hallucinogen production and naturally occurring exceptional states of consciousness such as near death experiences reported in 20% of resuscitated cardiac arrest patients. **C15**

147 Consciousness and the Autistic Mind: Theoretical Implications and a Proposed Experimental Approach Henry Kong <heinrichoo@hotmail.com> (Toms River, NJ)

Autism is a developmental disorder characterized by defects in four psychological domains: communication, central coherence, theory of mind, and executive function. Consciousness is a set of neurological states defined in terms of four mental processes: verbal access, subjective experience, self-awareness, and volition/free will. There are striking parallels between the central aspects of autism spectrum disorders (ASD) and of conscious processes such that investigations into one may lead to fruitful insights about the other. Autism research has made great strides in recent years, largely thanks to the rigorous application of cognitive neuroscience and developmental genetics. Insights from ASD could therefore be applied to consciousness research. How is consciousness altered in ASD? First, as is well known, the communicative deficits of ASD lead to impoverished verbal access consciousness. Second, sensory inflow in ASD is not extensively modified by cortical processing. This results in poor central coherence, but should also intensify subjective experience compared to neurotypical brains. Indeed, sensory hypersensitivity and savant-like perceptual abilities are often associated with ASD. A third characteristic of ASD is defective theory of mind resulting from hypoactivity in dedicated mentalizing and/or empathizing circuits. This leads to what Simon Baron-Cohen calls mindblindness. But although severe autistics lack even self-awareness, high functioning autistics may focus all their attention on their own minds. Finally there is the free will illusion, which depends on the direct matching of incoming proprioceptive/sensory information reporting on action with neural codes stored in the striatum that predict the action. In ASD, this matching machinery is defective, causing executive dysfunction, repetitive behavior, and perhaps a blunting of the sense of volition. In theory, then, those with low functioning ASD would be expected to possess less verbal access, self-consciousness, and free will. But they would have more access to raw qualia compared to neurotypicals. Those on the higher end of the spectrum, however, differ from low functioning ASD in that they may be even more self-conscious than neurotypicals. I propose a rather straightforward experiment comparing a population of randomly chosen controls with appropriately matched low functioning and high functioning ASD groups. All subjects will be fitted with beepers and microphones to be worn during the day while they go about their usual activities. At random times the beepers will go off, instructing the subjects to describe what they were thinking about at that precise moment. The responses will be analyzed based on the frequency of sensory/perceptual descriptions (phenomenal consciousness), references to self (self-consciousness) or to others (theory of mind), and references to future plans or intentions (volition). It is hoped that this experimental approach can not only shed light on the psychological differences between ASD subtypes but also reveal how the distinctions among conscious mental processes are rooted in specific neurobiology. **P1**

2.09 Coma and vegetative states

148 Speak To Me: 18 Years of Neuroimaging in Disorders of Consciousness – What Have We Learned? Martin M Monti <monti@psych.ucla.edu> (Psychology; Neurosurgery, University of California, Los Angeles, Los Angeles, CA)

What does it mean to be at the lower limits of consciousness? In the past 18 years non-invasive neuroimaging technologies such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) have but revolutionized our understanding of Disorders of Consciousness (e.g., Vegetative State and Minimally Conscious State). In this presentation I will take stock of almost 20 years of neuroimaging in patients with Disorders of Consciousness and highlight the revolutions that these techniques have brought by in terms of our understanding of these conditions, including (i) the dispelling of the myth of the "apallic brain," (ii) the highlighting of the severe limitation of our standard clinical (i.e., behavior-mediated) approach to assessing the presence of consciousness, and (iii) the search for a neural fingerprint of consciousness and of the mechanisms that accompany loss and recovery of consciousness after severe brain injury. In addition, I will also highlight the many shortcomings and difficulties posed by the use of these techniques, such as its low sensitivity to detecting consciousness and the difficulty in interpreting brain activations, as well as the many misunderstandings that have arisen as a consequence of the finding of signs of consciousness in patients clinically diagnosed as being in a Vegetative State. **PL10**

2.10 Anesthesia and pharmacology

149 Ketamine Injection Acutely and Rapidly Decreases Tonic Dopamine Levels in the Rat Dorsal Striatum Lindsey Crown, Kate L. Parent; Mitchell J. Bartlett; Mike A. Miller; Katie F. Gies; Torsten Falk; Michael L. Heien; Stephen L. Cowen <lindsey.m.crown@gmail.com> (Psychology, University of Arizona, Tucson, AZ)

Ketamine is a non-competitive NMDA antagonist that is known for its properties as an anesthetic, hallucinogen, and drug of abuse. Recent work also suggests that ketamine infusions can reduce symptoms associated with treatment-resistant depression, migraine headaches and L-DOPA-induced dyskinesias. Although ketamine acts primarily on glutamatergic signaling, ketamine also binds opioid and dopamine receptors with similar affinity. Perhaps due to the complexity of ketamine's effects on multiple transmitters systems, little is known regarding how ketamine alters behavior, mood, and perception. In this study, we explored the impact of ketamine injection on dopaminergic signaling in awake and behaving animals. To accomplish this, we utilized fast-scan controlled-adsorption voltam-

metry (FSCAV), a recently-developed technique that allows for real-time monitoring of sub-minute changes in tonic dopamine concentration in vivo. In this experiment, rats (n=3) were implanted with carbon-fiber microelectrodes that targeted the dorsal striatum (DS) for FSCAV measurements. The DS receives considerable dopaminergic input from the substantia nigra pars compacta, which plays a crucial role in motor function and in the gating of thalamo-cortical signals. Following recovery from surgery, recordings were acquired during 3 hour experimental sessions. During an individual recording session, animals were allowed to behave freely in their home cage for 1 hour prior to either ketamine (20 mg/kg) or saline intraperitoneal injection, and recording continued for 2 hours post-injection. We observed that ketamine injection triggered a quick decline in tonic dopamine levels. This effect slowly recovered to baseline over the course of ~30 min. It has been hypothesized that one function of tonic dopamine in the striatum is to set a background level of dopamine receptor stimulation and thereby modulate system sensitivity to phasic dopamine changes elicited by sensory stimuli. The observed dip in dopamine could therefore indicate a mechanism by which ketamine reduces the impact of sensorimotor information on cognition. **C20**

150 Administration of Ketamine During Isoflurane Anesthesia Increases Cortical Acetylcholine and Accelerates Recovery of Consciousness Viviane Hambrecht-Wiedbusch, George A. Mashour <vivianeh@umich.edu> (Anesthesiology, University of Michigan, Ann Arbor, MI)

Each year over 200 million patients worldwide undergo major surgeries, the majority with general anesthesia. Promoting arousal by manipulating certain brain regions and/or neurotransmitters has been a recent research focus, with the goal of trying to improve recovery from general anesthesia. Acetylcholine (ACh) is known to be critical for cognitive function and wakefulness and is suppressed in the cortex by most general anesthetics. However, ketamine has been shown to promote cortical ACh release. The present study is testing the hypothesis that a single intraperitoneal injection of ketamine (25 mg/kg) during isoflurane anesthesia causes an increase in cholinergic tone in the prefrontal cortex and accelerates recovery from isoflurane anesthesia. Adult, male rats were implanted with a microdialysis guide cannula targeted for the prefrontal cortex. Animals were randomly assigned to a saline or ketamine group. A microdialysis probe was inserted and ACh samples were collected every 12.5 min resulting in 3 samples during Wake, 3 samples during Isoflurane, 7 samples during Isoflurane + Drug (ketamine or saline) and 10 samples during Recovery phase. ACh was quantified by high performance liquid chromatography with electrochemical detection. In addition, the time it took the animal to recover from anesthesia was measured. To date, ketamine caused a significant increase in ACh release from the prefrontal cortex during the beginning of the Recovery phase (sample 1, 2 and 3; n=8 in each group). Consistent with these data, ketamine caused a significant, 44.25 % reduction in wake up time (n=9 in each group). These findings suggest that, paradoxically, the addition of the anesthetic ketamine during inhaled anesthesia can accelerate the recovery of consciousness. **C20**

151 Anesthetic Modulation of Brain Dynamics Anthony G. Hudetz <ahudetz@umich.edu> (Anesthesiology, University of Michigan, Ann Arbor, MI)

Neuronal ensembles of the brain engage in transient interactions that form metastable configurations at various spatiotemporal scales from local circuits to large-scale networks. Ongoing spontaneous activity is presumably self-organized and is probably necessary, or even sufficient, for conscious awareness. Self-organized criticality - a dynamic state at the boundary of order and disorder - is implied by the power-law scaling of the size of neuronal population events. Manipulation of neuronal activity by anesthetics allows one to investigate the state-dependent modulation of neuronal dynamics critical to the conscious state. Anesthetics may alter brain dynamics by acting on various neuronal targets including direct effects on cortical neurons and indirect modulation via thalamic and subcortical arousal sites. We investigated the dose-dependent effect of anesthetics on cortical neuronal activity, cellular interactions, local field potentials (LFP), and blood oxygen level-dependent (BOLD) signals by functional magnetic resonance imaging (fMRI). One of the hypotheses being tested is that anesthetics suppress consciousness by disrupting the dynamics of neuronal ensembles that underlie the temporal integration of sensory information flow. We find that during anesthesia, spiking activity of individual neurons is fragmented into discrete periods of activity interrupted by time gaps of a few hundred milliseconds. Simultaneously, the periods of active spiking become uncorrelated and the strength of monosynaptic excitatory interactions is reduced. Moreover, the correlation and complexity of spike interactions drop abruptly at the critical anesthetic associated with loss of consciousness. Exogenous stimulation of the ascending arousal system reverses the anesthetic reduction of spike interactions. At a mesoscopic scale, neuronal population events are associated with the negative deflections of LFP (nLFP) whose landscapes are conserved during

anesthetic administration. The probability distribution of typical nLFP landscapes follows power-law (suggesting self-organized criticality) that is affected only moderately in unconsciousness. In large-scale networks, the size distribution of spontaneous BOLD fMRI co-activations also conforms to power-law in both consciousness and unconsciousness. However, the temporal variance and complexity of BOLD co-activations are dramatically reduced suggesting that the anesthetized brain accesses a smaller repertoire of global brain states. Finally, graph analysis of human resting-state fMRI networks reveals that the power-law of node degree is conserved during anesthesia in healthy volunteers but not in patients in vegetative state with irreversible loss of consciousness. In summary, our results show that the power-law distribution of dynamic neuronal ensembles is preserved during anesthesia and therefore do not support scale-invariance or self-organized criticality as a defining condition for the conscious state. On the other hand, anesthetics clearly interfere with brain dynamics, causing temporal fragmentation of neuronal activity and a reduction in the repertoire of large-scale brain configurations. Thus, anesthesia may modulate the state of consciousness primarily through temporal mechanisms, impeding neuronal interactions and the temporal integration of the stream of sensory information. **PL9**

152 Cholinergic Stimulation of Prefrontal Cortex Reverses Traits of Sevoflurane Anesthesia Dinesh Pal, Brian H. Silverstein, B.A., Stella Wisidagamage, M.S., George A. Mashour, M.D., Ph.D. <dineshp@med.umich.edu> (Anesthesiology, University of Michigan, Center for Consciousness Science, Ann Arbor, MI)

Reversal of anesthetic-induced unconsciousness is an area of active inquiry and not only has direct translational relevance, but is also of fundamental importance for understanding the neural circuitry involved in the emergence of consciousness. Several past studies have attempted to reverse the state of anesthesia both in humans and animals. However, those studies involved either systemic intervention or followed a bottom-up approach by manipulating components of ascending reticular activating system. In this study, we investigated the effect of cortical cholinergic stimulation in anesthetized rats on behavioral arousal and electroencephalographic indices of brain connectivity. Male Sprague-Dawley rats (N=9, 300-350g) were surgically implanted with 1) screw electrodes to record monopolar electroencephalogram (EEG) across the cortex, and 2) a guide tube in prefrontal cortex (PFC) for reverse dialysis delivery of carbachol, a mixed cholinergic agonist. Changes in brain connectivity - corticocortical coherence and frontoparietal directed connectivity - were measured from EEG while simultaneously delivering carbachol into PFC during sevoflurane anesthesia at 2.0-2.2 % concentration. State of anesthesia was determined on the basis of loss of righting reflex, a well-established surrogate for loss of consciousness in rodents. In addition, we quantified the local changes in acetylcholine (ACh) concentration before, during, and after carbachol infusion into PFC. We demonstrate that cholinergic activation of rat PFC during sevoflurane anesthesia produced signs of arousal and EEG activation in all rats. In addition, four out of nine rats were able to regain righting reflex and showed complete mobility while still inhaling sevoflurane anesthesia. Carbachol in PFC also caused a highly significant ($p<0.001$) increase in local ACh levels. These results suggest that PFC contributes to top-down control of arousal state. However, despite the increase in local ACh levels, EEG activation, and signs of behavioral arousal, the brain connectivity measures - corticocortical coherence and frontoparietal directed connectivity - did not return to wake levels and remained at the levels observed during sevoflurane-induced unconsciousness. Further studies are required to understand the relationship between reanimation under anesthesia and cortical brain connectivity. **C20**

153 Tubulin Conformation and Anaesthetic Interaction - An Experimental Study Pushpa Sahni <deipushpasahni@gmail.com> (Chemistry, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Everything we know about the world comes to us through our brain. Yet, our own conscious mental world of thoughts and feelings is isolated and private for each of us. Despite several centuries of research on the brain, communication through language or gesture remains the only way we can discover the conscious thoughts and experiences of others. In the last few decades, neuroscientists have begun to attack the problem of understanding consciousness from an evidence-based perspective. But if thoughts and feelings arise from patterns of neural activity in the brain, then it should be possible to directly decode such conscious experiences from brain activity alone. Many researchers have sought to discover specific neurons or behaviours that are linked to conscious experiences. Recent advances in brain imaging technology raise just such a possibility, by showing that it is possible to accurately decode a person's conscious experience based only on non-invasive measurements of their brain activity. Such brain reading' abilities may transform our understanding of the brain and

provide important new medical insights. Penrose and Hameroff (2011) suggest that quantum-superposed states develop in tubulins, remain coherent and recruit more superposed tubulins until a mass-time-energy threshold, related to quantum gravity, is reached. Memory and consciousness are interrelated, thus, microtubules could be the link between these two phenomena. Microtubules are cylindrical hexagonal lattice polymers of the protein tubulin, comprising 15% of total brain protein. Microtubules regulate synapses and are suggested to process information via interactive bit-like states of tubulin. The aim of our work is to characterize the conformation of tubulin in both polymerized and depolymerized conditions and the involvement of hydrophobic interactions in tubulin functional activities. For these purposes we have examined the effects of binding of anaesthetic with tubulin protein with the help of circular dichroism and Time Resolved Fluorescence Spectroscopic studies. Circular dichroism of tubulin in presence of propofol suggests major changes in its overall conformation. Time Resolved Fluorescence Spectroscopic study further supports the change in secondary structure of tubulin protein when it binds with anaesthetic (propofol). Though assembly / polymerization of microtubule may not be the best measure of microtubule activity relevant to consciousness and conditions ideal for quantum brain structures relevant to consciousness have not been considered, however, our future endeavour would be to determine the conformation of tubulin under conditions ideal for quantum brain structures relevant to consciousness. In future, we aim to discover quantum effects in microtubules responsible for information processing. **C20**

154 Theta-gamma Coupling During Propofol-, Sevoflurane-, and Ketamine-induced Unconsciousness in Rats Brian Silverstein, Dinesh Pal; Viviane Hambrecht-Wiedbusch; Claudia Scheffzuk; Anthony G. Hudetz; George A. Mashour <bsilvers@med.wayne.edu> (Translational Neuroscience, Wayne State University School of Medicine, Detroit, MI)

There is an incomplete understanding of the neurophysiological mechanisms through which anesthetics with diverse molecular, neurophysiological, and pharmacological profiles achieve the same end point, i.e., behavioral unconsciousness. Studies from different laboratories using human and non-human species have demonstrated that a breakdown of functional connectivity in frontoparietal networks correlates with physiological, pharmacological, and pathological states of unconsciousness (Boly et al., 2012; Imas et al., 2005; Lee et al., 2013; Noirhomme et al., 2010). However, local cortical interactions between different frequency components as an outcome or measure of changes in states of arousal have not been studied in detail. We investigated cortical changes in phase-amplitude cross frequency coupling (CFC) between frequency bands associated with behavioral and electroencephalographic arousal, delta (1-4 Hz), theta (4-10 Hz) and gamma (low: 25-55, medium: 65-125, high: 125-175 Hz), during unconsciousness induced by sevoflurane, propofol, and ketamine, three anesthetics with distinct molecular mechanisms. Male Sprague Dawley rats (n = 26) were implanted with screw electrodes to record monopolar electroencephalogram (EEG) from frontal, parietal, and occipital cortices. One subgroup of rats (n = 6) was implanted with chronic intravenous catheters for propofol (800 µg/kg/min) infusion. The other two subgroups received 2.0-2.2% sevoflurane (n = 10) and intraperitoneal (150 mg/kg) ketamine (n = 10). CFC between the theta and gamma bands was calculated using the modulation index algorithm (Canolty et al., 2006) at each electrode and compared before, during, and after anesthesia. Loss of righting reflex was used as a surrogate for unconsciousness. The baseline waking state in all three experimental groups was characterized by strong coupling between theta and medium gamma, which was consistently disrupted during anesthetic-induced unconsciousness; theta phase frequency was centered around 6 Hz and medium gamma amplitude frequency around 90 Hz. All three anesthetics induced coupling between delta and low gamma which was not present during wake or recovery. Recovery from sevoflurane anesthesia was characterized by the return of theta-medium gamma coupling to pre-anesthesia baseline wake levels while theta-medium gamma coupling stayed significantly lower during the recovery epoch in propofol and ketamine group. In addition, ketamine produced an intense increase in coupling between theta and high gamma solely during emergence from anesthesia, and propofol anesthesia was marked by the appearance of theta-low gamma coupling. The changes in CFC were evident across frontal, parietal, and occipital electrodes, though were most prominent in the frontal area. The reduction of theta-gamma coupling by diverse anesthetics suggests the possibility of a common neural correlate for anesthetic-induced loss of consciousness, whereas the CFC correlates of emergence may be more agent-specific. References: Boly, M. et al (2012) J Neurosci 32, 7082-7090. Canolty, R. T. et al (2006) Science 313, 1626-8. Imas, O. A. et al (2005) Neurosci lett 387, 145-150. Lee, U. et al (2013) Anesthesiology 118, 1264-1275 (2013). Noirhomme, Q. et al (2010) Front Syst Neurosci 4, 160 (2010). **C20**

2.11 Cellular and sub-neural processes

2.12 Quantum brain biology

155 Does The Meyer-Overton Correlation Explain Anesthesia and Consciousness? Alian Aquino, Travis Craddock; Jack Tuszynski, Stuart Hameroff <aquinoa@anesth.arizona.edu> (Anesthesiology, Banner – University Medical Center Tucson, Arizona)

Background: The Meyer-Overton correlation showed the potency of anesthetic gases in preventing purposeful behavior in a variety of animals correlated precisely with their solubility and binding in a non-polar, lipid-like medium akin to 'olive oil', comprised of pi electron resonance rings. Later work showed such relevant binding occurred by weak, quantum-level 'London' dipole dispersion forces within proteins, e.g. with pi resonance rings in aromatic amino acids tryptophan, phenylalanine and tyrosine. The search for specific proteins mediating anesthetic action (loss of consciousness, immobility and memory formation) focused on membrane receptors and ion channels, but that focus failed, and work now suggests relevant anesthetic action on cytoskeletal microtubules inside neurons. Regardless of the particular protein target, how does quantum-level binding cause loss of consciousness and memory, immobility, and measurable slowing in EEG? Dipole oscillations among pi resonance clouds in terahertz (1012 Hz) have been detected in proteins, and appear to cascade and interfere, causing slower vibrations including EEG. Such vibrational cascades stemming from terahertz are proposed to be essential for consciousness and memory. In this simulation study, we looked at effects of anesthetic binding on terahertz oscillations between pi resonance clouds (benzene rings). Methods Using a simulated pair of pi resonance benzene rings separated by 3.7 angstroms as a model system, we calculated London dipole dispersion E (ionization 9.2 eV, polarizability 68 a.u.) for pi resonance oscillation at 68 terahertz (1012 Hz) to be 4.4 x 10-20 Joules, an energy barrier for terahertz oscillation. We then calculated effects of a halothane molecule (permanent dipole 1.41 Debye) placed 4.5 angstroms from the pi resonance rings, as occurs in tubulin. Results We found dipole dispersion due to the presence of halothane increased oscillation threshold to 5.1 x 10-20 Joules, a 20 percent change likely able to slow terahertz oscillations, thereby dampening the brain's scalar hierarchy including EEG. Discussion The Meyer-Overton correlation defines pi resonance regions within biomolecules conducive to quantum-level dipole oscillations, which in turn may be necessary for consciousness, memory and behavior. Our work suggests anesthetics act by dampening terahertz quantum dipole oscillations, e.g. in microtubules in dendrites and soma of brain cortical neurons. References 1) Sahu et al (2013) Biosens. Bioelectron. 47: 141-148. 2) Sahu et al (2013) Appl. Phys. Lett. 102: 123701. 3) Sahu et al (2014) Scientific Reports 4:7303-1 DOI:10.1038/srep07303, 4) Craddock et al (2012) PLoS ONE. 7: e37351. 5) Craddock et al (2014) J Roy Soc Interface 05/11(100). DOI:10.1098/rsif.2014.0677, 6) Craddock et al (2015) Curr Topics Med Chem 15 (6) 523-533(11), 7) Hameroff & Penrose (2014) Phys. Life Rev., 11(1):39-78, http://www.sciencedirect.com/science/article/pii/S1571064513001188 **C15**

156 Marcuse's Matrix Donald Mender <donald.mender@yale.edu> (Psychiatry, Yale University, Rhinebeck, NY)

This presentation starts with two theoretical assumptions: first, with substantial empirical justification, that all energy of the human brain at root originates from quantum photosynthesis, and second, with yet undemonstrated empirical support, that dissipative thermofield dynamics can preserve coherences across the food chain. These ideas are then marshaled to construct a possible physics of hermeneutics. Three main hermeneuticians, foci of integrative critical theory by the Frankfurt School and especially by its most famous member, Herbert Marcuse, are considered. The three hermeneuticians are Marx, Freud and Heidegger. Marx's labor value is reframed as kinetic energy expended through productive work on objects by the intending human subject. Freudian libido is understood as desire that imbues all objects of human interest with potential energetic value as candidates for consumption. If we quantize the sum of the above potential and kinetic energies, its unitarily evolving Hamiltonian wave function under conditions of non-collapse unremarkably traces out a coherent superposition of "histories" delineated by lagrangian functionals. The lagrangian dimension of action is energy X time, which may be applied to the physics of both Marxist "labor-time" and Freudian libidinal ontogeny. Among all the superposed Freudo-Marxist paths, one is optimally direct, most probable, and in correspondence with a "classically" limiting case. We might follow Paul Ricouer here in considering such an extremum as the route of Heideggerian authenticity in comparison to other hermeneutic "detours." Insofar as the above path integrals entail Feynman diagrams, they should be amenable to second quantization formalizing creation and annihilation of bosons and fermions. One can envision linking creation and annihilation operators with Freud's Eros and Thanatos. It may

be also reasonable to link Bose-Einstein statistics, scaled up by thermofield dynamics, to fungible object relations and Fermi-Dirac statistics to fragmented drive cathexes. Imposed somatic boundary conditions might be understood to set up overtones that constitute "eigendefenses." Possible quantized counterparts in a Marxist neurophysics may relate to tunneled "leakage" of productive neural energy debt over time and to superposed parallelism in neuroenergetic division of labor. Initially "thrown" and mortally final states of Heidegger's Dasein might delimit the points of departure and termination for a unitarily evolving quantum Hamiltonian characterizing a Riceourian superposition of hermeneutic pathways. Further elaborations may be possible. All could have physically quantifiable specifications. Implications might endow the Frankfurt School's project of a rigorous critical theory, integrating the hermeneutic insights of Freud, Marx, and Heidegger, with mathematical and empirically testable teeth. **P1**

157 Electron and Proton Transfer in Tubulin Raag Saluja, Amla Chopra <saluja.raag@gmail.com> (Zoology, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The tubulin heterodimer polymerises to form microtubules, which have been shown to play a key role in learning and memory, intracellular transport, cell division, cell motility and cancer. They have now also been shown to be capable of information processing and mediation of consciousness. Hameroff et al have previously speculated the role of tryptophan, while Bandyopadhyay's group showed the importance of water channel for resonance to occur in microtubules. Hence, we used in silico methods for analyzing the roles of all the 20 amino acids in tunneling. We mutated the molecule in silico and compared the structure and physicochemical properties of the mutants. As the rate of electron transfer is related to the stability of the molecule we calculated the potential. This showed the importance of Lys, Trp, Arg, Asp and Glu. Asp, Glu, Arg, Lys, Gln and Asn form the proton wires and Trp, Phe, Tyr and His form the electron transfer tracts. The proton wires and electron transfer tracts intersect at Tyr and Trp, illustrating that the two are inter-related. Visualization of tunnels confirmed the roles of the above-mentioned amino acids in tunneling. There were about 30 tunnels originating from all the amino acids in tubulin and in our positive controls, while there were only a couple of tunnels in the negative controls. This illustrates the importance of the 3D conformation of the protein, rather than the amino acid in particular. There were only 126 electron transfer tunnels and 168 proton transfer tunnels. Also, out of all the aromatic amino acids (involved in electron transfer) only Trp contributed significantly to the stability. However, amongst the amino acids involved in proton transfer, Lys, Asp and Glu affected the stability of the molecule. This illustrates that while both electron and proton transfer occur in tubulin, proton transfer is clearly plays a more important role. When Lys (which has earlier been shown to form salt bridges with Asp and Glu) was mutated to Arg, the molecule became more stable. This shows the importance of delocalization of electrons, found in Arg. This, and the fact that the proton wires and electron transfer tracts intersect, suggest the possibility of coherence in tubulin. Our study illustrates the importance of Lys as well as Trp in consciousness. **C15**

158 "Swing Dancing" Our Way to Understanding Quantum Entanglement in Neurons Nancy Woolf <nancywoolf@yahoo.com> (Psychology, UCLA, Las Vegas, NV)

Most people intuitively doubt that the full range human thought and emotion can be reduced to mere electrochemical responses. Nonetheless, that is precisely the mainstream scientific view according to reductionism. Quantum theories of conscious mind remain controversial despite their uncanny ability to exponentially expand purely neurobiological explanations of mental activity. The mind, particularly the human mind, captures the most far-reaching potential of quantum physics. Take, for example, time travel: Our minds quite ably travel back in time (memory) while simultaneously living in the present and delving into the future (anticipation, planning). In fact, our minds rely on "time travel" to reach even the most trivial of visual perceptions. The world we see exists largely in own minds. The mind sees not mere patterns or wavelengths of light: it deduces form and color via a vast number of comparisons made between inputs of varying contrast, luminosity, and wavelength–the sum total of which is further altered by past experience and future prediction. Venturing beyond the chemical synapse brings new phenomena into play. Quantum entanglement deeper within the neuron provides a powerful mechanism able to detect and record relationships among neural inputs. Fifteen years ago, Woolf and Hameroff (TICS, 2001) proposed a model of visual consciousness whereby neurotransmitter function at the synapse triggers quantum computations deep inside the neuron. Many signaling paths enable synaptic events to reach the cell interior; these are undisputed facts. Theoretical quantum computations carried out in the neuron's microtubule matrix according to the Hameroff-Penrose model continue to gain support. Moreover, recent evidence for quantum entanglement at room temperature (Klimov et al., Sci. Adv., 2015) and over a distance of 143 Km (Herbst et al., PNAS, 2015) suggests that quantum entanglement in the warm wet brain is indeed possible. Besides the overall feasibility of quantum mind models, another question arises: Does quantum entanglement offer a superior means of "binding" neural information compared to synaptic models (such as co-incident detection, the idea that neurons that fire together wire together)? Recently, a University of Pittsburgh team of researchers discovered electrons can "swing dance" in nanowire transistors, effectively affecting each other's behavior beyond mere synchronization (Cheng et al., Nature, 2015). In this presentation, I will use authentic swing dance videos to illustrate how quantum entanglement could operate much more flexibly to "connect" synapses linked by microtubule tracks deep within the interiors of a neuron. Dance partners affect one another's performance based on brief and minimal connections that intensify at key points in the dance, just like relationships between inputs. As envisioned within tubulins in microtubule tracks, an entanglement not only links inputs together (comparable to co-incident detection models) it has the potential to entangle with distant tubulins in other parts of the brain. Hence quantum entanglement, if sufficiently widespread as to include a critical mass of microtubule protein (calculated as the total tubulin found in ~10,000 neurons), could effectively bring about the "conscious realization" of a selected group of inputs and furthermore combine those "realizations" into a hierarchy of increasingly complex concepts. **C23**

2.13 Brain networks, synchrony and scale

159 Emergence and Mechanisms of Cognition Gyorgy Buzsaki <gyorgy.buzsaki@nyumc.org> (The Neuroscience Institute, New York University School of Medicine, New York, NY)

The fundamental goal of the brain is to predict the future. More complex brains evolved multiple hierarchical loops between their outputs and inputs to make prediction more reliable in more complex environments and at longer time scales. With extensive training these prediction mechanisms have become 'internalized'. At the center of this model are self-propagating loops of neuronal coalitions connected by modifiable synapses that can be propelled forward without external cues. The implication of this conjecture is that brain networks are endowed with internal mechanisms that can generate a perpetually changing neuronal activity even in the absence of environmental inputs. I will discuss examples and mechanisms of this framework. **PL9**

160 Decoding the Dynamics of Conscious and Unconscious Processing Stanislas Dehaene <giovanna.santoro@cea.fr> (Neurospin, College de France, Paris; INSERM-CEA Cognitive Neuroimaging Unit, Saclay, Gif Sur Yvette, France)

What stages of neural processing transform a patch of light on the retina into a conscious percept? To dissect the time course of conscious and unconscious processing, my laboratory has developed a method that combines time-resolved recordings of brain activity, obtained with electro-encephalography [EEG], magneto-encephalography [MEG], or intracranial recordings, with multivariate analyses that learn to 'decode' various aspects of mental representations from those time series. The method determines precisely when a specific mental content becomes explicitly represented in brain activity. Most importantly, how the trained classifier generalizes across time and experimental conditions sheds light on the temporal organization of information-processing stages. I will illustrate the method using several recent MEG+EEG experiments in which temporal decoding is used to track the fate of conscious and unconscious stimuli in the brain. Decoding clarifies the time course of several classical phenomena such as masking, blindsight, attentional blink, and psychological refractory period. All of these paradigms give converging results, suggesting that conscious perception is associated with the late formation of a sudden, distributed and metastable neural assembly that encodes the current subjective state of the conscious mind. However, we also identify long-lasting brain signals that maintain relevant features of a subliminal stimulus, sometimes for up to several seconds. Our results clarify the relationship between conscious and unconscious forms of working memory. References: Charles, L., King, J.-R., & Dehaene, S. (2014). Decoding the dynamics of action, intention, and error detection for conscious and subliminal stimuli. The Journal of Neuroscience: The Official Journal of the Society for Neuroscience, 34(4), 1158-1170. http://doi.org/10.1523/JNEUROSCI.2465-13.2014 King, J.-R., & Dehaene, S. (2014). Characterizing the dynamics of mental representations: the temporal generalization method. Trends in Cognitive Sciences, 18(4), 203-210. http://doi.org/10.1016/j.tics.2014.01.002 King, J.-R., Gramfort, A., Schurger, A., Naccache, L., & Dehaene, S. (2014). Two distinct dynamic modes subtend the detection of unexpected sounds. PloS One, 9(1), e85791. http://doi.org/10.1371/journal.pone.0085791 Marti, S., King, J.-R., & Dehaene, S. (2015). Time-Resolved Decoding of Two Processing Chains during Dual-Task Interference. Neuron, 88(6), 1297-1307. http://doi.org/10.1016/j.neuron.2015.10.040 **PL1**

161 Restructuring Consciousness Theory to Include the Observer - Putting the Horse Before the Cart John Russell Hebert, M. Kafatos; J. Hagelin <tmeeg@aol.com> (Maharishi University, Houston, TX)

No integrative theory of consciousness has appeared on the horizon. The goal of this presentation is to define a missing element in consciousness theory for a more complete theory. The current paradigm is based on the finding 20 years ago that successfully describes how the brain integrates incoming sensory information into a perceptual moment through a phenomenon called zero-lag gamma phase synchrony. We call this object-based consciousness theory. Each of us knows that there are two aspects of experience the observer and the observed object. Researchers are concluding lately that no theory of consciousness is complete without a neuroscience depiction of the observer. We sought to isolate the observer by separating out the content as seen in what some theorists call the "ground state" of content-free consciousness, a state of minimum cognitive activity, maximum negative entropy or in current jargon "transcendence". We reasoned that the EEG signature of the observer in the ground state would give a clue as to the observer in active states which has been the goal of this report-to identify the observer and the object together. We located a unique EEG signature, the alpha in-phase standing wave (AIPSW) that has been predicted by neural math modelers but never identified in the literature. Simply put this is a state of zero-lag alpha over the whole cortex associated with quiescent observer. The standing wave occurs because of alpha's qualification as the primary resonance frequency (PRF) of the brain. The PRF sets up the framework for resonance frequency interaction suggesting alpha-gamma resonance. Cross-frequency phase synchrony has been rigorously documented and has gained momentum as a growing consensus in the literature. As these resonant interactions are gaining acceptance in the EEG literature an adjustment in the understanding of the origin of the EEG is needed. The ruling paradigm for decades describes how the EEG is formed through the electrical fields in the brain called synaptic potentials. Recently EEG experts have begun to include spike potentials as a contributor to the EEG. This presenter agrees with this proposal and has concluded that spike potentials are at the basis of the alpha frequency. From the analysis of the spike potentials as they contribute to traveling alpha waves, the conclusion is made that alpha from the white matter is the primary driving force of consciousness and the synaptic electrical impulses in the gray matter constitute a secondary aspect underlying the content of consciousness. This report suggests that alpha is the observer and that alpha is necessary for experience. Both phases synchronized alpha and gamma in phase-locked configuration are necessary for experience. Identifying the observer as phase synchronized alpha and the object as a phase synchronized resonant gamma interaction suggests a paradigm shift from object-based to observer-based consciousness theory. The missing observer is in place at the center of consciousness theory. The horse now comes before the cart - as it should be. The presentation finds the theory to be integrative with high explanatory value as is already being seen in clinical and performance studies. **C4**

162 Network Topology and Directional Connectivity Patterns in Mouse, Monkey and Humans: Implications for the Evolution of Consciousness Joon-Young Moon, Kim, Junhyeok; Ko, Tae-Wook; Kim, Minkyung; Mashour, George; Lee, Uncheol <moonjy@umich.edu> (Department of Anesthesiology, University of Michigan Medical School, Ann Arbor, MI)

Brain connectome projects are constructing structural and functional maps of the brain. A critical aspect of these projects will be to understand how the brain network determines local functions and information transfer patterns essential for consciousness and higher cognitive functions. Finding a general relationship of global network topology, local node dynamics, and the directionality of information transfer in the brain network is crucial. In this study, we demonstrate that functional inter-node directionality in brain networks arises naturally from their structural network topology. We investigated the distinct topology and directionality of brain networks in human, macaque monkey, and mouse. Analytical, computational, and empirical results all demonstrate that the underlying structural network determines the directionality of the functional connectivity: the nodes with more connections (hubs) are the targets, whereas the nodes with fewer connections (periphery) are the sources. In comparing the three species, the human brain has the primary hub nodes in parietal/occipital regions, and peripheral nodes in the frontal regions. Thus, a dominant anterior-to-posterior directionality arises in the resting state. The peripheral nodes shift posteriorly to central regions for the macaque monkey, and even more posteriorly to parietal/occipital lobes for the mouse, therefore, the posterior-to-anterior directionality is dominant in the mouse brain. Regarding implications for the evolution of consciousness, the prefrontal region is the site that has undergone great expansion over evolution but it is likely the connectivity that drives differences in consciousness and cognition across the species. We speculate that the evolution of functional and directional connectivity patterns are linked to the evolution of consciousness. **C14**

163 Distant Healing with Shaman Healer Ilona Palucki: A Case Study Demonstration of Excess Correlation in Right Temporal Lobe Activity Between Healer and Receiver at Distances Exceeding 6000km Mandy A. Scott <mx_scott@laurentian.ca> (Neuroscience Research Group, Laurentian University, Sudbury, ON Canada)

The phenomenon of distant healing involves aspects of non-local processing that include remote viewing, psychokinesis (intentional effects of subtle energy on matter), and some degree of macro-entanglement. To further explore the effects associated with distant healing intentionality, a series of experiments were conducted with Ilona Palucki, a shaman healer (female, age 69) in Le Luc, France. Quantitative electroencephalographic (QEEG) measures were collected during a distant healing treatment involving a distance of 6505km (Le Luc, France to Sudbury, ON, Canada) where Mrs. Palucki employed her technique for healing on a male receiver (age, 29). The participant reported depression prior to the treatment and indicated they did not consider distant healing effects to be a possibility. The participant was informed of the potential for significant cognitive-behavioural and affective changes to initiate following the treatment. The experiment began with 3min each eyes open and eyes closed baseline measures, with the treatment lasting approximately 42min before 3min each eyes open and eyes closed post baseline measures. sLORETA analyses demonstrated a significant increase in post treatment parahippocampal activity in the receiver, a significant change in subcortical activation which persisted in a 5month follow up baseline. This change was accompanied by a cessation of behavioural symptoms associated with clinical depression, a result supported by POMS-SF scores also completed at 5months post treatment. To further explore dynamic changes during distant healing, coherence analyses completed demonstrated increased coherence between right frontal-temporal channels within theta and gamma at key intervals during the treatment. These key moments of synchronization of cerebral activation during distant healing will be discussed in detail along with a review of the spectral QEEG profiles of the healer and receiver during the treatment. Overall the results demonstrate the neuropsychological efficacy of distant healing as a reliable treatment for cognitive-behavioural disorders which in this case involves clinical depression. **C7**

164 The Mind State Ket as an OR Landscape Measuring Device Luiz Paulo Silveira, Luiz Paulo Oliveira Pereira Da Silveira <luizs1981@uol.com.br> (EdX, Brasilia, Brazil)

A Bloch sphere is a 3D surface appropriate for embedding kets of quantum unknowns. One mind may be irrational and tied to physiologic functions: |mind>=1*|alive>. As the mind gains autonomy, more degrees of function can be expressed as: |mind>= alpha*|alive>+beta*|activity> Note that to ensure longevity, the mind must not stray far from ||beta||<<1. Over many measurements, if ||beta||>0, the activity may be discerned superimposed over the alive state: as time passes, external observers notice the activity. Divisions between |mind>=alpha*|awake>+beta*|asleep> are also possible.
As we project |mind> over one Bloch sphere, we have: |mind>=cos (theta)*|alive>+exp(i*phi)*sin (theta)*|activity> With the constraint of ||theta||<<1 to ensure longevity, we are left with two parameters for the |activity>: theta and phi. The space swept by the |mind> vector over the Bloch sphere may be called a "life cone": the space where the |mind> vector maintains itself alive. It is known: neurotransmitters influence thought. In order to ascertain specific behaviors, the mind exerts sustained and synchronized pressure over the cellular machinery, with neurotransmitters in chemical synapses and electromagnetic fields in direct synapses. The global and local effects of these pressures in the state of the |mind> may be appreciated. These effects of neurotransmitters on |mind> may be understood as a restriction of the positions available for |mind> on the Bloch sphere: every neurotransmitter has a "spectrum" of possibilities on the surface of the sphere. This Bloch sphere life cone creates on the Objective Reduction (OR) configuration of the space a new set of superpositions additional to those created by the body mass itself, and the gravitational interaction (collapse frequency) of |body> OR space and |mind> OR space are also different: when dealing with the OR of |body> and |mind> space-time immersions, especially in mental tasks, has a differente gravity(x) operator than . The manipulation of Fermi levels of semiconductors using crystal site substitution changes the charges' mobility and field configuration as different electronic clouds interact. Experience shows that these Fermi level modifications exerted by neurotransmitters influence the |mind> state on the Bloch sphere. In this regard, every neurotransmitter release is a collapse of the OR landscape, as the superposition of probabilities of |mind> changes when the spectra of active neurotransmitters interact and change the shape of the life cone spanned by |mind> on the Bloch sphere. These life cone shape changes are limited, with the Bekenstein bound of information processing as a hard limit. Tubulins

are semiconductor crystal chains arranged in superficial configuration. The Fermi levels interactions are thus also a way of leveraging varying configurations of the circuit created by the tubulin cylindrical surface. Connections between changing tubulin configurations and mind states are as of yet not fully understood, but correlations between mind state and cortical region activation/deactivation are more pronounced. Changes in local Fermi levels coalesce into the general mind state (and also influences the |body> state) as the local OR configurations interfere and are combined in the general OR of the |mind> itself. **P2**

2.14 Emotion

165 Anatomy of Emotion: Input, Feelings, Evaluation, Responses, Experience, and Reflection Bill Faw <bfaw@bpc.edu> (Psychology, Brewton-Parker College, Harrisonburg, VA)

Emotional episode stages include: Input, Feelings, Evaluation, Responses, Experience, and Reflection. INPUT: Representations of neutral stimuli come from every sensory system, as quickies from the thalamus and highly-processed from the rhinal cortex. Primary/innate smell and taste come from areas near the insula. Negative and positive primary bodily sensations come through C-fibers from skin and organ receptors, through specialized spinal, brainstem, and thalamic pathways, to posterior insula, to anterior insula; then to amygdala, hippocampus, and orbital frontal. BODILY FEELINGS: Anterior insula is likely the site for ever-changing bodily feelings, which can be experienced, color discrete emotional experiences, and can trigger emotional responses. Anterior insula also coordinates internal and external sensory inputs and can activate Salience Network dorsal-ACC to turn up Task-Positive Network and turn down Default. EVALUATION: Primary positive or negative reinforcers are hardwired to trigger bodily responses at evaluation centers. Stimulus input is evaluated as to whether it represents a primary or conditioned reinforcer, a neutral stimulus, or paired neutral-reinforcer stimuli. Amygdala Lateral Nucleus (LA) and old amygdala (Central:CeA, Medial:MeA, and intercalated masses:IM) evaluate these in an implicit shoot-first manner. The LA and new amygdala (Basolateral:BLA) enlist orbital frontal cortex (OFC) for nuanced, deliberative, and explicit ask-questions-later evaluation; differentiating reward, punisher, neutral; and quality and relative magnitude of reinforcer. Hippocampus supplies contextual dimensions to emotion evaluation. OFC regulates the amygdala up or down, as well as projecting to adjoining ventromedial prefrontal (vmPFC) and perigenual anterior cingulate cortex (Pg-ACC) for the next phase. The Amygdala and OFC can each request more-detailed and repeated sensory input. MOTOR RESPONSES: A range of visceral, hormonal, and skeletal-motor responses are made: such as reflexes, muscular tension, ballistic action patterns, and deliberative behaviors. Less deliberative can be triggered by old amygdala, which can also activate cortical attention and vigilance networks. Pg-ACC can trigger them all indirectly through the amygdala and hypothalamus, or directly to brainstem areas for arousal, sympathetic or parasympathetic responses and various stereotypical action patterns including facial expressions. Distinct areas of Pg-ACC trigger cortisol release, parasympathetic, sympathetic, action patterns, and behaviors. EMOTIONAL EXPERIENCE: Anterior insula creates the bodily feelings component of background-emotions and emotional experience the latter, seemingly, through feedback to the insula of changes in bodily feeling from emotional responses by Pg-ACC and other triggers. Pg-ACC's substantial connections to Default Networks retrosplenial posterior cingulate (rs-PCC) brings previous emotional experiences into the current experience. Emotional experience also includes input from every sense, awareness of triggering causes, thoughts of the future, etc.; involving perceptual, language, and decision-making networks. Emotional experience is the basic having of a feeling of sadness, anger, or the like, before reflecting upon it. REFLECTION: Reflection is a matter of concentrating on the experience, often in conjunction with such things as the triggering cause, tightness in the chest, or loss or gain of self-esteem or shame based on this event. OFC is likely the hub of emotional reflection as the site of working-memory evaluation, with close links to frontal circuits involved in perception, language, and awareness of goals and plans. **P2**

2.15 Sleep and waking

166 Lucid Dreaming as a Methodology for Studying Consciousness and Metaconsciousness During Rem Sleep Stephen LaBerge <stephen.laberge@gmail.com> (lucidity.com, Tucson, AZ)

In the course of everyday life, most people do not ordinarily think about the fact that they are awake. Likewise, while dreaming, most people are not usually aware of the fact that they are dreaming. Of course, lucid dreaming is a significant exception to this generalization. During lucid dreams, it is possible to reason rationally, to remember the conditions of waking life, and to act voluntarily within the dream upon reflection or in accordance with plans decided upon before sleep - all while remaining soundly asleep, vividly experiencing a dream world that can appear astonishingly real. Our research at Stanford proved by means of voluntary eye-movement signals that lucid dreams occur during unequivocal REM sleep. These basic results have been replicated in at least a dozen labs around the world. The fact that lucid dreamers can remember to perform planned actions and signal to the laboratory opened a new approach to dream-state consciousness research: Lucid dreamers can carry out experiments time-stamping particular dream events with eye-movement signals, allowing correlations between the dreamer's subjective reports and physiology, and enabling the methodical testing of hypotheses. We have used this strategy in a series of studies demonstrating significant correspondence between dreamed actions and physiological responses. Moreover, studying dreams can tell us much about how consciousness works. For example, comparing waking and dreaming casts light upon the constructivist/top-down/endogenous and ecological/bottom-up/exogenous determinants of the contents of consciousness. In order to study dreams optimally, it is necessary to do so with the mindfulness and cognitive clarity afforded by lucid dreaming. Lucid dreaming is a learnable skill that can be developed by training in dream recall, concentration, and prospective memory. The frequency of lucid dreaming can also be increased by a variety of other methods, including pre-sleep pharmacological and behavioral manipulations; sleep-cycle interruption; and lucidity cueing by meaningful sensory stimuli applied during REM sleep. **C21**

167 Inverted Consciousness in Sleep and the "Hard Problem" Simon Peimer, Jack Ringler MD <lpeimer1@verizon.net> (Berkshire Sleep Disorders Ctr., Berkshire Medical Center, Pittsfield, MA)

The traditional approach to the "hard problem" of consciousness is to contrast qualia or subjective experience with the "easy problem" of sensory information processing. In this regard, sleep is a unique condition of mind when information processing from the outside world becomes relatively inactive. Hypnagogy is the descent from full wakefulness into sleep. The sleeping mind is certainly not "off", but rather changes its direction of focus, utilizing memory and perhaps other neurocognitive substrate as basis of subjective experience. Considering this phenomenon from the perspective of sleep physiology and sleep medicine, we introduced the concept of inverted consciousness in sleep (2011, 2012). To define state consistently with changes in consciousness, our subjects were instructed to squeeze rhythmically a rubber bulb connected with pressure sensor ("pumping") in wakefulness and to continue to do so falling asleep. Dynamical analysis of such performance can recreate a topologically equivalent picture of the original behavior of complex network by using the time series of a single observable variable (F. Takens, 1981). Furthermore, the rules that govern the behavior of the original system can be recovered from its output. Based on new data, we are able to demonstrate experimentally that simple motor activity across the continuum of drowsiness, light non-REM sleep and REM sleep may follow low dimensional, chaotic dynamics; our subjects frequently exhibited access to memory, i.e. the command to squeeze the bulb, throughout the hypnagogic process and well into sleep. The narcoleptic subjects incorporated the command and the motor activity into dream content. In a novel way, we have demonstrated in human subjects that the descent into sleep may represent a model for studying what might be characterized as vector consciousness. The integration of internal and external signals was predicted in computational studies (Arecchi, 2003; Malashchenko, 2011, Hasselmo, 2012). Such a process is important in creating an internal model of the world and related qualia in absence of external sensory input. Similar mechanisms may be active in the subjective experience of wakefulness. For example, when our subjects were instructed to squeeze the bulb only in response to changing of one possible interpretation of the Necker cub to another, our analyses revealed the same phase-space portraits and the same quasi-periodic mode of chaotic behavior as in superficial non-REM sleep and REM sleep in narcoleptic patients. Our data support the notion that all behavioral states require common standard and inverted information processing that may represent an adequate basis for internalized percepts and qualia. These processes, in turn, are associated with habituation to environment, modification of sensory and motor pathways along with strong endogenous input (inverted consciousness). Furthermore, studies of the hypnagogic state may help elucidate the deeper meaning in directional changes of consciousness. **C21**

168 Age-Related Changes in Theta-Delta Ratio Measures of Slow-Wave Sleep Jean-Paul Wiegand, Daniel T. Gray; Lesley A. Schimanski; Peter Lipa; Carol A. Barnes; Stephen L. Cowen <jplw@email.arizona.edu> (Neuroscience GIDP, University of Arizona, Tucson, AZ)

Aged animals exhibit a marked decrease in sleep quality, often characterized by reduced total sleep time, cortical spindle rate, and hippocampal ripple rate, as well as time spent in slow-wave sleep. Theta-delta ratios have been cited as reliable, physiological measures of slow-wave (NREM) sleep, as

described by Wierzynski et al. 2009, with values of below 1 indicating slow-wave sleep. We theorized that the reduced rate of spindle and ripple events in aged animals was due to a decrease in sleep quality. To address this, measures of movement and depth of slow wave modulation were analyzed in aged and young rats, implanted with hippocampal tetrodes, during rest periods before and after a spatial eyeblink conditioning task. We observed that aged animals actually exhibited significantly less movement during pre- and post-behavior rest relative to young animals ($p < 10\text{-}4$; 2-Factor ANOVA (age, time)). Analysis of the physiological quality of slow-wave sleep (theta/delta ratio of local-field activity measured during non-movement periods (Wierzynski et al., 2009)) revealed that aged animals had a lower theta/delta ratio during and post- but not pre-behavior rest ($p = 0.00003$, Kruskal-Wallis test, post-hoc test p-pre = 0.57, p-post = 0.03). This observation, along with the analysis of movement during rest, suggests complexity to the dogma that aged animals exhibit reduced sleep quality: this age-related change in a measure of unconsciousness could be further indicative of age-related changes in consciousness. **C21**

2.16 Brain stimulation techniques

169 Meditation, Neurofeedback and Mind Wandering Arnaud Delorme, Tracy Brandmeyer <arno@cerco.ups-tlse.fr> (Toulouse, France)

While Neurofeedback and Biofeedback have been used since the 1960's, previous neuroscientific and clinical research investigating its efficacy has been limited, lacking controlled studies and significant findings. However, a recent overview of the existing body of literature on neurofeedback research has now led the American Academy of Pediatrics to recognize Neurofeedback, as well as working memory training, as one of the most clinically efficacious treatments for children and adolescents with attention and hyperactivity disorders. Neurofeedback has been used to treat a wide variety of other disorders such as insomnia, anxiety, depression, epilepsy, brain damage from stroke, addiction, autism, Tourette's syndrome, and more. Interestingly, many of the conditions that benefit from Neurofeedback treatment are consistent with the conditions that improve with regular meditation practice. For example, both ADHD patients and individuals diagnosed with depression benefit from meditation training as well as neurofeedback training protocols. Thus, it is plausible that the mental training involved in meditation may be fundamentally no different than other types of training and skill acquisition that can induce plastic changes in the brain. The identification of a particular oscillation reliably associated with meditation might be essential for establishing effective neurocognitive protocols. In experiments carried out in 24 meditators, we have shown that increased frontal-midline (fm) theta rhythm was associated with deeper meditation and that decreased fm-theta was associated with mind-wandering. According to other studies, enhanced cognitive processing is associated with an increase of fm-theta and high fm-theta amplitude has been linked to improved task performance. Thus, with the aim of training executive functions, frontal-midline (fm) theta might serve as an ideal parameter for participants to control. In this experiment, we trained 24 individuals over a 2-week 8-session neurofeedback protocol and assessed neuro-cocognitive as well as neuro-anatomical changes following the training protocol. Test subjects were compared with sham subjects that underwent the same type of training but were not actively controlling the feedback display with their brainwaves. We will present results at the conference as the data is currently being collected and analyzed. Our hypothesis is that we will observe neuro-anatomical as well as behavioral changes after the neurofeedback training that will be consistent with an increase in mind-fullness and a decrease in mind-wandering markers. **P2**

170 Experimental Production of Excess Correlation of Right Temporal Theta-gamma Activity Between Subjects Pairs Sharing Circumcerebral Rotating Magnetic Fields at Distances Exceeding 6000km Brendan Lehman, Mandy A. Scott; Nicolas Rouleau; Lucas W. E. Tessaro; Lyndon M. Juden-Kelly; Kevin S. Saroka; Michael A. Persinger <bx_lehman@laurentian.ca> (Behavioural Neuroscience, Laurentian University, Sudbury, ON Canada)

Throughout history multiple cross-cultural reports have detailed specific shared experiences between individuals separated by thousands of kilometers. Recent experimental demonstrations of excess correlations generate increasingly more reliable effects with involvement of electromagnetic fields and photons. In this study, completed during the summer of 2015, 5 pairs of volunteers separated by more than 6,000 km wore identical cerebral toroids through which patterns of phase shifting, 30 nT magnetic fields (which diminished the local magnetic field in both loci by 1-5 nT) were exposed to the sequences that produced excess correlation in chemiluminescent reactions and shifts in pH. Power between the right hemispheres of pairs of participants was enhanced during the

interval documented to produce excess correlation compared to baselines and control procedures. Coherence analyses indicated diminished coherence within the theta band only within the right temporal lobes of the pairs. Independent Component Analyses indicated paired brain responses to 6.5 Hz pulsed tones occurred within the 30-40 Hz band over the caudal temporal lobes during exposures to the effector field. During the 6.5 Hz tones there was a peak in the spectral power density (SPD) at that frequency over the right temporal lobe of the person listening but a trough in SPD over this region for the person who was not. This experiment, based upon physical principles, suggests there is a technology that can generate reliable excess correlation of brain activity (and potentially consciousness and specific experiences) between two people separated by thousands of kilometers. **C7**

171 MyHeadquarters: A Novel Neurofeedback Paradigm Through Live EEG in Virtual Reality Patrick Palucki, Mandy A. Scott <datapalucki@mac.com> (MyHeadquarters, Berlin, Germany)

Neurofeedback aims to assist individuals in training and maintaining optimal and desired states of consciousness. Brain-computer interfaces (BCIs), originally designed to assist individuals with disabilities (e.g. prostheses), are a type of neurofeedback that use brain signals to control external devices. The development of both neurofeedback and BCI technology has had the potential to transform health and healing, as well as catalyze the acceleration of the ongoing shift in human consciousness, allowing individuals to access an enhanced ability to transform their neuropsychophysiology through intentionality. The problem, however, is that BCI technologies and neurofeedback services are difficult to access due to high cost and limited availability of qualified trainers, restricting its applicability to the elite and wealthy, such as top athletes and professionals. One solution to this ongoing barrier to supporting individual and collective transformations of consciousness is to create new technologies that are scalable to the masses and capable of delivering high-quality experiences in neurofeedback. MyHeadquarters involves the integration of media-technology, media-art and aesthetics with neuroscience and the science of consciousness in the form of software applications for EEG- and VR-Headsets. It is the world's first neurofeedback and neurogaming paradigm that employs a multi-channel live EEG system combined with the immersive experience of the virtual reality (VR) space. MyHeadquarters is developing new ways of visualizing brain data in VR, an environment that is yet untapped by the world of personal development. This approach provides users with an immersive experience of moving through their own dynamic state changes. These novel visualizations will be integrated with the principles of neurofeedback and flow to assist the user in cultivating their optimal or desired states, including enhanced creativity, flow, focus, as well as training for the cultivation of both non-dual (meditative) and non-local (distant intentionality) states. www.myheadquarters.co **C8**

172 The LUMINOUS Project (2016-2019): Studying, Measuring and Altering Consciousness Through Information Theory in the Electrical Brain Giulio Ruffini, Niels Birbaumer; Steven Laureys; Marcello Massimini; Isabelle Merlet; Michael Nitsche; Hubert Preissl; Aureli Soria-Frisch; Irene Tracey; Katie Warnaby; Fabrice Wendling <giulio.ruffini@neuroelectrics.com> (Neuroelectrics, Cambridge, MA)

While humankind has struggled with the concept of consciousness questions for millennia, the Luminous Project (EU FET Open) will focus on more modest but nonetheless ambitious and related goals. Inspired by recent developments in neuroscience and the potential role of fundamental concepts such as information integration and algorithmic complexity, we will study, model, quantify, and alter observable aspects of consciousness. Our vision is that consciousness will someday be electromagnetically measured and altered, and that the associated needed insights will prove crucial to the development cognitive sciences. The conceptual framework of the project rests on information theoretic developments that link consciousness to the amount of information that a physical system can represent and generate as an integrated whole, and from the related idea that consciousness can be quantified by metrics reflecting information processing and representation complexity (Kolmogorov Complexity). We ultimately aim to create non-invasive consciousness-probing technologies integrating electro- and magneto-encephalography, peripheral and non-invasive electromagnetic brain stimulation (NIBS) with advanced techniques to analyze brain activity, including functional and effective connectivity in the perturbed and unperturbed brain as measured by EEG, fMEG and fMRI. Based on the derived brain activity metrics and on other recent work, we will explore intervention, i.e., the use of NIBS to alter consciousness in different scenarios spanning the consciousness landscape. To achieve these goals we will further develop current computational models and carry out parallel human studies in sleep (lucid dreaming), anesthesia, locked-in syndrome, disorders of consciousness, and in utero - supported by modern techniques, signal processing and machine

learning - to disentangle the essential aspects of consciousness and establish links with artificial cognition research. We will develop an experimental system based on our unique multisite transcranial stimulation platform (Starstim). We aim to implement novel NIBS-EEG metrics in a new device featuring up to 32 dual EEG/tCS channels and on- board processing to implement user defined stimulation as well as closed-loop capabilities with solutions for stimulation signal artifact removal. In addition, we will rely on recently proposed a method for optimizing the configuration of multifocal tCS for global stimulation of brain networks, as represented by spatially extended cortical targets. We showed how, based on fMRI, PET, EEG or other data specifying a target map on the cortical surface for excitatory, inhibitory or neutral, a solution can be produced with the optimal currents and electrode locations relying on fast calculation of multifocal tCS electric fields from a 5-layer finite element model of a realistic head. A qualitatively new aspect of these intervention protocols is that they enable us to perform for the first time activation of cortical networks and monitoring the effects at both the physiological and behavioral level. The project brings together neuroscience, neuromodulation and consciousness experts with computational scientists, physicists and engineers. The project will also explore the ethical implications of such technologies and the prospects for clinical translation. If successful, this paradigm-shifting work will have profound social and clinical impact and provide key insights in fundamental neuroscience and artificial cognition research. **C8**

2.17 Specific brain areas

2.18 Neurobiological theories of consciousness

173 Freeman Neurodynamics and the Sentient Cortex Bernard Baars <baarsbj@gmail.com> (CEO, Society For Mind-Brain Sciences, Oceanside, CA)

How does the cortex support conscious knowledge? William James already proposed in 1890 that cortex supports consciousness, and with ongoing progress in brain recordings the evidence has strengthened dramatically. Consciousness science is therefore converging with a century of neurobiology. (Here the word 'cortex' means neocortex, thalamus, and paleocortex, as long proposed by Walter J. Freeman.) Not all cortical functions are conscious –- long-term memory traces in cortex are obviously not; but direct recordings of the living brain show that reportable visual percepts are directly supported by the higher levels of the visual hierarchy. (See Dehaene, 2014; Baars et al, 2013). Studies of waking vs. slow-wave sleep also show massive 'pausing' in cortex during the unconscious valleys of the slow wave, the only true, natural states of unconsciousness in the daily cycle. Direct recordings of both conscious percepts and states therefore point to the same organ, the cerebral cortex, the enormously interconnected hyper-nexus that fills the upper half of our cranium. Since Cajal's discovery of the cellular nature of neurons, neuro-psycho-biology has advanced both towards the microscopic and macroscopic poles of functioning. Walter Freeman's intellectual journey focused on the macroscopic puzzle of mass action in the brain, as shown by Karl Lashley's pioneering studies. While Cajal revealed the cellular level, Lashley and others presented compelling evidence for macrolevel functioning, as in many cases of cortical damage. Walter's 1975 book Mass Action in the Brain appeared about half-way between Lashley's work and the present time. Since 1975, Freeman's research program has revealed new vistas of brain functioning, complementary to, but also quite different from, conventional approaches. By squarely tackling the intimidating nonlinearities found in cortical and scalp EEG, very unexpected empirical regularities have emerged, including ~100 ms stable microstates in the heaving ocean of cortical activity –- short cinematic phase equilibria separated by ~5 ms chaotic collapses. Because evidence must have the final word in science, we find ourselves looking at these robust phenomena over and over again. Global Workspace Theory (GWT) has been a consistent effort to understand a different set of facts, namely the differences between experimentally matched conscious (reportable) and unconscious (unreportable) brain events. GWT was initially based almost entirely on experimental psychology, by far the best source of evidence at that time. Today, we find ourselves doing psycho-neuro-biology, because the imaginary wall between mind and brain science is fading. Freeman Neurodynamics and cognitive theory are coming together in unexpected ways, like the famous nine blind men and the elephant. Walter Freeman started by studying cortex, not consciousness 'as such,' and GWT did not start with an understanding of cortex. But with the advent of high-quality brain recordings, the conscious cortex is becoming a natural meeting place. This was not planned or expected. Still, some of the blind men seem to think there's an elephant behind it all. **C4**

174 Energy-Proto-Consciousness Dennis Balson <danian.b@bigpond.com> (Taree, New South Wales Australia)

Without some form of energy the universe, matter and eventually life could not have come into being. When conditions on this planet changed, single-celled organisms came into existence and eventually they become multicellular entities. Primitive forms of life changed, adapted and evolved according to their ever-changing environment and different forms of life developed various survival and reproductive mechanisms. More intelligent forms of life evolved until the advent of brains with the capacity to sort, encode and stor information. The millions of cells in brains organize themselves so as to expand their connections as more information is processed. The neurons form layers and 'talk' to each other via neural networks as they communicate and cooperate with each other. It is the energy within these neurons that is nonphysical, but the consequence of their natural activity results in physical and mechanistic mental activity. Brains and other forms of matter rely on dynamic energy forces that are in constant flow and change. The mind receives and interprets information and like a computer, if the information is false then it would invariably reject important facts. The understanding of the mind is the understanding that nothing can be fully explained by thought, therefore it is difficult to comprehend the timeless and silent omniscient dimension of consciousness. If the mind ceases to function from a past dimension then it may experience a tranquility that is not the product of the past mind and only then is there the potential for the mind to momentarily sense a mystical dimension; a dimension that is devoid of preconceived concepts. The structure of reality also means that, like languages customs and beliefs, even TIME is an invention of the mind. Time does not exist until the mechanistic mind comes into existence. This universe, and everything in it, is as it is from moment to timeless moment. Energy-proto-consciousness can manifest itself in every form of life because nothing can exist without energy and energy manifest itself in all forms of matter. When the mechanistic mind is silent and the brain is not functioning, then knowledge has no real importance, but this seemingly 'immortal entity' existed long before forms of life came into being and this universal intelligence would continue to exist even if all life on this planet no longer existed. All theories and all scientific knowledge have evolved or changed over time, but they are limited and approximate. According to the quantum theory, when a light is turned on, the mind does not see energy, it sees the secondary effect of energy. Matter is visible, whereas the field is invisible. This invisible field interacts with matter continuously and it is the essence of all matter and the essence of all living things. Everything in the universe, whether known or unknown, is somehow interconnected. Human life is a pulsing scrap of energized matter linked to a creative intelligence and this mystical entity seems immortal and is devoid of mental properties: It can be named, but remains unknowable. **P3**

175 A Canonical Representational Process in Brains and Their Extensions in a Pan-Proto-Psychic World Ron Bar Lev <bar.lev.ron@gmail.com> (Tel Aviv, Israel)

A parsimonious partial model of "a-consciousness" is developed based on simple foundation assumptions: a. Proto-phenomenal manifestation is a natural low order-of-scale phenomenon, locally and temporally bounded and brought about by physical interaction, b. The role of brains includes the embedding, recognition and enactment of spatiotemporal patterns characterizing such manifestation. The model postulates that the pattern representation aspect of "a-consciousness" function involves in-time universal approximation: There are distinct advantages to iconic representation. It is implementable as a locally self-organizing and error pruning computational scheme, is generally information conserving and is compatible with distributed processing using distributed information. Accordingly, neural (computational) pattern processing may involve an isomorphic, invertible, embedding transform. Cohesive and contextual spatiotemporal relations may be extracted and embedded in a slowly conducting plastic medium, reduced (by directed interference) to morphing configurations of information depleted, near isotropic, activity. An inverse enacting (or biasing) operation would facilitate computational recognition - reconstitution of iconic world model components matching projection patterns upon an agent's sensory perimeter. Through functionally coupled bi-directional computational processing, synchronous in the relevant temporal order of scale, and characterized by coherent activity, encoding would literally constitute recognition. Corollaries of the proposed isomorphic transformation, assuming phenomenal expression on both "ends", would entail a. Encoding involves spatiotemporal smearing and b. The dynamic maintenance of a virtual focal point, a formation which could underpin the expression of an 'I' primitive of an agent-as-subject. Bound experiences are structurally constrained (to pattern factors) and temporally extended (effectively continuous), as microphysical proto-phenomenality "coalesces" relationally, filtered and coherently situated by the postulated transformation. Mutually compatible hypotheses to consider

would be: a. Expression of proto-phenomenality as a feature of neural machinery that is distinct from computational function, manifests in active lines and combines in conformity with patterned spatiotemporal structures. b. Proto-phenomenality of sensory origin is coupled with modulated complementary agent-as-subject proto-phenomenality, arising in active lines, generating "cognitive phenomenology". Quantum theories of consciousness may be attributing more cognitive functions to arrangements on the sub-microscopic scale than may be necessary or plausible. Manifestation of proto-phenomenality is the main natural mystery. With better understanding of reflexive properties the combination, binding and boundary problems may become scientifically tractable without recourse to fundamental physics. Representation in brains might be limited by neural computing resolution, but fine-grained sensory information is not necessarily discarded. Local processing in proximity to the sensory "perimeter" may serve to fill-in patterning, e.g. as could be associated with sensory "textures". Correspondingly, dismissal of the possibility that some proto-phenomenality partaking in subjective experience arises in sensory apparatus might be misleading. Common objections (temporal delays, dreaming consciousness, after-images etc. can be countered). This resonant (rather than generative) model is consistent with Dynamic Core ideas and with Integrated Information Theory, assuming a relaxed definition of information and seeing integration as but half of the story, needing functions to effect embedding and realization (i.e. differentiation). **P2**

176 Is Consciousness Just a State of Matter? A Critique of the Theory of Perceptronium Michael Cerullo <cerullom@hotmail.com> (Psychiatry and Neuroscience, University of Cincinnati, Cincinnati, OH)

In his paper 'Consciousness as a State of Matter,' physicist Max Tegmark attempts to generalize Tononi's Integrated Information Theory (IIT) from 'neural-network-based consciousness to arbitrary quantum systems.' Tegmark claims that consciousness can be viewed as another state of matter, perceptronium. In one sense, few would deny that the brain generates consciousness and therefore consciousness is (for reductionists) or is associated with (for non-reductionists) matter (i.e. the brain). Like other states of matter, perceptronium has several essential properties: information storage capacity; information integration; information processing capacity; and independence from the rest of the world. Thus Tegmark expands upon IIT in requiring three additional properties for conscious systems. Unlike other states of matter, the properties of perceptronium are not physical properties but instead properties that depend on an interpretation of the arrangement of the matter as information. While Tegmark is not completely consistent he seems to favor a reductionist theory of consciousness and claims that perceptronium is consciousness. Tegmark's version of IIT, which I will call the Theory of Perceptronium, is vulnerable to the same objections that can be raised against the original theory. First, Tegmark's theory does not address Chalmers' hard problem of consciousness. Instead, it attempts to identity psychophysical laws connecting matter with consciousness (this has been termed the pretty hard problem of consciousness). Even if Tegmark's theory is correct, it seems conceivable that a world could exist where perceptronium is not associated with consciousness (i.e. the argument from philosophical zombies). Second, the four properties of perceptronium apply at too abstract a level for computational functionalism. Perceptronium is not designed to capture the causal and functional structure of a system and thus like IIT it is vulnerable to fading/dancing qualia arguments. The final problem with the theory of perceptronium is also related to its highly abstract nature. Like IIT, the theory of perceptronium was developed outside of the standard definitions of consciousness used in neuroscience and psychology. Instead, when defining consciousness the theory assumes a panexperientialism similarly to IIT. The problem with allowing for experiences outside of a mind is that the theory of perceptronium is now related to proto-consciousness and not consciousness. Neuroscientists and psychologists are interested in the kind of consciousness that occurs when a subject is awake and is associated with global availability of experience and the cognitive functions associated with consciousness in animals. Proto-consciousness is not associated with any of these properties. Given that neither IIT nor perceptronium discuss the relationship of consciousness to proto-consciousness, rather than clarify our understanding of consciousness both theories instead add another layer of mystery. The lesson to be taken from IIT and the theory of perceptronium is that there does not appear to be an easy shortcut in which an abstract theory of consciousness based on physics or information would allow bypassing an understanding of the neural correlates of consciousness. **P2**

177 To Adapt or Innovate - What Determines Your Decision? Hans Liljenstrom <hans.liljenstrom@slu.se> (Agora for Biosystems, Sigtuna, Sweden)

All through history, we have had to struggle with a complex and changing natural and social environment, partly resulting from our own activities. As other species, humans had to adapt to a harsh and threatening environment in order to survive and thrive, but more than any other species, we also innovate to make our environments fit our needs and desires. Increasingly, we tend to innovate more than to adapt, as our technological and social skills develop, and the innovations made by few are mostly shared by many. What is the basis for this capacity to adapt and to innovate in response to the challenges we meet? Which role does our neural flexibility play, and how is it affected by our environmental and social interactions? For an individual, the decision to adapt or innovate may be determined by both internal and external factors, where emotion, as well as cognition comes into play. While emotion and cognition may influence our decisions and actions subconsciously, our conscious mind is expressed through attention and intention. Attention is about how the world is now, and is necessary for an appropriate adaptation. Intention is about what the world could be in the future, which is the basis for innovation. We use computational methods to explore the intricate complexity and interaction of cortical subsystems involved in decision making, in order to elucidate the neural processes associated with our willful acts. We have developed a stochastic population model representing the neurodynamics of decision making from perception to behavioral activity. We model the population dynamics of the three neural structures significant in the decision making process, (amygdala, OFC and LPFC), as well as their interaction. In our model, amygdala and OFC represent the neural correlates of emotion, while the neurodynamics of OFC represents the outcome expectancy of alternative choices, and the cognitive aspect of decision making is controlled by LPFC. Our model is intended to give insights on the emotional and cognitive processes involved in decision making under various internal and external contexts. Different options for actions are represented by the oscillatory activity of cell assemblies, which may change due to experience and learning. This is general for any actions, but specifically for those leading to adaptation or innovation. Knowledge and experience of the outcome of our decisions and actions can eventually result in changes in our neural structures, attitudes and behaviors. I will present simulation results that may have implications for how we make decisions for our individual actions, as well as for societal choices. Finally, I will discuss how our modeling efforts may relate to the role of consciousness in human adaptation and innovation. The effects of consciousness is most clearly linked to intention, as its more active aspect, which has to be considered if we are to understand its role in evolution. Exploration, through attention-perception and intention-action, is fundamental to all levels of existence. Adaptation and innovation are two ways to deal with the challenges we meet and consciousness may be the guiding force. **C11**

178 Fifty Years Without Free Will Aaron Schurger <aaron.schurger@gmail.com> (Cognitive Neuroimaging Unit, INSERM, NeuroSpin, Lausanne, Switzerland)

How are actions initiated by the human brain when there is no external sensory cue or other immediate imperative? How do subtle ongoing interactions within the brain and between the brain, body, and sensory context influence the spontaneous initiation of action? How should we approach the problem of trying to identify the neural events that cause spontaneous voluntary action? Much is understood about how the brain decides between competing alternatives, leading to different behavioral responses. But far less is known about how the brain decides "when" to perform an action, or "whether" to perform an action in the first place, especially in a context where there is no sensory cue to act such as during foraging. Fifty years ago, in 1965, scientists discovered a slow buildup of neural activity that precedes the onset of spontaneous self-initiated movements (movements made without any cue telling you when to move). This buildup was dubbed the "readiness potential" or bereitschaftspotential, and has since been confirmed at the single-neuron level. For the past five decades it has been assumed to reflect a process of "planning and preparation for movement". In the 1980s the readiness potential was used to argue that we do not have conscious free will, because the readiness potential appears to begin even before we are aware of our own conscious decision to act. Now we and others have challenged that long-standing interpretation by showing that the early part of the readiness potential might reflect sub-threshold random fluctuations in brain activity that have an influence on the precise moment that the movement begins. These fluctuations thus appear as part of the "signal" when we analyze the data time-locked to the time of movement onset. This fundamental insight leads to novel and testable predictions concerning both objective (brain signals and behavior) and subjective (the perceived time of the conscious intention) phenomena, and may also have important, philosophical implications. **PL5**

179 Consciousness and Relevance Realization John Vervaeke, Richard Wu; Anderson Todd <john.vervaeke@gmail.com> (Psychology and Cognitive Scien, University of Toronto, Toronto, ON Canada)

Dominant accounts of consciousness in cognitive science tend to focus on determining the function(s) of consciousness and delineating architectural models that would support such functionality. Recent proposals concerning the functionality of consciousness have converged on the determination (realization) of relevance as a core function of consciousness: a conscious agent is one that has enhanced abilities to realize relevance. This links the problem of consciousness to a unresolved version of the long-standing frame problem, i.e., the problem of relevance. Recently, Shanahan (2009) has argued that the core of what remains after recent theoretical progress in addressing the frame problem is the challenge in in explaining how a computationally limited agent determines that relevance of information in its changing environment. This problem of relevance, moreover, receives articulations in several areas in cognitive science (Vervaeke, Lillicrap, and Richards, 2012), but has only recently been linked to the problem of consciousness (Shanahan and Baars, 2005). This talk will examine four prominent accounts of consciousness - the Global Workspace Theory (Baars, 2005), the Integrated Information Theory (Tononi, 2011), the Radical Plasticity Hypothesis (Cleeremans,2011), and the Fronto-Parietal Network theory (Bor & Seth,2012) - and suggest that they converge on the connection between consciousness and relevance realization. The talk will then proceed to discuss how exploring this connection may, in addition to revealing insights about the function of consciousness, help to explain certain key phenomenological properties of consciousness. More specifically, an account of how consciousness helps an agent to realize relevance will provide an account of how the agent has a salience landscape (Ramachandran and Oberman, 2006). Roughly, a salience landscape is the way a cognitive agent determines relevance through decisions about how to commits its attentional, metabolic, temporal, and behaviour resources in a highly complex, dynamic, and self-organizing manner. These decisions and commitments result in certain information from the environment standing out more than other information such that the cognitive agent will only orient to certain aspects of objects and situations, it will only orient to information that is relevant to it and centered upon it, and it will only orient to information that is timed well to its dynamical realization of relevance. The salience landscape will have patterns of aspectuality, centrality, and temporality that may give us a powerful way to talk about the perspectival nature of consciousness. The perspectival nature of consciousness is the property of consciousness in which consciousness seems to be from a point of view, i.e., in consciousness information is focused on the agent under those aspects that are relevant to the agent, and at a particular temporal scale and duration. The perspectival nature of consciousness also contributes something of what it is like to have consciousness, i.e., what it is like to be a particular kind of conscious being. Therefore, the connection between consciousness and relevance realization may serve not only to explain the function of consciousness, but also shed explanatory light on the nature of consciousness. This, in turn, promises a more integrated account of consciousness as a whole. **P2**

2.19 Miscellaneous

180 Cardiac Neurons Amna Al Faki, MD <amna1952@hotmail.com> (Department of Pediatrics, Omdurman Islamic University, Kharoutm-Omuduman, Sudan)

The signals, and the neuronal mechanisms that underlying the behavior, actions and action-directed goals in man and animals during conscious state is not fully understood, as well as the neuron-dynamic mechanisms and the source of these neuronal signals are not authenticated. Temporal judgment alone can neither account for neural signaling necessary for emergence of conscious act nor can explain the readiness potential RP (the accepted neural correlate time needed for the neurons to fire) that precede the onset of action or the latency time of 0.5 ms that precede the conscious act found by Libet. Neuronal feedback mechanisms between the heart and the brain seem feasible and logical suggestions to be considered, so clearly I would suggest that the onset of a conscious directed goal, conscious action, freewill, and intention, the neural signals and mechanisms that control them may depend upon the interaction between two sources: 1) Brain, 2) Heart. The temporal-cardiac (neural system)interaction has been well established in the heart-brain interaction studies by many workers who found that the work of the heart precede that of the brain in EEG findings in conscious stimulation, which may explain and account for RP time and the 0.5 ms latency period of Libet's important findings. According to my hypothesis (AlFaki,2009) and views, the temporal neurons in the soma to-sensory cortex will respond to conscious stimulation only after receiving neuronal signals from the cardiac neurons in the neural plexus of the heart, after variable millisecond equivalent (RP) or Libet's latency period prior to temporal neuronal fringing in response to conscious act, this time is the time needed by cardiac neurons to process and signal information to the brain through feedback mechanism and heart-brain interaction. **C4**

181 Brain Imaging Studies With Psychedelic Drugs Robin Carhart-Harris <r.carhart-harris@imperial.ac.uk> (Neuropsychopharmacology, Imperial College, London, United Kingdom)

This talk will describe the results of a series of brain imaging studies with psychedelic drugs, such as psilocybin (magic mushrooms) and LSD. The case is made that underlying the psychedelic-state induced by these drugs is an increase in the level of entropy of cortical activity, i.e. cortical activity becomes less predictable or more disordered. The case is also made that this change in brain activity recapitulates the quality of brain activity observed during infancy, explaining overlaps between the psychology of both states. Potential applications of psychedelics in psychiatry are also discussed, and some preliminary data on the efficacy of psilocybin as a treatment for depression are presented. **PL10**

182 Brain Regions Involved in Self-transcendence Following Meditation Yi-Yuan Tang <yiyuan.tang@ttu.edu> (Texas Tech University, Lubbock, TX)

Self-transcendence (ST) is one of human experiences often related to harmony with nature or feeling oneness with others or the self as an integral part of the whole universe. Previous studies showed that ST has significant positive correlation with the ventral-subgenual anterior cingulate cortex (sgACC) encompassing a ventromedial portion of the prefrontal cortex (PFC). However, ACC as a part of the brain's limbic system, appears active in many mental processes including self-control, emotion regulation and self-awareness via neuroimaging studies. Are there other brain regions participating ST? Meditation often exemplifies positive emotion, pleasant feeling, introception and ST experience in practitioners. Therefore, it's reasonable to speculate the reward and introceptive system such as striatum and insula also participating the ST following meditation. Studies showed that ST is positively related to meditation practice supported by ACC/PFC, striatum and insula. The automatic self-transcending techniques could transcend own activity and improve ST. ST not only induces brain and behavioral changes, but also often involves brain (mind) and body cooperation indexed by central (CNS) and autonomic (ANS) nervous system interaction. For example, During and after brief meditation training, significantly better physiological reactions in heart rate, respiratory amplitude and rate, and skin conductance response (SCR) were detected. Differences in HRV and EEG power also suggested greater involvement of the ANS during and after training. Frontal midline ACC theta was also correlated with high-frequency HRV, suggesting control by the ACC over parasympathetic activity. These results indicate that brief meditation induces better regulation of the ANS by a midline ACC brain system. This changed state probably reflects training in the coordination of body and mind, suggesting that body-brain works together to maintain certain consciousness states such as ST that may be related to different performance. Our findings suggest meditation training could induce altered states of consciousness which may allow us to explore the neuroscience of consciousness based on how alterations in normal consciousness result in functional or/and structural brain changes and plasticity. It should be noted that ST as one of human experiences related to harmony with nature or feeling oneness with others, also interacts with nature or universe or others at the same time. Although we don't have the proper equipments for co-measurements of body, brain and environment this moment, the advanced techniques in quantum physics and informatics may provide a tool for exploring these dynamics. Acknowledgements: This work was supported by the Office of Naval Research. References: Tang YY, Holzel BK, Posner MI. The neuroscience of mindfulness meditation. Nature Reviews Neuroscience, 2015, 16, 213-225 Tang YY, Tang R. Rethinking the future directions of mindfulness field. Psychological Inquiry, 2015, in press Tang YY, Posner MI. Training brain networks and states. Trends in Cognitive Sciences, 2014, 18, 345-50 Tang YY, et al. Central and autonomic nervous system interaction is altered by short term meditation. Proc. Natl. Acad. Sci. U.S.A. 2009, 106, 8865-70 Tang YY, et al. Short-term meditation training improves attention and self-regulation. Proc. Natl. Acad. Sci. U.S.A. 2007, 104, 17152-17156 **C4**

183 Integrated Information Theory: Falsifiable? Zhiyue Wang <zxw142830@utdallas.edu> (Behavioral and Brain Sciences, University of Texas at Dallas, Plano, TX)

The Integrated Information Theory (IIT) of consciousness puts forth a formal framework for describing and predicting the amount of consciousness, phi, in any given system. Its reasoning appears divisible into four steps: 1) consciousness expresses undeniable characteristics to its first-person beholder, 2) the nature of these characteristics suggests necessary specifications in the underlying

physical architecture, 3) the specifications can be mathematically described, and 4) the mathematical description yields a value meaningful in relating physical systems to consciousness. Step two of this reasoning, IIT's derivation of necessary features of physical systems from experience itself, is seductive, interesting, and the theory's most crucial component. I contend that it is also IIT's Achilles heel: it traps IIT from becoming more than an argument from intuition. From this, I explore some implications regarding IIT's capacity for empirical validation. The first implication: A theory of consciousness that begins in phenomenology precludes validation against standards established from the third person - e.g., behavioral or neural correlates of consciousness. An agreement between IIT and an established behavioral correlate of consciousness, for instance, means an agreement between the third-person judgment of consciousness and the IIT proponents' first-person intuition for what should be conscious; a disagreement, likewise, is merely a disagreement between intuitions. As such, this fundamental gap of intuitions between the third- and first-person approaches prevents meaningful cross-evaluation of IIT's predictions. The second implication: Given the first implication, I contend that IIT claims to make predictions that cannot be measured beyond IIT's own framework. I demonstrate this with an analogy. Suppose that there is an Integrated Sorcery Theory of Demon-Conjuring (IST) that puts forth a set of axioms, a set of postulates of necessary physical properties given the axioms, a formalization of these properties, and an output value of this formalization that intends to express the relationship between a magic circle's physical properties and the power-level of the demon that it summons. Suppose that demons are physically imperceptible: massless, invisible, etc. IST specifies that the larger the perimeter and roundness of any 2D shape, the more powerful the demon the 2D shape can summon. IST thus predicts that a circle can summon a stronger demon than a square. Against what measuring stick might IST proponents claim that their predictions are true? The third implication: Given the second implication, I dispute that IIT's predictions are predictions at all. Due to the reason that there are no independent measures for gauging the correctness of IIT's claims, when IIT "predicts" that some system cannot be conscious and another is, it merely makes reference to its own postulates. Given an IIT-type postulate "conscious systems must have feature F," the statement "IIT predicts system X without F is not conscious" is no different from "IIT claims that X without F is not conscious because IIT also claims that conscious systems must have F." I.e., IIT does not predict; rather, it circularly restates its claims for any specified system. If this line of reasoning holds, then IIT is an unfalsifiable, non-scientific theory. **P2**

3.0 Cognitive Science and Psychology

3.01 Attention

184 Consciousness is a Discontinuous Predictive Brain State: Evidence From Predictive Visual Tracking Measures Jun Maruta, Jamshid Ghajar <jmaruta@braintrauma.org> (Brain Trauma Foundation, New York, NY)

CONSCIOUSNESS IS THE EXPECTATION OF THE IMMEDIATE FUTURE THAT IS REALIZED IN THE PRESENT MOMENT: Consciousness is defined by awareness that is of both the external world and self. However, it is not clear what establishes the boundary between the external and the internal. We note that the time delay associated with sensorimotor processing poses a critical biological constraint on interactions with the external world and that generating spatiotemporal prediction of changing external states provides a survival advantage. We contend that the boundary between the external world and self is determined as a byproduct of this prediction. We further posit that self is validated and contrasted to non-self by correct spatiotemporal prediction. One's capacity to predict ongoing external events and create synchronized behavioral output serves a selective function of attention, and can be subjected to experimental investigation. Human visual tracking is ideally suited for this purpose because the relative slowness of visual sensory processing mandates spatiotemporal prediction in order for the gaze to be brought on the target. We have utilized a highly predictable circular target motion as a stimulus to test the hypothesis that the implementation of spatiotemporal prediction is compromised in some abnormal states of consciousness. In particular, by quantifying the positional variability of the gaze around the tracked target, we have shown that even mild alterations in conscious states induced by sleep deprivation or concussion result in degraded synchronization compared to the baseline state or to normal peers. This degraded synchronization is supported by a common complaint by sleep-deprived or concussed individuals who feel like being "in a fog" or "out of it" – subjective terms representing reduced "selfness" or self-validation. THE DISCONTINUOUS PREDICTIVE BRAIN STATE: Neural computations involved in synchronization during predictive visual tracking are highly automatic, a notion supported by the observation of a lack of awareness regarding the performance quality such that uninterrupted tracking of the target is subjectively reported even when the eye movement records clearly indicate poor quality of tracking. Using circular tracking data collected from normal subjects, we estimated the time proportion in which the target image intersected with the foveola, the high visual acuity central retinal region. The subjects twice tracked a 0.5? target that moved continuously along a 10? radius circular trajectory for 15 s at 0.4 Hz. The estimated time proportion during which the target intersected the foveola was typically less than 50% although widely ranging from less than 15% to nearly 95%. Additionally, a continuous intersection between the target and the foveola typically lasted for a mere fraction of a second at a time and never lasted for more than a few seconds even for best performers. Thus, accurate gaze-target positional match was achieved discontinuously, rather than continuously. These findings may be interpreted to state that self is validated by discrete correct predictive events, and the robustness of self-validation vary individually. SUMMARY: Attention-based visual tracking synchronization indices can be used to ascertain prediction efficiency and to quantify the grade of self-validation. Support: CDMRP W81XWH-08-1-0646 **P1**

3.02 Vision

3.03 Other sensory modalities

185 Descriptive Study of the Autonomous Sensory Meridian Response (ASMR): A Relaxed State of Consciousness Karissa Burnett, Craig Richard; Jennifer Allen <karissaburnett@fuller.edu> (Fuller School of Psychology, Pasadena, CA)

The autonomous sensory meridian response (ASMR) has been described as a relaxing, tingling sensation that originates from the back of the head, spreads across the scalp, and moves down the spine and through the upper limbs. It appears to be stimulated by interpersonal experiences such as being read aloud to, hearing proximal whispering, or observing another's attentive performance of tasks (e.g., painting, calligraphy) in a quiet environment. Such stimuli are thought to be especially triggering when repetitive, methodical, and delivered by an individual with an attentive and caring demeanor. ASMR has been increasingly discussed in social and mainstream media since 2010, and there exists a significant demand for online video content that simulates the occurrence of in-person triggers (i.e., some have over 3-million views). This demand has been largely in part to the relaxing properties anecdotally-reported by those sensitive to the phenomenon. To contribute to the leading-edge of its scientific understanding, we collected descriptive data from a large, international pool of 11,023 participants (64% female, 35% male) who reported sensitivity to ASMR. Participants ranged in age from 18 to 74 years (mean = 28.57, st. dev. = 9.76), and estimated their first ASMR experience occurring at the age of 10.20 years on average (st. dev. = 5.92). Within this sample, the following clinically-diagnosed mental disorders were reported: major depression (29%), anxiety or panic (26%), and ADHD (8%). Participants were mainly recruited via ASMR-related websites/groups (43%) or ASMR YouTube channels (26%), while others found the survey after an Internet search on the topic (19%). Participants completed an IRB-approved survey measure that consisted of descriptive and open-ended items related to their experiences of ASMR. Regarding frequency, many participants reported ASMR occurring several days per week (45%) or several days per month (35%), with only a small sample reporting daily experiences (7%). The sensation associated with ASMR, largely described as tingles (94%) or waves (54%), was primarily felt in the head (96%), the spine (72%), and the arms and/or hands (41%), consistent with previous reports. Participants described feeling especially relaxed (95%), soothed (82%), and calmed (82%) during an ASMR episode, and reported that such an experience thus helped them to feel more relaxed (89%), less stressed (78%), fall asleep (77%), and feel less sad (34%). However, a group of participants (37%) reported that their ability to experience ASMR had diminished or gone away entirely, and themes such as aging or psychotropic medication emerged as possible contributors to this reduction. In conclusion, our findings support ASMR's description as a relaxed state of consciousness, and reveal the need for further investigation due to its potential therapeutic implications. ASMR appears to be related to mindful and meditative states, but may be distinctive in its triggering by primarily interpersonal stimuli. Although thousands of individuals appear to experience ASMR, its prevalence and underlying biological mechanisms remain unknown in the current literature. **P2**

3.04 Memory, learning and synaptic plasticity

186 Investigating the Efficacy of Frontal Midline Theta Neurofeedback: A Comprehensive Approach Via Eeg, Fmri, Mri & Dti Tracy Brandmeyer, Delorme, A. <tracy.brandmeyer@gmail.com> (Centre De Recherche Cerveau Et Cognition, Paul Sabatier University, Toulouse, Midi Pyrenees France)

Recent research has highlighted the meaningful relationship between cognitive functions and synchronous neuronal oscillations. One theory underlying neural communication implicates slow, long range low frequency mechanisms, however at present the scientific research and identification of which frequencies are associated with a given cognitive function remains a highly debated topic (Gohse and Maunsell, 1999, Enriquez-Geppert et al. 2013). The identification of a particular oscillation consistently associated with cognition is necessary for establishing effective neurocognitive protocols. Enhanced cognitive processing and improved task performance has been associated with an increase of a train of rhythmic waves referred to as frontal-midline theta (fm-theta: 4-7hz; Mitchell et al., 2008, Klimesch et al., 1996). Fm-theta shows a high degree of inter-individual variability (e.g., Mitchell et al., 2008) and coincides with our previous research findings in advanced meditation practitioners (Brandmeyer & Delorme 2016, submitted) who demonstrate increased fm-theta activity while engaged in a concentrative meditation technique. With the aim of training and individual's capacity of sustained attention (and potentially other executive functions) via neurofeedback (NFB), our study investigates the pre-post effects of 8 sessions of fm-theta NFB training (24 subjects; 12 sham/controls) on executive functions, resting state functional connectivity (EEG and fMRI) and white matter connectivity (DTI). **C8**

187 Are You Living on Autopilot, Too? Or Are You Mastering Your Memory and Mood States? Ulrike M. Pruem <ulrikemaria@t-online.de> (Psychology and Sport Science, University of Innsbruck, Siegsdorf, Bavaria Germany)

The immense, vital importance of memory to our daily lives is the main focus of this paper. The topic covers up-to-date, specific experiences of visitors of the The 'Science of Consciousness (TSC) Conference' in Tucson, Arizona, April, 2016, too. What basic information from the considerable amount of papers respectively abstracts of the 'TSC Conference' are you able to remember consciously? Individual memory performance is influenced by a wide variety of factors, e.g. degree of awareness, implicit priming (sometimes we are able to recall more information than we are aware of), body position, individual abilities, motivational aspects, frequency, and significance of life experiences, that are affectively valenced (positive, negative, e.g. traumatic events), as well as several mood states. All these factors can cause positive or negative memory bias of explicit or implicit long-term memory processes. Jacoby's "process dissociation framework" (1991) is explaining dissociations between explicit and implicit memory. In his view, explicit memory is largely a product of conscious, controlled (intentional) processing, while implicit memory is largely a product of unconscious, automatic, effortless, involuntary (incidental) processing. Several explicit and implicit long-term memory systems (Tulving, 1995) are effectively affected by mood states: The 'mood-congruent memory' bias (Blaney, 1986) states that happy people will better remember happy than sad materials, whereas sad people will better remember sad than happy materials. In this context, recent studies have shown a significant relationship between negatively biased self-referential implicit cognition and depression: These depression-related implicit cognitive biases could predict past, current and future depression. As a result, treatment efficacy may be improved by integrating psychotherapeutic strategies that target implicit processes, too. Positive or negative mood states and experiences (e.g. verbal, nonverbal psychotherapeutic interventions) are able to change our brain in a deeply impressive, multi-faceted way (neuroplasticity); they may change the quality of conscious and unconscious long-term memory processes. The 'TSC Conference 2016' will provide the opportunity to discuss to what desirable extent changeability (e.g. cognitive modifiability) of explicit and implicit memory processes (and mood states) might be possible. Special focus is given to the human capacity to use positive memories to improve sad mood (mood-repair) or to rewrite negative memories (cognitive-repair). You will find a description of several case studies of patients of varying ages (adolescents, adults). Further studies of implicit memory could provide extended insights into unconscious mental life, and, in turn, on consciousness itself. The relationship between brain and consciousness is one of the most current, fascinating topics of modern brain research. In fact, important questions still remain open. **P2**

3.05 Emotion

188 Transient Worry Enhance Executive Attentional Functioning and Vigilance Performance: Further Evidence for a New Science of Compassionate Care Rado Gorjup, Niko Gorjup, ITR - Institute for Transdicsciplinary Research and Develpoment <radogorjup@hotmail.com> (ITR - Institute for Transdicsi, ITR - Institute for Transdiciplinary Research and Development, Nova Gorica, Goriska Slovenia)

Abstract Considerable interest has grown in the last decades in studying the relationship between anxiety and attention. Personality researchers traditionally distinguish between trait and state anxiety, which in some way can be explained by a lack of control (Lazarus, 1991). In their seminal theory, Eysenck and Eysenck (1985) proposed that vigilance performance is mediated by behavioral traits through arousal processes. However, even though extraversion and attention share the same cortico-reticular circuits, arousability per se did not confirm extraversion as enough convincing predictor of attentional processes (Koelega, 1992). The most in depth theoretical explanation of relationship about the effects of anxiety on attention networks has been done by Eysenck and Calvo (1992), and finally contemporary Attentional control theory-ACT was proposed (Derakshan & Eysenck, 2009; Eysenck, Derakshan, Santos, & Calvo, 2007). The theory states that high levels of Anxiety decrease the efficiency of attentional system in particular the central executive (inhibition and shifting). Contrary to prediction of the ACT theory, using the go/no-go dual task, our multiple regression model showed that trait anxiety was not at all a predictor of performance and attention functioning of the primary and/or secondary task even if executive control was involved. In support of our findings, Walkenhorst and Crowe (2010) also failed to find significant effects of trait anxiety on tasks when central executive was involved. Furthermore, the same authors (Walkenhorst and Crowe, 2009) investigated the validity of processing efficiency theory (Eysenck and Calvo, 1992) by testing the possible influence of high/low trait anxiety and high/low state worry on performance. Contrary to expectations, state worry did not decrease the performance but instead enhanced the performance on visual tasks in participants with low trait anxiety. Another surprising result, opposing from the prediction of processing efficiency theory showed also that individuals high in trait anxiety and state worry (for the purposes of this article state worry is used interchangeably with the cognitive and somatic state anxiety) displayed shorter response latencies then those low in state worry and trait anxiety. Walkenhorst and Crowe (2009) concluded that higher levels of transient worry (cognitive and somatic state anxiety) might enhance the allocation of resources in processing of visual stimuli which facilitates problem solving and executive control functioning. Given the fact that response inhibition is an essential component of executive control (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000) which in the go/no-go dual task was the ability to inhibit dominant or prepotent response in the primary task, we clearly show why executive functions and self-regulation processes interact with each other. Indeed, they share the same resources (cognitive effort). We argue how the interplay of transient anxiety and state dependent vigilance can explain the improved executive functioning. In conclusions, we support our results with the Dual Competition framework (Pessoa, 2009), Conflict monitoring hypothesis (Donkers and Van Boxtel, 2004, Botvinick, Cohen, and Carter, 2004) and show how this self-regulation process can interfere with the pharmcodynamic properties of a drug through the uncertainty principle. Finally, the New Science of Compassionate Care is introduced. **P2**

3.06 Language

3.07 Mental imagery

3.08 Implicit and explicit processes

3.09 Unconscious/conscious processes

189 Implicit and Explicit Processes in the Stream of Consciousness: Comprehension and Imagination Below and Above the Threshold of Consciousness Annette Marino <amemail@cox.net> (Arizona State University, Scottsdale, AZ)

The premise of the embodied cognition hypothesis is that cognitive processes require emotion, sensory, and motor systems in the brain, rather than using arbitrary symbols divorced from sensorimotor systems. The hypothesis explains many of the mechanisms of mental simulation or imagination and how they facilitate comprehension of concepts and can provide a framework for exploring the mechanisms underpinning the stream of consciousness. Previous research using electroencephalography (EEG) and other neurophysiological methods has identified a particular

waveform known as the mu rhythm (8-13 Hz) in the sensorimotor cortex of the brain. Power in the mu band is suppressed (or de-synchronized) when an individual performs an action, as well as when the individual imagines performing the action. An important question, however, is whether the sensorimotor cortex involvement, as measured by mu suppression, is part of the comprehension process or if it reflects an imagery strategy after comprehension has taken place. To answer this question, participants first took the Gates-MacGinitie reading comprehension test. Then, mu-suppression was measured while participants read experimental materials. The degree of mu-suppression within 300 milliseconds of verb presentation correlated at .45 with their score on the Gates-MacGinitie test. This correlation strongly suggests that the sensorimotor system involvement while reading action sentences is part of the comprehension process rather than being an aftereffect, and that it may be occurring before the participant's conscious awareness of the meaning of the verb. Further, this study also looked at alpha (8-13Hz) activity in the occipital regions related to visual imagery while imagining or performing actions. By analyzing mu and alpha waveform data from the sensorimotor and visual systems, the findings provide a compelling picture of the sequence of development of the stream of consciousness, from pre-consciousness to conscious awareness. **P2**

190 The Reality of Consciousness–Ego Vs. Soul Paula Muran <paula@paulamuran.com> (Scottsdale, AZ)

The Reality of Consciousness workshop explores the relationship between the ego and soul and the implications this duality plays on life. Ego and Soul is the ultimate duality as seen in religions and philosophies throughout history, especially in the Hindu Bhagavad Gita, which refers not only to one historical battle, but to the cosmic conflict between good and evil: life as a series of battles between Spirit and matter, soul and body, life and death, knowledge and ignorance, and health and disease. This illustrates our internal conflicts and humanity's plight, symbolized in the relationship between Krishna (God) and Arjuna (humanity), indicating the separation between humanity and God. The information presented in the Reality of Consciousness: Ego vs Soul is based on 20 years of private practice working with mindsets, along with research and application of the wisdom in the Bhagavad Gita and the Upanishads. Today, we have forgotten about these historical concepts, yet experience similar battles in life; people struggle and suffer, still seeking to improve their lives. The goal of this workshop is to answer the following questions: (1) Why is the mind conflicted? (2) What are the origins of suffering? To answer these questions, this workshop will provide an experiential journey into the ego mind's unconscious patterning. To do this, participants will be guided through processes to: (1) examine the complex database of memory, an infinite field populated with experiences; (2) look at how beliefs created in early childhood develop into lifelong patterns, forming a foundational consciousness; (3) investigate how emotional attachments reinforce the conflicted ego, promoting greater separation; and (4) examine how the conflicted ego subdues the soul and shrouds our views of the world with fear and doubt. As we discover the origins of suffering, we rectify the mental conflicts that construct the ego's identity. Participants will leave the workshop with concrete ways to reconcile the conflict between the ego and soul, ceasing some of the dualism and thus freeing the soul. Paula Muran is a registered yoga and meditation teacher, certified bodyworker and a graduate of the University of Cincinnati. For 30 years, she has guided people on profound journeys of self-inquiry, in which they transform themselves and the world around them. While maintaining a private yoga psychology practice, Paula gives workshops locally and abroad. She has published articles on numerous platforms, including BeliefNet, Elephant Journal, and Natural Awakening. For the past 15 years, Paula has lead life-changing meditation retreats to Bali, India, Egypt, Peru, and Nepal. She is a life-long explorer and researcher of body-mind therapies, studying everything from Buddhism to Zen. In 1986, Paula's mind silenced and she ceased to experience dualistic thinking. For more information, visit www.PaulaMuran.com. **P1**

191 Experimenter Effect and Replication in Science Marilyn Schlitz, Arnaud Delorme <mjmschlitz@gmail.com> (Worldview Enterprises, LLC, Petaluma, CA)

Fundamental to science is the idea that reality can be studied and understood using objective methods. And yet there are some basic questions about the role of objectivity and intention in experimenter effects across various research paradigms. That the expectancy and intention of an experimenter may influence the outcomes of their research has important epistemological and ontological implications for the science of consciousness. Research on experimenter expectancy involves examining how an experimenter's attitudes and expectations about an experiment may influence its eventual outcomes. In the field of psychology, demonstrated experimenter expectations have been observed in more than 300 studies, including those in classroom and clinical settings. This form of

psychological "interference" is understood in the context of exposure effects in mainstream psychology, which indicate that a greater stimulus response is elicited when exposure is subliminal or incidental. Although the experimenter effects are usually attributed to sensory cues, researchers have suggested that some may actually be psi mediated. For example, subjects did better at guessing psi targets prepared by a psi proponent than on those prepared by a psi skeptic. The experimenter effect in psi research would also help explain why the outcome of a psi experiment also seems to depend on the experimenters' belief (either psi believer or skeptic). For example, Schlitz and Braud in 1997 reported that experimenters can influence subjects' electrodermal activity from a distance. Using this same protocol, Schlitz and psi-skeptic Richard Wiseman collaborated in three attempted replications using the same subject pool and procedures. Schlitz obtained significant psi effects in two of the three experiments, but Wiseman failed to get an effect in any of them. We recently conducted a more controlled and larger scale experiment attempting to address the experimenter effect in psi research. In 2011, Daryl Bem published results from a series of psi experiments in the Journal of Personality and Social Psychology. Using a variety of protocols, his nine experiments tested for possible retroactive influence of well-established psychological effects (e.g. priming) by "time-reversing" the stimulus and response. In other words, subjects' responses were recorded just before the traditional (and purportedly) causal stimulus was administered. Bem reported statistically significant results in eight of the nine experiments, with results from the nine experiments statistically significant overall. Research in our laboratory has investigated experimenter effects using the retroactive priming protocol (Experiment 4) of Bem's series. This study included 12 different laboratories across 32 experimenters and 512 participants. The results did not support a correlation between study outcome and experimenter expectancy, although they did show evidence for precognition. This work is now being extended to examine priming of experimenter and subject expectancies on experimental outcomes. In this presentation, based on both theoretical and experimental data, we discuss how expectancy and intention of an experimenter may influence the outcomes of their research. **C7**

192 Consciousness In Enacting Procedural Knowledge During Mathematical Reasoning Annie Selden, John Selden <aselden@math.nmsu.edu> (Mathematical Sciences, New Mexico State University, Las Cruces, NM)

We describe a perspective for examining the enactment of a common kind of procedural knowledge in mathematics and how that enactment relates to consciousness. Here, we view procedural knowledge in a very fine-grained way, for example, considering a single step in a mathematical procedure, and discuss knowledge that includes, not only how to, but also to, or when to, physically or mentally act. We call the mental structure that links information allowing one to recognize that an act is to be performed, to what is to be done and how to do it, a behavioral schema. We consider how such behavioral schemas might be enacted and how they might interact. The processes associated with a schema's enaction appear to occur outside of consciousness, but some information triggering its enaction is conscious, and the resulting action is conscious or immediately becomes conscious. We include examples as simple as calculating (10/5) + 7 and r elate this view to how we teach proving theorems. For some time now the mathematics education research literature has had much more to say about topics related to conceptual knowledge than about those related to procedural knowledge. This can be seen, for example, reflected in recent papers in the ERIC database and Journal for Research in Mathematics Education. For example, one might expect that in the construction of a mathematical proof–a well-developed form of conceptual reasoning–that the role of conceptual knowledge would dominate that of procedural knowledge. In particular, one might expect that one's actions in the proving process were caused, in some immediate sense, by one's conceptual reasoning. However, as far as we can see, when we construct proofs we 'just do' many of the actions. That is, we are often not conscious of any causal conceptual reasoning just prior to an action, even though we could later provide a justification for it. To be more explicit, if the statement of a theorem starts, explicitly or implicitly, with "For all x in the real numbers," then near the beginning of the proof we might write "Let x be a real number," meaning that x is to represent, not a variable, but a particular arbitrary, that is, unspecified, real number. For such actions in writing proofs, we have asked ourselves of what were we aware just prior to the action of writing? Apart from the situation calling for the action, that is, that we were proving a theorem whose statement started with a universally quantified real variable, the answer is nothing. In particular, we do not recall being aware of, that is, being conscious of, any kind of reasoning mechanism calling on conceptual knowledge. We could easily have provided such conceptual reasoning, for example in inner speech, but did not do so. However, since our actions were not capricious, something must have guided them. We conjecture that they are guided by

behavioral schemas. We will discuss the genesis and enactment of such behavioral schemas. These considerations have led to a special way of teaching proving. **P2**

3.10 Sleep and dreaming

193 Dream Emergence David Kahn <davidkahn01@earthlink.net> (Psychiatry, Harvard Medical School, Boston, MA)

Thoughts, feelings and images that come to mind while asleep may come from recent or distant memories, fragments of both recent and distant memories, from salient day emotion or maybe even randomly. But we still don?t know how dreams form. This paper hypothesizes that dreams form through the process of emergence, and that the neural basis for the emergence of a dream is the emergence of collective neuronal firing, and as a product of emergence dreams are functional. Dreams are functional because a story emerges from widely ranging memories and fragments of memories and functionality is independent of specific dream content. The dream as an emergent product creates content that is largely unpredictable even when knowing individual content. This is a hallmark of emergence; something new is created from the collective interaction of initially individually interacting elements. **P2**

194 Analyzing The Dream Jules Kennedy <utopianvision@msn.com> (Trinidad, CO)

The intention of this research and consequential paper is to explain briefly the importance of dreaming, how dream analysis works and the possible reasons why the described therapeutic and self-help dream methods might contribute toward healing the body, mind and spirit of the individual dreamer. It demonstrates how inner dream work can change the perception of the world around us, can actually generate new ideas, beliefs and conceivably even alter cells to heal the body. Through the research we have learned that our dream life is a very organic part of being human in our world today. Dreaming is an essential part of the human complex as Ken Wilber shows us in his Spirit Levels, 9 and 10. If we understand our dreams they can help us navigate our lives, and we can change our dreams to suit our healing/health. Conscious awareness is the key to enlightenment. Dream awareness can help us get there. **P2**

195 Emotions Experienced During Non-Lucid Problem-Solving Dreams Activate Secondary Consciousness Miloslava Kozmova <kozmova@hotmail.com> (Boston, MA)

This presentation refers to published research about emotions in non-lucid problem-solving dreams (Kozmova, 2015). Emotions dreamers experience in dreams have been considered simple experiential awareness and theorized as primary consciousness (Hobson, 2009). The current study investigated emotions as part of core variable of problem-solving phenomenon (Kozmova, 2008, 2012). The author analyzed 979 dreams by the method of grounded theory with questions applied through constant comparative analysis to individual instances of dreamers' problem-solving. Yielded 29 dreams represent core variable with 86 different components of cognitive and psychological processes accompanied by dreamers' emotional awareness in emotions' signaling, stimulating, self-regulating, or action prompting or preventing roles. The critical emotional awareness during efforts to resolve difficult situations alerts dreamers and allows them to shift from being a passive recipient in the mode of primary consciousness with simple awareness of emotions into the active initiatory and participatory mode of secondary consciousness in which dreamers enrich their problem-solving efforts by reflective and intellectual abstract analyses. These mental efforts are considered an adaptive self-organizing goal-oriented process. Based upon the results of present study it could be argued that emotional awareness within problem-solving dreams needs to be understood not as a simple primary consciousness or as a part of hypothetical protoconsciousness (Hobson, 2009), but as a critical component of non-lucid dreamers' capacities to use secondary consciousness. References: Hobson, J. A. (2009). REM sleep and dreaming: Towards a theory of protoconsciousness. Nature Reviews: Neuroscience, 10(11), 803-814. doi:10.1038/nrn2716 Kozmova, M. (2008). The investigation of nocturnal cognitive problem-solving using cross-cultural dreams. (Unpublished doctoral dissertation). Saybrook University, San Francisco, CA. Kozmova, M. (2012). Dreamers as agents making strategizing efforts exemplify core aggregate of executive function in non-lucid dreaming. International Journal of Dream Research, 5(1), 47-67. doi: http://dx.doi.org/10.11588/ijodr.2012.1.9159 Kozmova, M. (2015). Emotions during non-lucid problem-solving dreams as evidence of secondary consciousness. Comprehensive Psychology, 4, Article 6. doi: 10.2466/09.CP.4.6 **C21**

196 Cholinergic Enhancement Increases Lucid Dreaming in Post-Intervention Sleep Kristen LaMarca, Stephen LaBerge PhD <kristenlamarca@gmail.com> (Lucidity Institute, La Jolla, CA)

We typically do not notice we are dreaming until after we awaken. A significant exception to this

is lucid dreaming, in which we become metaconscious of dreaming while continuing to dream. Research has shown that lucid dreaming reliably occurs during phasic REM sleep (LaBerge et al. 1981). By intensifying REM sleep, LaBerge hypothesized that Acetylcholinesterase Inhibitors should increase the probability of lucid dreaming. After our laboratory found that Donepezil (Aricept) before sleep enhanced rates of self-reported lucid dreaming in 10 experienced lucid dreamers (LaBerge & Brylowski, 2004), we subsequently predicted that galantamine ingested after the third REM period (REMP) of the night would also show positive results in the subsequent REMPs. In a series of larger experiments using a double-blind, placebo controlled, cross-over design, we tested whether ingesting galantamine after approximately the third REMP increased rates of lucid dreaming. Ss were a high interest group of 121 volunteers (63 males, 58 females, ages 19-75) attending one of six, consecutive 7-day lucid dreaming seminars (Dreaming and Awakening, lucidity.com) in Hawaii. On average, Ss reported nightly dream recall, and lucid dreaming about once every three months. Following a practice night to familiarize Ss with sleep-interruption, reporting procedures, and content scales, Ss interrupted their sleep on three consecutive nights and ingested capsules containing either 0 mg (placebo), 4 mg, or 8 mg of galantamine with counterbalanced orders. After about a 30 minute period of wakefulness, participants returned to bed, with the mental set to remember to recognize dreamsigns, and slept for an average of 199 (69) minutes. Following one or more spontaneous awakenings, participants rated several measures of dream content. Self-reports of lucid dreaming were verified by experts through the Ss?s written narrative, and if necessary, a follow up verbal interview. Galantamine significantly increased lucid dreaming in a dose-related manner during post-intervention sleep. Lucid dreaming was reported by 75 (62%) Ss during the three nights of the study: 51 (42%) Ss with 8 mg, 33 (27%) Ss with 4 mg, and 17 (14%) Ss with 0 mg, with placebo rates higher than would be expected from pre-experiment reports. Compared to placebo, 8 mg was 4.63 times more likely ($p<.000$; $d=.084$) and 4 mg was 2.43 times more likely ($p=.005$; $d=.49$) to result in lucid dreaming. Ss were 1.91 times more likely to report lucid dreaming with the 8 mg compared to 4 mg dose ($p=.013$; $d=.36$). Galantamine also significantly elevated ratings of sensory vividness, dream recall, environmental complexity, bizarreness, positive emotions, odd somatic sensations, clarity, sexual content, and control in a dose-related manner. To conclude, we found a strong and statistically reliable effect for cholinergic enhancement on increasing lucid dreaming, specifically when paired with the mental set for inducing metaconsciousness (lucidity) during sleep. **P1**

197 Studying Higher Consciousness Through the Study of Dreams Sumitra Srivastava <susriv30@yahoo.com> (New Delhi, Delhi India)

The present paper is an attempt to understanding this higher consciousness or ?Qualia? through the study of dreams. Spiritually enlightened persons, especially those belonging to the lineage of saints, have talked about a higher consciousness which is a part of their day to day experiences e.g. Lord Krishna, Kabir, Guru Nanak, Sheikh Moinuddin Chishti and many others have talked of such higher consciousness. It is believed that these persons have come from a higher plane, but scientifically speaking the brain functions do not differ, even though these persons are able to function at a higher level. Neuropsychologists working in the field assert that like all other processes this higher consciousness should also have a neurophysiological basis amenable to scientific study. The focus of the present paper is also on understanding this higher consciousness or ?Qualia?, by attempting to understanding the higher consciousness and explaining Qualia in terms of scientific knowledge about physiological functioning. However, working on the concept of dreams being a manifestation of this higher consciousness, the focus has been narrowed down to exploring higher consciousness through the study of dreams, and is based upon the various studies already done in the area of dreams. Several of these investigations have been carried out under scientifically controlled conditions in sleep labs where it is possible to study the dream process by conducting EEG, MRI and other such devices through which, an effort is made to establish a relationship between dreams and the underlying physiological processes likely to give an insight into the higher of higher consciousness and to demystify the human functioning at a spiritual level. Studies in the field indicate that during sleep, brain activity inhibits exteroceptive sensory inputs and motor outputs from the brain during REM sleep, suggesting that dreams are internally generated, possibly in the specific forebrain regions. The only commands sent are those to the toes, fingers and eyes. The latter are responsible for rapid eye movements (REM). An understanding of these processes could give an insight into Qualia. Several investigators have reported that the dreaming brain relaxes into self-organised patterns. Even an external stimulation can relax it into internally originating images. These workers have also suggested that dreams are not-as-yet saved information spread over the entire brain. These studies suggest that

neural basis of consciousness ? higher or mundane may be in the pre-frontal cortex, which functions in close coordination with several centres in the other locations in the brain. Investigators also report that during REM sleep, there is a burst of randomly timed spikes of neuronal activity that originate in the pons in the lower brain stem and travel upwards to lateral geniculate bodies, and from there proceed to the primary visual cortex. It is asserted that these powerful waves proceed towards the primary visual cortex resulting in dream imagery. These Ponto-geniculo-occipital waves or PGO waves are thought to be a powerful and structured stimulus in which the dreaming brain seeks meaning. **P1**

198 EEG Functional Connectivity Prior To Sleepwalking Episodes In Adult Sleepwalkers Antonio Zadra, Marie-Eve Desjardins; Jean-Marc Lina; Nadia Gosselin; Jacques Montplaisir; Julie Carrier <antonio.zadra@umontreal.ca> (Psychology, University of Montreal, Montreal, Quebec Canada)

There has been increasing interest in examining sleep EEG data in terms of functional brain connectivity. This new and powerful investigative tool, however, remains practically unexplored in relation to sleep disorders. We studied the EEG coherence and inter-dependencies between brain areas before the onset of somnambulistic episodes recorded in the sleep laboratory. 38 adult sleepwalkers were investigated with polysomnography. Patients were selected on the basis of having experienced a somnambulistic episode in the sleep laboratory during an overnight PSG recording as well as during daytime recovery sleep following 25 hrs of sleep deprivation. All of the 76 selected episodes occurred out of N3 sleep. EEG coherence in the 0.5-4 Hz EEG frequency band was investigated during the 20 seconds immediately preceding the onset of each episode and compared to the 20 seconds occurring two minutes prior to these episodes? onset. Data from the F3, F4, C3, C4, P3, P4, O1, O2 leads were investigated for each night using two complimentary measures of brain connectivity: phase coherence and phase lag index (the latter addressing zero-lag interactions due to common sources). Indices of phase coherence and phase lag index yielded similar results. A main effect of time segment was found, revealing a significant difference between the 20-second periods immediately prior to episode onset and the 20-second segments taken 2 minutes before the episode, with greater connectivity occurring immediately before episode onset. No significant interaction with brain areas or sleep deprivation was found. These findings are in line with early pilot results suggesting that episodes of somnambulism are preceded by changes in brain connectivity. The study of EEG connectivity during sleep may thus help elucidate brain processes involved the occurrence of NREM parasomnias while providing a better understanding of fundamental processes underlying normal and pathological sleep. This research was supported by a research grant to AZ and JM from the Canadian Institutes of Health Research (CIHR). **P2**

3.11 Cognitive development

199 Do Distortion Images Affect Visual Self-Recognition in 24-,30- and 36-month-olds? Kieron Mottley, Annette M.E. Henderson; Thomas Suddendorf <kmottley@gmail.com> (Psychology, The University of Auckland, Auckland/Trentham, New Zealand)

The visual self-recognition (VSR) task is a classic test used to determine if children can identify themselves in external representations. Hypothesized mechanisms for VSR require the child to locate either contingency cues (matching movement) and/or feature cues (familiar features) in the external representation. Despite numerous studies on VSR it is unclear how these mechanisms are used as children develop a sense of their physical self. The current study looks at cue use by investigating the effect of reducing feature cues on the performance of children aged 24-, 30- and 36- months. In an initial experiment, 24- and 36- month-olds were tested on a convex mirror and a normal mirror. Both age groups performed as well when using a convex as they do a normal mirror, suggesting that children are able to decipher this distortion. In a second test, 24-, 30- and 36- month-olds were tested on live video in which a video filter produced a minor reduction in the quality of feature cues presented. All three age groups did just as well when presented with the distortion video compared to normal video. A final test was done using a different video effect that produced a major reduction in image quality by inverting the image contrast. In this condition 36- but not 30-month-olds performed as well when compared to normal video suggesting that there is an age-related increase in a child's ability to process information in order to solve a VSR task when the quality of feature cues is highly reduced. Together, our findings support the idea that VSR may depend on the ability to decipher and process visual information into familiar images containing features that match expectations from previous experiences. This is the first study to test for VSR in children using distortions in either mirror or video images. (Participation sponsored by DPG, New Zealand Defence Force) **C13**

200 Electrophyisological Correlates of Nature Experiential System Pooja Sahni, Jyoti Kumar <poojars@hotmail.com> (National Resource Centre for V, Indian Institute of Technology (IITD), Noida, Uttar Pradesh India)

The word 'consciousness' is used in many different ways. It is sometimes used for the ability to discriminate stimuli, or to monitor internal states, or to control behavior. It includes states of perceptual experience, bodily sensation, mental imagery, conscious experience or 'Qualia', emotional experience, and more. Our brain which is endowed with the phenomena of brain plasticity has the ability to reorganize the neural circuitry throughout life as the function of experiences. Interaction with natural environment inevitably yields corresponding states of such conscious experiences through positively affecting our brain and general well being (Selhub, Eva M and Logan, Alan C. 2012). It also affects the cognitive abilities (Kaplan et al. 'Attention Restoration Theory') and behaviors (Ulrich, Roger S. 2009). Further scientific studies have also provided evidence of enhanced structural plasticity, brain synchrony and oscillations- the electrophysiological correlates of attention and cognitive functions. These correlates are attributed to psychological development and higher mental capabilities associated with nature experiences. The results are also corroborated through psychometric analysis using standardized tests and self reports showing a high correlation between consciousness level and pro environmental traits and behaviors. Theoretical and empirical models of Nature experiential system and conscious systems model discusses the pathways in support of experimental findings. Thus, an understanding of how to optimize and improve the functioning of human consciousness on one hand and a positive impact on response to environmental issues on the other, can offers major opportunities to accelerate positive and practical responses to the sustainability agendas. Nature experience may also have a potential alternative therapeutic intervention for certain cognitive dysfunctions. **P1**

3.12 Artificial intelligence and robotics

201 Robot Self Consciousness and Autism Antonio Chella <antonio.chella@unipa.it> (Chemical Management, University of Palermo, Palermo, Italy)

Frith and Happe (1999) hypothesize that people affected by autism may present a dysfunctional self-consciousness, lacking introspective capabilities. In brief, people affected by autism are unable to develop a Theory of Other Mind and therefore they could be unable to develop a Theory of Own Mind. Chella et al. (2008) developed a cognitive architecture aimed at modelling introspective capabilities in a robot organized in three computational areas. The subconceptual area is concerned with low level processing of perceptual data coming from the sensors. In the linguistic area, representation and processing are based on a knowledge representation system. In the conceptual area, data coming from the subconceptual area are organized in conceptual categories according to the notion of conceptual spaces (Gardenfors, 2000). A conceptual space is a metric space in which each dimension is a perceived quality as space position and distance. A point represents a perceived entity, e.g., a chair, while the metric distance is a measure of perceived similarity of the corresponding entities. A Concept is represented by a region in which all the points considered as instances of that concept are located. To model introspective capabilities in a robot, the notion of higher-order space has been introduced: a point in an higher order space corresponds to a perceived agent together with its own conceptual space, i.e., the robot itself, a person, another robot with introspective capabilities. Therefore, the Theory of Other Mind and the Theory of Own Mind of the robot may be modeled by the same formalism. A point corresponding to a perceived other introspective robot is linked with an estimate of the conceptual space of the other robot, thus representing the Theory of Mind related with that robot. A point representing the robot itself is thus related with the Theory of Own Mind of the robot. Happe (1999) discusses the information processing style of autistic people based on weak central coherence. In brief, autistic people are able to perceive detailed features of objects but they lack the capability of perceiving global configurations; moreover they are unable to contextualize perception. Gustafsson (1997), McClelland (2000) proposed models of weak central coherence by means of neural networks with abnormal parameters. We model these aspects by a conceptual space with an excessive number of quality dimensions: a robot equipped with this space is able to represent every detail of perceived entities, but it misses the capability of representing concepts: e.g. it is able to store each instance of chairs seen while it is unable to represent the concept of chair. Moreover, the robot is unable of introspective capabilities because all the higher order spaces collapse to a first order space with an infinite number of dimensions. The robot is thus unable to represent the Theory of Mind of the other introspective entities, including itself. In summary, the study of self consciousness in a robot may offer indeed new opportunities for autistic research. **P1**

202 Machine Morality: Need of Ethics in AI and a Study of Artificially Intelligent Agents From a Moral Perspective Achint Satsangi <achintsatsangi94@gmail.com> (Faculty of Engineering, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In the present era of advanced technology, there is extensive research going on in the field of ARTIFICIAL INTELLIGENCE (AI). Artificial Intelligence refers to human-like intelligence exhibited by machines or software. Presently, the research is primarily focussed on neural networks, machine learning and making the artificial agents smarter and faster in terms of functionality. However, the issue of MACHINE MORALITY has also emerged as a challenging subject of debate and research. The emergence of autonomous killing machines, self-driving cars etc. has raised issues regarding machine morality. This paper will discuss issues pertaining to Machine morality, technological advancements and research in the field of artificial intelligence, propose modifications in laws of robotics, and highlight the need of ethics in artificial intelligence, concepts of machine learning, emotion and cognition in machines, advantages and risks of A.I. (artificial intelligence) technologies. From observing the state of crime and violence in various parts of the world, the paramount importance of human values and ethics is clearly evident. The usage of drones and development of autonomous killing robots by some countries is being debated on ethical grounds. Also, there are speculations that the artificially intelligent agents may pose a threat to humanity in future. Hence, there is an important need for integration of ethics into the machines. The paper would also discuss the development of emotional artificial intelligence technologies and applications like the pain detectors, emotion detectors through conversation, typing patterns, and facial expressions etc. self-learning robots and artificial brains like: Robo-Brain- which learns from the internet resources, mind-reading fashion NEUROTiQ,(Google's) self-driving cars etc. The limitations and risks associated with the "unethical" artificial intelligence would also be discussed. Also, the interesting idea of how can we, as humans, can benefit from the process of incorporation of ethical values in machines will be introduced, and thereby use similar methods for training human beings for inculcating humane moral values and emotions in present scenario will also be discussed. The concept of roboethics would also be discussed- that how humans should interact with the robots. Also, more issues will be discussed like- the responsibility of making the life-death decisions should be taken care by humans not robots; the robot should give priority to the lives of humans above its own safety etc. **P1**

3.13 Neural networks and connectionism

203 Rapid Brain Change Across Cultures Karen Shanor <drkarenshanor@gmail.com> (Adj. Prof., Georgetown University (Psychology, Neuroscience), Washington, DC,)

Every thought and every experience changes our brain. This premise for my Cultural Neuropsychology course at Georgetown University will be discussed in the context of the latest neurological research on the dynamic brain and the cultural implications. For example, recent imaging studies highlight neural modifications in immigrant brains. The conceptual framework of neuroplasticity, neurogenesis, epigenetics, and brain self-organization will be addressed. I'll also discuss the cultural neuropsychological aspects of: (UC Berkeley) Walter J. Freeman's work on brain waves/fields, emphasizing the 'action-perception cycle' and memory; and Karl Pribram's 'images of achievement' as discussed in Pribram's 2013 book, The Form Within. **P1**

3.14 Cognitive architectures

204 Modeling Cognition in the "Conscious Agent" Formalism Chris Fields, Don Hoffman; Chetan Prakash; Manish Singh <fieldsres@gmail.com> (Independent, Sonoma, CA)

The "conscious agent (CA)" formalism (Hoffman and Prakash, 2014; extended in Hoffman, Singh and Prakash, 2015) provides a mathematical model of an experiencing, deciding agent that makes no ontological assumptions about the world with which the agent interacts. The CA formalism postulates only measureable sets and Markov kernels as representations of both agents and the world. It is consistent with the claim of "conscious realism" (Hoffman and Prakash, 2014) that the world comprises CAs and only CAs; hence it is consistent with the claim that consciousness is an irreducible ontological fundamental. It is shown here that the CA formalism provides a natural representation of a cognitive agent. The distinctions between short and long-term memory and between episodic and semantic memory emerge naturally within the formalism, as do competition between proactive and reactive attention systems, feature-based categorization, and case-based planning - planning by modifying episodic memories - as an alternative to using general knowledge to generate and test possible futures. These results suggest that the limited syntax imposed by the CA formalism is a reasonable working hypothesis for modeling cognition, as well as supporting the Interface Theory of Perception (Hoffman, Singh and Prakash, 2015) as an ontologically neutral alternative to causal or other grounding-dependent approaches to preception and representation. References: Hoffman, D. D. and Prakash, C. (2014) Objects of consciousness. Frontiers in Psychology, 5, 577. doi:10.3389/fpsyg.2014.00577 Hoffman, D. D., Singh, M. and Prakash, C. (2015). The interface theory of perception. Psychonomic Bulletin & Review, 22, 1480-1506. **C3**

205 Expect Yourself: Predictive Processing and Consciousness Anil K. Seth <a.k.seth@sussex.ac.uk> (Informatics, University of Sussex, Brighton, United Kingdom)

Predictive processing (PP) is emerging as a powerfully unifying of vision of the neural basis of perception, cognition, and action. In this talk I will examine how far PP helps us understand consciousness, with a particular focus on the experience of being an embodied self. I will start by noting that PP neatly accommodates classical results implicating so-called 'top down' signalling in conscious perception. I will then describe novel experimental results supporting the view that Bayesian 'expectations' actively shape conscious contents via specific neural mechanisms. Extending PP to the case of interoception, I will argue that the experience of being an embodied self depends on control-oriented predictive regulation of physiological homeostasis. Speculatively, this provides a way to understand the deeply subjective nature of consciousness as emerging from systems that care intrinsically about their own existence. I will finish by posing some challenges to the PP view, in the context of other 'roads to consciousness'. **PL1**

206 Theoretical Characterization and Empirical Testing of Integrated Information Theory (IIT) of Consciousness Naotsugu Tsuchiya <naotsugu.tsuchiya@monash.edu> (Psychological Science, Monash University, Clayton, Victoria Australia)

Integrated Information Theory (IIT) of consciousness starts from the extraction of essential aspects of phenomenology and tries to derive physical mechanisms that can possibly support the phenomenology (Tononi 2004 BMC, Oizumi et al 2014 PLoS Comp, Tononi 2015 Scholarpedia). In particular, two of the essential properties, information and integration, play a pivotal role in IIT, hence its name. In this talk, I start with a brief overview of IIT, then present some recent advances in theoretical characterization and empirical testing of IIT from our group. First, we clarify the meaning of "information" and "integration" in IIT. Intrinsic information in IIT refers to the differentiation of phenomenology, corresponding to how much difference a system's current state can make to its own past/future states. One way to consider intrinsic information is the mutual information between the current and past states of a system (Balduzzi & Tononi 2008 PLoS Comp). This conceptualization of information is quite distinct from Shannon's (extrinsic) information, which quantifies the efficiency of the message transfer between a sender and a receiver through a channel, from a viewpoint of an outside observer. Integration in IIT refers to irreducibility of phenomenology, corresponding to how much difference non-independent interactions among parts of a system make to the whole system. These considerations arrive at a concept of integrated information as the amount of intrinsic information that is lost when the system is disconnected. Second, based on the above concept, we derive empirical measures of integrated information that can be applied to real neural recording data (Oizumi et al 2016 PLoS Comp). We further refine the concept by comparing integrated information with other types of measures, such as transfer entropy and Granger causality. From a perspective of information geometry, we propose a unified framework on these measures, pointing out that various measures use different types of disconnected models (Oizumi et al 2015 arXiv). Third, we discuss how to empirically test IIT. While IIT claims the identity between the mathematical structure, called maximally irreducible conceptual structures (MICS) and phenomenology, it is unclear what it means for these two completely different ideas to be identical. We propose to employ a fundamental mathematical formalism of category theory to precisely test such claims (Tsuchiya et al 2016 Neuroscience Research). As an example of empirical testing, we quantified the relationship between conscious perception of faces and a multidimensional patterns of local integrated information, computed from the intracranial neuronal activity recorded from the face-responsive areas in the ventral and lateral temporal cortex in awake humans. Finally, we argue that IIT provides novel ideas that promote a progress of consciousness research and that interdisciplinary empirical testing of IIT will be highly fruitful (Tsuchiya et al, in press, Returns of Consciousness). While IIT's current formulation requires refinement, we believe that its core and most original concepts (e.g., from phenomenology to mechanisms, mathematical formalism) remain most promising among the currently available theories of consciousness. **PL4**

3.15 Ethology

3.16 Self-consciousness and metacognition

207 Metacognition in Perception-Action Loop Dalila Achoui, Martijn Wokke, Marlies Vissers, Axel Cleeremans <dalila.achoui@gmail.com> (Universite Libre de Bruxelles, ULB, Brussel, Brussels, Belgium)

Metacognitive judgments of perceptual decisions are largely dependent on the strength of the incoming sensory signal, but recent studies suggest that neural activity in areas other than the sensory areas representing the stimulus in a perceptual task also contribute to metacognitive judgments. Specifically, motor areas of the brain have been found to contribute to metacognitive performance. A possible explanation for the involvement of the motor cortex to metacognition is that the brain/metacognitive system starts to use information from motor areas as stimulus-response pairs come to be reliably paired during the course of an experimental session. In this way, the stimulus not only predicts a certain motor response, but the motor response also 'predicts' the presence of the preceding stimulus. To test this idea that the brain gradually learns about its own state and that information from different levels in the perception-action loop can contribute to metacognitive performance we carried our a study in which participants were required to give confidence ratings for a visual perception task. Crucially, these confidence ratings were made in three different conditions which differed in the sources of information on which participants could base their confidence judgments; 1) visual information only, 2) visual + response preparation, and 3) visual + response preparation + response execution. Separating the source and amount of information available to the participant for confidence ratings allowed us to track what stages in the perception-action loop contribute to metacognitive performance. EEG data was also recorded to investigate how functional connectivity between prefrontal cortex and sensory-motor areas relate to metacognitive accuracy. Results will shed light on the different types of information the metacognitive system uses to judge accuracy of perceptual decisions. **P2**

208 The Self as a Coalition: The Left Hemisphere and Verbal Reports of Confidence in a Normative Sample Leslie Burton <leslie.burton@uconn.edu> (Psychology, University of Connecticut, Stamford, CT)

Studies on split-brain patients have contributed a great deal to our ideas about consciousness, especially the idea that a verbal response reflects the left hemisphere's activity. The idea that the left verbal hemisphere is primarily responsible for the verbal report of confidence regarding performance when stimuli are presented in either the left or right visual field, even in a normative sample, was evaluated in the present data. These data support the idea that normal individuals function as a successful "coalition" of specialists. **P1**

209 Cross-Cultural Differences in the Effectiveness of Social Influence Techniques Based on Subjects Egotistic Motivations - Comparative Study Karolina Dobrosz-Michiewicz <karolina.dobrosz@uni.lodz.pl> (Communication Theory and Pract, University of Lodz, Lodz, Poland)

Care of a positive SELF-image growth is one of the most important human adaptive traits outstanding us as self-conscious individuals from other living beings. It affects many of our social behaviors, frequently not intended, related with self-promotion or self-defense (Oles, 2003). Although the SELF-system has largely hidden and automatic nature, it plays main and significant role in our perception processes and has many implications for our social cognition or motivational functioning. People used to know what they feel, what to choose and what they think, but not how it happens. Their experiences and derived from them beliefs are treated as something personally important much more than the same experiences of somebody else, not related with SELF e.g. death of my father or death of somebody unknown. We tend to favor information matched to our SELF system and reject contradicted (Pervin 2002), as well as to interpret and reinterpret all around events in accordance with SELF. Past experiences associated with SELF organize and direct all new incoming information, evaluate and select them according their importance for SELF. This insures the consistency of the SELF-system and induces positive emotions. Any discrepancies in SELF-system caused by e.g. motivational conflicts (approach vs.. avoidance situations) induces negatives: from depression to anxiety (Higgins 2000, 2005, 2007). Discrepancy between the real and ideal SELF causes depression. Discrepancy between ought and ideal SELF causes anxiety. To minimize those feelings, people strive to reduce discrepancy in SELF-system even at the expense of the rightness or truth of their beliefs. In effect, this tendency makes people more susceptible to persuasion. The main condition for the effectiveness of persuasion is feeling right of individuals, who are persuaded (Cesario, Higgins,

Scholer, 2008). Study present the results of 3 natural experiments made to verify (1) if it is possible to influence people referring to their self-schemas activation and (2) how to use the SELF-system activation to increase persuasion and what is the impact of cross-cultural differences on persuasion effectiveness (3) . In the experiments [executed in deal-focused culture conditions (Norwegians), moderately deal-focused culture conditions (Polish people)and relationship-focused culture (Colombians)] - 2 x 2 x 2 between subject factorial designed each - the subjects were influenced in one of sixteen experimental conditions (SELF-system activation vs.. no activation vs. message-goal congruency vs. discrepancy; Higgins 2012a). The results indicate two preliminary conclusions: (1) SELF-system activation and goal-message congruency increase the level of subjects submission but the effect of congruency was stronger than SELF-system activation in all conditions, irrespective of deal versus relationship cultural orientation but (2) SELF-system activation increases the effect of goal-message congruency only in relationship-focused culture. **P2**

210 The Relationship Between Metacognitive Feelings and Insight Vs. Non-Insight Solutions to Magic Tricks Mikael Ringstad Hedne, Elisabeth Norman; Janet Metcalfe <post@mikael-hedne.no> (University of Bergen, Bergen, Norway)

The experimental study focuses on the relationship between ongoing metacognitive feelings during problem solving and subsequent solution accuracy with or without insight. Whereas several studies have looked at "Aha!" experiences characteristic of successful "insight" problem solving (e.g., Gick & Lockhart, 1995; Topolinski & Reber, 2010), less is known about metacognitive feelreasonings that occur before or during solution attempts. The study builds on previous work showing that successful solutions to incremental problems are associated with predictive "feelings of knowing" and "feelings of warmth", but that solutions to insight problems are not (Metcalfe, 1986; Metcalfe & Wiebe, 1987). We address whether this is also the case when the to-be-solved problems are magic tricks. Such tricks have been proposed as a new task domain for studying problem solving (Danek et al., 2013). It has been argued that magic tricks are particularly suitable for comparing the cognitive processes involved in insight versus non-insight problem solving because each problem may be solved with or without insight (Danek et al., 2013, 2014a, 2014b). For this reason they afford researchers the possibility of studying the two forms of problem solving within a single set of tasks. We report the results from an experiment that combines the procedure used by Danek and colleagues (2013, 2014a, 2014b) with the metacognitive ratings developed by Metcalfe and colleagues (Metcalfe, 1986; Metcalfe & Wiebe, 1987). Participants are presented with a series of videos of magic tricks that they are asked to solve. For each video, they rate their initial "feeling of knowing" the correct solution. Then, at regular intervals during problem solving, they indicate the perceived closeness to the correct solution (i.e., their "warmth ratings"). We report the relation between metacognitive feelings and their objective closeness to the solution. Our main focus is on the comparison between insightful versus non-insightful problem solving, but we also explore this relation for unsolved trials. The findings have specific implications for our understanding of how intuition and insight are related in problem solving, and contribute to our understanding of whether and when problem solving involves a gradual/continuous or a sudden/discontinuous process. More generally, they also have implications for our knowledge about the relationship between metacognitive feelings and implicit/unconscious cognitive activity (Koriat, 2007). Results will be reported at the conference. **C17**

211 The Second-Person Perspective in Science and Contemplative Traditions Wolfgang Lukas <wolfgang.lukas@gmail.com> (Institute for Astro- and Parti, University of Innsbruck, Institute for Astro- and Particle Physics, Graz, Austria)

Human experience and evaluation are being found to consist of self-reflexive feedback mechanisms that inherently involve observer biases and hidden assumptions. One of the most fundamental assumptions is the distinction between self and other (e.g. organism and environment), which enables first-, second- and third-person perspectives. While science and philosophy have mostly been focusing on the first- and third-person, we call attention to the second-person, arguing that it represents the general case of all three perspectives, interdependently co-arising with the first distinction between self and other. This has far-reaching consequences for science and our understanding of the world, and calls for practical methods to increase our awareness of second-person dynamics and evaluations. We identify three disciplines which emphasize the second-person perspective, organism-environment relations, and interdependent co-arising. (1) Neurophenomenology provides a new stance that accounts for the first-, second- and third-person perspectives in theory-and-practice. It advocates the mutually informing application of introspection-and-dialogue-based phenomenological approaches and the precise methods of

experimental science, suggesting that our systematic biases can be reduced by contemplative and/or secular training methods which emphasise direct experience, introspection and metacognition. Two practical systems with different origins and striking parallels can serve this purpose: (2) Buddhist philosophy-and-practice, which can be understood as a 2500-year-old «mind science» that highlights the interdependent, self-reflexive nature of experience in «dependent co-arising» (paticca samuppada), a complex non-linear system with nested causal feedback loops that facilitates the deconstruction of systems, causality, and even its own conceptual representation. Practitioners are advised to attend directly to processes and causal relations, impermanence and non-identity, thereby reducing habitual reification (papanca). (3) General Semantics, introduced in 1933 as a secular, practical, interdisciplinary «non-Aristotelian» system which applies modern scientific thinking to human evaluation, emphasizing unique features of human abstracting processes and immediate interactions of the organism-as-a-whole-in-its-environment. Key principles include non-identity («the map is not the territory», covers not all territory, is self-reflexive), semantic reactions, consciousness of abstracting, etc.; practical training enhances verbal, sensory and behavioural awareness. We show that the conceptual and practical parallels between General Semantics and Buddhist philosophy-and-practice have a common denominator in their scientific orientation, and that both systems can complement each other in theory-and-practice in order to enhance verbal and sensory awareness of mental and physiological processes, thus facilitating the deconstruction of self-other distinctions via the second-person perspective, interdependence and non-identity. We further explain how these systems extend beyond the currently prevailing scientific third-person paradigm by naturally integrating the first-second-and-third-person perspectives, thus providing a route towards a new stance in which the interrelations between sciences, humanities, contemplative traditions, etc. become accessible in theory-and-practice. When this potential becomes fully realized, our worldviews, evaluations and experiences co-evolve as we progress towards our own systematic disillusionment. **P2**

212 Self-Consciousness as Determinant of Metacognition Jyoti Mehra, Sona Ahuja <jyoti.mehra7@gmail.com> (IBM, Mohali, Punjab India)

The efficiency of cognitive processes can be honed by knowledge of self cognitive abilities and further can be controlled or regulated in accordance to the demand of the situation. These meta-cognitive components participate in general intelligence, together with processing efficiency and reasoning, which have traditionally been considered to compose fluid intelligence (Flavell, Demetriou, A.; Kazi, S. (2006). The metacognitive abilities also optimize the potential to think, learn and evaluate. The self-reflection of cognition addresses the underlining characteristics of consciousness. Though consciousness binds together knowledge and metaknowledge (Koriat, 2000), but the variation in metacognition as accounted by self-consciousness is not envisaged. In the present study the functional relationship between self-consciousness and metacognition is discussed. Web-based questionnaires were conducted. The subjects were asked to give subjective ratings for how much they are aware about their self-consciousness and how they actually conduct actions in their daily lives with metacognitive abilities. The regression model gives the extent of variation in metacognition as accountable by consciousness. The results also reveal the most accounting dimension of consciousness for variance in knowledge about cognition and control of cognition. Further, the predictive ability of each of the dimension of consciousness to determine metacognitive processes is discussed using regression analysis. **P1**

213 The "Self-Awareness–Anosognosia" Paradox Alain Morin <amorin@mtroyal.ca> (Psychology, Mount Royal University, Calgary, Alberta Canada)

Healthy volunteers engaged in self-referential tasks such as reflecting on their personality traits exhibit mostly left lateralized brain activation, yet patients with lack of awareness of their deficit suffer from predominantly right hemisphere damage. How can the same basic process of self-awareness be associated with opposite sides of the brain? One possibility is that anosognosia and self-awareness substantially differ on important dimensions and thus should not be equated. It is proposed that impaired awareness of deficit is mostly caused by problems with self-monitoring, pre- / post-brain damage comparisons of performance, and episodic memory, and is more passive, unintentional, and about the body. Self-awareness produced by inviting participants to intentionally and actively think about more mental aspects of the self relies on judgements, inferential reasoning, imagination, and semantic memory. Consequently, the claim that healthy self-awareness is located in the right hemisphere because anosognosia results from damage to this side of the brain must be fallacious. **P2**

214 Metacognition and Mindfulness: The Role of Fringe Consciousness Elisabeth Norman <elisabeth.norman@uib.no> (Psychology, University of Bergen, Bergen, Hordaland Norway)

The involvement of metacognition in mindful states is already acknowledged in recent models of mindfulness (e.g., Jankowski & Holas, 2014). In this talk, I address how mindfulness may be seen to involve fringe consciousness, which refers to the transitive, fleeting and inarticulate contents of conscious experiences (James, 1890; Mangan, 1993, 2001). Fringe consciousness has similarities to experience-based metacognitive feelings in that they both are proposed to occur in relationship to implicit/unconscious cognitive activity, and to play a functional role in metacognitive monitoring and behavioural control (Norman, Price, & Duff, 2010). I first address ways in which meta-experiences during mindfulness may be seen as a variety of fringe consciousness. I then turn to how mindfulness practice may change a person's attitude to fringe feelings, which in turn may influence the ease with which currently unconscious cognitive content may be retrieved. Finally, I specifically discuss how feelings of novelty, described by many as characteristic of mindful states, may be understood within the fringe consciousness framework. I propose that fringe consciousness may be a useful concept in order to get a better understanding of the relationship between implicit/unconscious cognitive activity and subjective feeling states during mindfulness. **C17**

215 Hogs and the 'Three Roads to Consciousness" - A Pluralist and Integrative Approach to Understanding Consciousness Robert Van Gulick <rnvangul@syr.edu> (Philosophy, Syracuse University, Syracuse, NY)

In keeping with the TSC 2016 theme of "Three Roads to Consciousness (Higher-order, Global Workspace and Predictive Coding)" we should remember that consciousness is a complex aspect of mind, and no single model or theory is likely to capture all its relevant features and dimensions. Understanding consciousness calls for a pluralist approach that uses a diversity of models to describe and explain its multi-faceted nature. Though supporters often champion a single view, many current theories need not conflict, and we should be open not only to the possibility that a variety of them may be of explanatory value, but also to the ways in which they may fit together or even mutually support and deepen each other. Rather than being competing or independent models of consciousness, we should explore the ways in which they can be synergistically combined. One such proposal for doing so is the Higher-Order Global State (HOGS) model, which aims to explain the complex interplay between Higher-Order theories and Global Integration/Workspace models (2004, 2006). The key feature of the HOGS model is that it treats the higher-order or reflexive aspect of consciousness not as residing in a distinct and separate meta-state, but rather as implicitly embedded in the integrative relations between conscious states - relations in virtue of which they interdependently constitute the states of a single virtual self and the representation of a unified virtual world - i.e. a self that exists in relation to that world and a world that exists from the point of view of that self. Main features of the HOGS model are explained with special attention to the way in which two key unities - that of the unified virtual self and that of the unified virtual world - emerge collectively and interdependently from the relevant integrative processes among contents . Each of those virtual entities exists only in relation to the other, and both depend on the crucial integrative and reflexive relations among represented contents (2014). Going one step farther with the "Three Roads" theme, I also draw on that mutual relation to virtual selves and virtual worlds to explore some possible ways in which the HOGS model might be further extended to incorporate and help explain some key features of the Predictive Coding models. The extended HOGS model thus holds the promise of uniting all of the "Three Roads to Consciousness" in a single interdependent theory. Van Gulick, R. (2004). "HOGS (Higher-Order Global States) - an alternative higher-order model of consciousness". In R. Gennaro (ed.) Higher-Order Theories of Consciousness. Amsterdam & Philadelphia: John Benjamins. 67-92, (2004). Van Gulick, R. (2006). Mirror-mirror, is that all? In U. Kriegl and K. Williford (eds.) Self-Representational Approaches to Consciousness. Cambridge, MA: MIT Press/Bradford Books, 11-40 (2006). Van Gulick, R. (2013). Phenomenal unity, representation and the self. Philosophy and Phenomenological Research 86:1,209-13 (2013). **C4**

216 Experimental Manipulation of Bodily Self-Consciousness Influences Metacognition Laurene Vuillaume, Nathan Faivre; Axel Cleeremans; Olaf Blanke <laurene.vuillaume@ulb.ac.be> (Faculte Des Sciences Psycholog, Universite Libre De Bruxelles (ULB) and Ecole Polytechnique Federale de Lausanne, Bruxelles, Belgium)

Humans normally experience their self as being localized within their body. This conscious experience, defined as bodily self-consciousness, has been shown to depend on the multisensory integration of bodily and external signals. Over the last ten years, different methods have been devel-

oped to induce body illusions in healthy participants and alter bodily self-consciousness, enabling a new understanding of the mechanisms that sustain it in everyday life and to find out more about its interplay with other cognitive processes. While bodily self-consciousness is known to interfere with low-level perceptual processes (reviewed in Faivre, Salomon & Blanke, 2015), little is known about whether and how self-consciousness influences higher-level cognitive processes. In this study, we aimed at exploring the impact of a body illusion on second order knowledge, that is, metacognition or "knowing about knowing". We experimentally manipulated bodily self-consciousness with a robotic master-slave system previously used to alter bodily self-consciousness (Blanke et al., 2014): participants were asked to make small movements with their right arm in order to move a master device in front of them. These movements were sent to a slave robot placed behind them, which applied tactile stimuli following the same motion in real time to the participants? back (synchronous condition). By introducing a delay between the movement of the participant and the tactile cue delivered by the master robot (asynchronous condition) a sensorimotor conflict could be generated, which resulted in an illusory body perception in healthy participants, namely the feeling of a presence and a change in self-location. We compared the synchronous and asynchronous self-touch conditions with a control condition in which the movement was controlled by the experimenter. We investigated the effects of this manipulation on the metacognitive abilities of 18 healthy volunteers. Metacognition was operationally defined as the accuracy of a confidence judgment about performance on an auditory temporal order judgement task. Results showed a reduction in metacognitive accuracy specific for stimuli presented in the asynchronous condition compared to the baseline and synchronous conditions. These results suggest that the body illusion induced through this sensorimotor conflict between touch and motion impairs metacognitive abilities. In conclusion, our results confirmed the use of a new technique to experimentally manipulate bodily self-consciousness in healthy subjects and extended these findings by suggesting that a strong sensorimotor conflict alters metacognitive accuracy in a perceptual task. **C17**

217 Validating Metacognition of Attention Using Magnetoencephalography Stephen Whitmarsh <stephen.whitmarsh@gmail.com> (Karolinska Institutet; Ecole Normale Superieur, Paris, France)

In many meditative traditions, attention is directed towards the body, e.g. as instructed in the Buddhist Anapanasati sutta. The meditation practice also often explicitly relies on a purported ability to introspect accurately on spontaneously occurring fluctuations of attention. For instance, one is instructed to notice when one's attention is wandering off, e.g. towards distracting thoughts. However, the ability to reliably report on spontaneous fluctuations in attention to the body has not yet been objectively verified. A systematic neuroscientific study of this key aspect of meditation is therefore necessary to better understand the cognitive mechanisms of its practice. I will present two studies we done on the neuronal dynamics underlying self-awareness of attention to the body. Directed attention has been consistently associated with a reduction of spontaneous oscillations in the alpha range (8-14Hz) generated in sensory areas. These modulations are found to be spatially specific when directed towards different parts of the somatosensory (body) or the visual field, called somatotopy or retinotopy, respectively. In such experiment, attention is typically modulated by the experimenter through external cues or task demands. In a more ecologically valid approach, we explored whether spontaneously occurring fluctuations of attention as measured by magnetoencephalography recordings of alpha activity, can be accurately captured by self-reports of somatosensory attention. First, we instructed subjects to attend to either their left or right hand. At unpredictable moments we asked subjects to report on their level of attention to the attended hand. We showed that somatosensory alpha power did indeed correspond to self-reported attention, and that this was specific to the somatosensory cortex contralateral to the attended hand. In another study, we then set out to further investigate the relationship between self-reported attention and sensitivity to body sensations. Additionally, we wanted to investigate whether neural correlates of self-reported attention can be dissociated from self-reported confidence in a tactile discrimination task. Subjects had to discriminate electro-tactile stimulations to the left thumb, after which they evaluated either their attention or confidence in their performance. Both attention and confidence ratings correlated equally to task performance. However, at the neural level, only attention ratings correlated negatively with alpha power in a distributed network, with the strongest effects at the cortical area representing the attended hand. Together, these findings demonstrate the human ability to accurately aassess internally directed, spontaneous fluctuations in somatosensory attention in a manner that is independent of stimulus cues or (perceived) task performance. These studies provide encouraging support the

underlying mechanism of meditative practices where self-awareness of attention is an important and possibly overarching cognitive process. **C17**

218 Distinct Neural Mechanisms Underlying First-Order Task Performance and Metacognition Martijn E. Wokke, Dalila Achoui, Axel Cleeremans <martijnwokke@gmail.com> (Psychology, Universite Libre De Bruxelles, University of Amsterdam, Amsterdam, Netherlands)

Decision-making is one of the most fundamental parts of our daily life. Undoubtedly, when having to select a course of action conscious monitoring of our decision process is of crucial importance. Here a line of three experiments on first and second-order decision-making will be presented. In the first experiment we recorded EEG signals while participants were asked to make a diagnosis after seeing a sample (a complex visual pattern) of fictive patient data. Single-trial EEG analyses demonstrate that although task accuracy was related to beta band activity in motor regions, second-order decision-making was specifically associated with late emerging (anterior) frontal theta band activity. In a second experiment we tried to determine how sensory (visual area MT) and higher-level (anterior prefrontal cortex) regions in the brain contribute to first-order and second-order decisions using transcranial magnetic stimulation. In the last experiment we investigated whether neural activity related to motor preparation and execution contributes to the quality of second-order decisions. Results will be discussed in the light of how and to what extent metacognition and first-order task performance are related. **C17**

3.17 Temporal consciousness

219 Subjective Experience is a Hippocampal Simulation Matt Faw, Bill Faw <mattfawfilmmaker@gmail.com> (Stickman Films, Los Angeles, CA)

We propose that Subjective Experience is actually a brand new episodic memory, in the process of activating neocortical and default mode networks of the brain. Like a TV news outlet, structures in the Hippocampal Complex receive reportage from widely distributed structures around the brain, and bind those reports together into a unified, contextualized, but vastly simplified summation of what just happened. This 3D spatiotemporal multimodal 'newscast' is then fed back to structures across the brain, to inform them of the big picture and to expedite predictive processing. Because episodic memory is the only unified and contextualized representation of self-in-the-world in the brain, and because it informs most of the major cortices about 'what just happened', it is misinterpreted as the actual interaction of the body/mind with its environment. This misinterpretation offers insight into many of the distinct and mysterious features of Subjective Experience and pathologies of consciousness. **P2**

220 Consciousness Needs the Flow of Time and Therefore Perceptual Completion Ronald Gruber, MD, Richard A. Block <ronaldpgruber@gmail.com> (Clinical Assoc. Professor, Stanford University Medical Center; UCSF, Stanford, CA)

Penrose suggested that consciousness needs time to flow. We chose experimentally to examine what is required. We assert that the flow of time has two components, or kinds of processes. Lower-level processes result in perceptual completion and provide the dynamic experiential phenomena between discrete observations in all fundamental perceptions, such as motion perception. Upper-level processes result in objects (including the observer) appearing to move from the present into the past. If perception is discrete, not continuous (and current evidence suggests that is so), perceptual completion for continuity is required to fill the gaps. Object persistence is then deduced from the percept of continuity. Unless objects are perceived as persistent ("same"), the conscious observer cannot perceive himself or herself as moving "through time." To demonstrate that the brain is capable of providing perceptual completion of continuity, we examined the spatial limit of the classic phi phenomenon with overlapping stimuli flicker. We discovered that by appropriately adjusting the stimulus duration and interstimulus interval, the flicker disappeared, and an apparent singular stimulus was perceived. This is an illusory percept that fills the gap between the overlapping stimuli. The illusory percept seems to be one of visual persistence, not iconic memory. Thus, under the discrete-perception theory, observation of any continuously appearing stimulus is in effect a series of discrete percepts separated by illusory percepts to fill the gaps. A somewhat similar phenomenon is color phi. Our newly revealed illusory percept occurs "backwards in time." In short, consciousness needs the illusory percept of perceptual completion. **C6**

221 Time Traveler's Stress Dilemma (TTSD) Czarina Salido, Alaric Weber <czarinas@gmail.com> (Time in Cosmology, Tucson, AZ)

Einstein's Special Theory of Relativity leads to a strange, experimentally verified phenomenon known as time dilation. This is most evident in the "Twin Paradox" where a set of twins is separated by a near light speed round-trip journey into space, only to find upon return, the twins have aged differently. The effects of time dilation are well known, however we cannot say for sure what sorts of psychological effects the twins will befall. Moreover, the question arises: What are the stress level differences, if any, endured by the twins? To further illustrate, imagine a Gedanken Experiment where twins Mark and Scott, are at the Market buying groceries, coincidentally there is a space-ship offering round trip space rides to a nearby star at a speed of 99.9% the speed of light. The ride operator does specify that the passenger will return to the exact same location, but they will be gone for a total of 5 years. So Scott bravely decides to take the space ride while Mark decides to stay behind at the market. After his space journey Scott, only aging 5 years, observes that his twin brother, Mark, has aged nearly 111 years. Although this may sound like science fiction, it is not, and as Einstein explains it, "if we place a living organism in a box one could arrange that the organism, after any arbitrary lengthy flight, could be returned to its original spot in a scarcely altered condition, while corresponding organisms which had remained in their original positions had already long since given way to new generations. For the moving organism, the lengthy time journey was a mere instant, provided the motion took place with approximately the speed of light." In a sense, time dilation effects would be equivalent to comparing ages between future "time travelers" who advance into the future, to those who have aged "normally". It is proposed that by suitably defining stress level indicators and establishing measurably quantified parameters, predictions can be made about the amount of stress experienced between a space or time traveler and those left aging at the normal rate. It is argued that there is a stress difference between the "traveler" and the "non-traveler" wherein it is predicted that it will be more stressful for the latter than for the former. In other words, on average, as more time passes, the more the non-traveler will be stressed. The experimental design will consist of an analysis of existing stress measure databases. These databases will be sorted into stress categories S(i). The collection of all S(i)'s will be called an Adele S-Set (S(A)). A non-stress control database, Non-Adele S-Set (S(non)), will also be collected identifying minimum stress levels. This resource analysis may now be used to make specific stress comparisons by using the null hypothesis that there will be no stress level difference between the twins. A two-tailed test will be used to reject the null hypothesis at the .05 level of significance. **P2**

222 Voluntary Actions Cause a Temporal Rate-shift in Visual Awareness: Evidence From Visual Illusions Matti Vuorre, Janet Metcalfe <mv2521@columbia.edu> (Psychology, Columbia University, New York, NY)

Voluntary actions are characterized by a subjective feeling of being in control of one's actions, and through them, outcomes in the world. This sense of agency is sensitive to the temporal interval between one's actions and their outcomes (Metcalfe & Greene, 2007). Interestingly, voluntary actions seem to modulate the subjective duration of these intervals: Retrospective reports of time intervals following voluntary action are shorter than passively observed intervals, or intervals that follow involuntary actions (intentional binding; Haggard, Clark, and Kalogeras, 2002). To determine whether retrospective reports of shorter intervals following voluntary action reflect a shift in memory or perception, we showed participants visual illusions that result in qualitatively different percepts depending on the inter-stimulus interval (ISI) of the presented stimuli. If reports of shorter intervals following actions reflect a genuine shift in temporal perception, participants should observe the visual illusions at longer ISI when they follow voluntary action in contrast to passive observation. In Experiment 1, participants observed apparent motion following voluntary action or no action. Apparent motion is a visual illusion whereby two successive but static and spatially offset disks result in perceived motion when the ISI is short enough: Participants continued to see apparent motion at longer ISIs when the disks followed voluntary action, supporting the explanation that voluntary actions compress the experience of time in visual awareness. In Experiment 2, participants observed the Ternus display following voluntary action or no action. This display, at short ISIs, is perceived as one circle leapfrogging over another to land on its other side (element motion), while at longer ISIs the two circles appear to move in tandem (group motion). The results from Experiment 2 confirmed the previous finding: Participants observed element motion at longer ISI following voluntary action. These results support the idea that voluntary actions cause a temporal rate-shift in visual awareness. This perceptual shift, in turn, strengthens the original notion that intentional binding reflects the brain's attempt to maintain a coherent sense of agency (Haggard, Clark, and Kalogeras, 2002). **C6**

3.18 Intelligence and creativity

223 Quantum Complexity, The Multiverse and Godel's Views on the Afterlife: The Musicality of Unique Minds Kala Perkins <quasar9@mac.com> (Bioethics, Graduate Theological Union, Woodside, CA)

We are transported. The musicians themselves loose their physicality, hovering somewhere between. This they confirm. The music and presumably the composer Dmitri Shostakovich, wrote this sonata for viola and piano (opus 147), his final composition, somewhere between the worlds, neither in this one nor the other. We pass with him moving into a place sublime and enticing, familiar yet like the gentlest footsteps upon the heart. Passion courts transcendence. Do we recall our own comings and goings between the worlds, gliding with the composer to share in his elevated transport? Perhaps. Coupled with Alban Berg's "To the Memory of an Angel", there is no doubt left that we are trans-substantiated. Berg was Shostakovich's student, madly in love with the daughter of Alma Mahler who died quite young. Berg wrote this piece to her memory and then quickly followed after her. As I read Godel's letters on his thoughts about the afterlife, I wonder what music accompanied this sensitive logician in his spiritual inquiries. He saw the reflection on an afterlife as apart from the philosophical problem of the existence of God: "Of course this supposes that there are many relationships which today's science and received wisdom haven't any inking of. But I am convinced of this [the afterlife], independently of any theology." Godel proposes that as creation itself seems to be utterly rational and reasoned, and in that the human being has, in fact, an immeasurably greater potential than that which they are allowed to actualize in this single lifetime here in this world, logic itself has it that there should be another world(s) wherein the human potential is expanded upon, and a greater learning and expression realized. What I am drawn to in his reasoning is its implications for the integral and logistic self-consistence of what I will call Totality (as it is commonly used in the Taoist and Buddhist philosophical writings). Godel, himself speculated on the potential infinities of other worlds. How this feeds back into conjectures on possible roles for consciousness, creativity and its quantum complexity dynamics, with respect to the function of humans in Totality, is the inquiry of this presentation. **P2**

224 Hooked In To Technology, Plugged Out of Self-Awareness? Prem Sewak Sudhish, Sheela Reddy, University of Chicago <pss@alumni.stanford.edu> (Physics and Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

This study attempts to investigate the effect of the technology revolution on the conscious traits of human behaviour. While modern technology in general and the recent social networking revolution in particular have indubitable advantages - both for individuals and for the society as a whole, there are also perceptible disadvantages. The ancillary existence of individuals in the virtual world, without due jurisdiction, is sometimes known to take catastrophic proportions, where individuals start to evade real world interactions and problems that may lead to what is now come to be known as 'internet addiction'. While there are several ways in which an individual may be hurt by an indiscreet use of technology, including hacking, identity theft and other online scams, we focus our attention in the present study to examine the sociological and psychiatric indicators that such an addiction may lead to - such as procrastination, loss of interpersonal relationships, alteration in social sensibilities and perhaps even an overly mechanistic world-view with a dwindling sense of self-awareness. This intercontinental techno-psychiatric study from a computer scientist's (Dayalbagh Educational Institute, India) and a psychiatrist's (University of Chicago, USA) perspective proposes a restrained and balanced use of technology, based on the personal needs and priorities of an individual for a wholesome and fulfilling lifestyle. **P1**

3.19 Cognitive theories of consciousness

225 Consciousness From the Perspective of an Engineer: Why Does it Feel Like Something? John Aynsley <aynsley@btinternet.com> (Independent, Romsey, Hampshire United Kingdom)

This presentation summarizes a computational account of consciousness that addresses the question of why it "feels like something" to be conscious, given from the perspective of an engineer. Consciousness is viewed as behavior that emerges within the control system of an evolved biological organism, or by generalization, an agent embedded in a world. Getting a proper understanding of consciousness is problematic because we all misconstrue consciousness from the start, we are all disadvantaged by the lack of good analogies, and understanding involves the simultaneous appreciation of multiple facets. Some form of na?ve realism is an insideous delusion of human experience. We take it that we are separate from the things we perceive. The problem with such a view is that

there is no satisfactory answer to the intuitive question of how subjective feelings arise. Attributing feelings to a mind separate from the material world where the "things" reside leads directly to dualism and the "hard problem", whereas smearing the feelings across the entities involved leads to panpsychism. From an engineering perspective, both views are problematic. The resolution is to consider subject, object, and consciousness to be abstract constructs constituted by a single process that occurs on a physical substrate, primarily but not exclusively within the brain. The subject, a construct of a process, believes itself to be a person conscious of objects, also constructs of that same process. Physical reality is not the world as we perceive it, but seems empirically to be describable in purely mathematical terms. Experience has multiple facets that need to be grasped simultaneously. 1) The contents of experience are abstract symbols grounded in physical or social reality, and symbol activation is graded. 2) Experience seems to be unified, the elements being presented as parts of a single scene. 3) Experience has no reference point outside of itself. 4) Each moment of experience has a unique qualitative character determined by the current set of active symbols and unconscious inputs. 5) The self is a cluster of symbols in this space, characterized by its persistence and salience. For normal adult humans, the series of moments forms an unfolding story centered on a self as a person in a world. 6) The resultant phenomenology is transparent. This account has several corollaries. Since consciousness is an abstract construct of the process by which an agent interacts with its environment, it is neither an instantaneous state nor localized in a particular region of the brain. Since consciousness is an aspect of how an agent represents itself to itself, it fundamentally concerns content rather then mechanism. Finally, consciousness is not uniquely defined but is hugely contingent on the the history of an individual and its species. There are no a priori facts about how an agent represents itself to itself and there is no absolute threshold of organization or complexity above which an agent should be considered conscious. **P1**

226 Combining Integrated Information Theory with a New "Three Agent Model" May Explain Enlightened States of Consciousness Frank Heile <frank@heile.org> (Retired, Santa Clara, CA)

Integrated Information Theory (IIT) (Tononi 2008) proposes an explanation of certain aspects of consciousness. A new "three-agent model," suggested here, combines with IIT to explain enlightened states. These three agents are assumed to be embodied, which requires each agent to represent and model both the world and the agent itself in that world, as suggested by Douglas Hofstadter ("I am a Strange Loop," 2007). Dual Process Theory (DPT), a psychological theory popularized by Daniel Kahneman ("Thinking Fast and Slow," 2011), proposes two systems that correspond to two of the three proposed agents. The neuroanatomy of the brain suggests the presence of a third agent. The three separate but interconnected proposed agents are the "Thinker," "Doer," and "Experiencer." The Thinker corresponds to DPT's System 2; it generates the conscious thoughts that may be experienced as the inner voice. The Doer corresponds to DPT's System 1; it may be viewed as controlling the body and is motivated by feelings and emotions to achieve its goals. The Experiencer can be thought of as constructing and representing both the sensory and language models of the world and the agents. The Experiencer may be implemented in the occipital, temporal, and parietal lobes of the brain (60% of the cortex); the Thinker and Doer may share the frontal lobes. A fundamental concept of IIT is that the conscious part of the brain is the sub-network containing the maximum amount of integrated information. The boundaries of this conscious sub-network depend on the current state of neurons and the connectivity of neurons that can be changed by neural plasticity. Some spiritual traditions claim that their practices can lead to an enlightened state, and some of these traditions describe multiple types of enlightened states. The Thinker-Doer-Experiencer model proposes that transitions from an unenlightened state to one or more enlightened states could be caused by changes in the distribution of the IIT conscious sub-network among the three different agents. In the unenlightened state, the conscious sub-network could be mostly limited to the Thinker and the language model portion of the Experiencer. Varying the proportions of the conscious sub-network in the Thinker and Doer could explain multiple types of enlightened states. One example is a state in which the Thinker has none of the conscious sub-network (it would only be in the Doer and Experiencer). Another example is a state in which the Experiencer has all of the conscious sub-network. The Thinker-Doer-Experiencer model could explain unusual experiences reported by people in these types of enlightened states, analyze how meditation and other spiritual practices are used to achieve them, make testable predictions about changes in the sensory perceptual abilities of individuals in the Experiencer-only enlightened state, and predict an innovative meditation practice for producing enlightened states. **P1**

227 A Framework of the Cognitive Hierarchy Incorporating Meditative States of Consciousness Sucharit Katyal <skatyal@umn.edu> (Psychology, Post-Doc, University of Minnesota, Minneapolis, MN)

For over two millennia, Eastern meditation traditions have developed techniques for self-investigation into the nature of mind and consciousness. These techniques include practices for refining one's attention as well as continuously reassociating one's self-identity with a larger transpersonal self-concept. Expert practitioners of such techniques can attain states of consciousness not normally experienced in day-to-day life. Such states of consciousness are said to allow an empirical dissociation of the cognitive hierarchy through which the practitioner is able to form a deeper understanding about the nature of oneself. Modern cognitive science also largely tries to understand the mind in terms of hierarchical models of cognition. So far little work has gone into exploring the relationship between traditional contemplative models of cognition to modern scientific ones. Here I propose a framework that relates the contemporary scientific understanding of hierarchical cognition to Yogic concept of "layers of the mind" that practitioners unveil through meditation practices. I draw from Yogic, Vedantic and contemporary literature on contemplative psychology and philosophy of mind, including ideas about the five sheaths of the mind (kosas) and the layers of cognition (tattvas). These writings propose a two-way relationship between the spatio-temporal degrees to which a cognized object is evaluated and the depth to which one has delved into the meditative experience. That is to say, being in a deep meditative state, one phenomenologically experiences an object as being placed within a larger space-time window than in a mundane state of consciousness. In my framework I relate this idea to the neuroscientific understanding of the roughly caudal-to-rostral organization of the human brain, as well as the increase in spatial and temporal scales of operation along the cognitive hierarchy. For example, as one proceeds upwards along the cognitive hierarchy, there is a concomitant increase in the time-scales of neural oscillations correlated with the cognitive operation of that stage. Recent studies have shown that whereas high frequency (gamma) oscillations are involved in feature binding, perceptual and attentional modulation occurs at slower frequencies (alpha and theta), while even slower (<1 Hz) oscillations are correlated with states of arousal. By combining the phenomenological approach from meditation traditions with cognitive neuroscience, as well as incorporating findings from extant meditation electrophysiology literature, I propose a theoretical framework that can be used to test scientific hypotheses about the cognitive psychological and neural effects of meditation. One such hypothesis that comes out of this theory, which I am currently investigating, is that meditation can alter neural oscillatory patterns by slowing down oscillatory frequencies responsible for generating specific cognitive and perceptual phenomena. **P2**

228 A Brand New Mind - How Culture, Cognition, Myth and Language Came Together to Make Us What We Are and What Has Happened in Us Since Thomas Lawson <ttlawson@gmail.com> (Daleville, VA)

Pulling together, for a book in progress, recent work in archaeology, cultural anthropology, cognitive neuroscience, genetics, and evolutionary linguistics I reach the surprising conclusion that fluent language did not materialize until about 12,000 years ago. Scholars probing the co-evolution of genes and culture have come independently to the conclusion that at a certain point in human evolution culture began to evolve on its own, freed of the tardy mechanisms of genetic change. Biologist Peter Richerson and anthropologist Robert Boyd employ the term "coevolving mutualisms" to describe the parallel evolution of disparate elements, which at a critical point produce in combination a thing not implicit in any of them. Psychologist and cognitive scientist Merlin Donald and neuroscientist V. S. Ramachandran separately have described the same thing. None has fixed upon a time or place for such an eventuality. I find the coevolving mutualisms to be culture, cognition, myth, and language, and the new thing derived from them to be human consciousness. I place their coalescence in the Near East early in the Neolithic at the point of the inception of agriculture. Prior to this point all humans had been hunter-gatherers. Within a few thousand years thereafter, the world over, the dominant modes of existence were farming and herding. This was a cultural change, and, as Donald points out, the suffusing element in the life of every emerging culture was myth. By the time modern humans came out of Africa the human brain had reached its current size. Donald makes the case that the selection pressures that drove the cognitive breakthrough to consciousness were not environmental in nature, but derived from the interior need of an expanding cognitive power to make sense of the world, to link together isolated episodes of awareness into a coherent whole. A narrative line had to be achieved, and it could be achieved only through language. The narrative that emerged was myth. Moreover, it has been richly demonstrated that there is but a very restricted set of mythic concepts, and that these are universally held. We cannot say what in the course of the evolution of

the human mind produced exactly these. Carl Jung labeled the deep inherited structures of the mind as archetypes. His eminent successor, Erich Neumann, identified the earliest myth to be that of the Great Mother and her consort, the Son-Lover. He linked this myth to the emergence of consciousness, historically and in the psyche of every child. These two figures appear together for the first time at Mureybet, in northern Syria as a prelude to the invention there of agriculture. They then dominate the pantheon in the Levant and Eastern Mediterranean for thousands of years. An astonishing hunter-gatherer site currently being excavated at Gobekli Tepe in south-central Turkey is moving archaeologists to accept, with Jacques Cauvin, excavator of Mureybet, that the driving force behind agriculture and the Neolithic Revolution was not economic or environmental, but was mythic and cultural. The coevolving mutualism came together there and then. **P1**

229 Computational Aspects of the Overflow Model of Consciousness Ken Mogi <kenmogi@qualia-manifesto.com> (Sony Computer Science Laboratories, Tokyo, Japan)

The sensory overflow (Lau & Rosenthal 2011, Block 2011) is one of the fundamental constraints in considering the nature and evolution of consciousness. Overflow could be considered in two layers: The physical overflow and the phenomenological overflow. The physical overflow refers to the actual presence of massively parallel sensory data entering the biological system from the environment. The phenomenological overflow is the representation of sensory qualities (qualia) captured in the multiple sensory modalities such as vision. In visual awareness, there are more information than could be processed cognitively, as is evidenced by change blindness (Simons & Levin 1997) and inattentional blindness (Mack and Rock 1998). The sensory system of the brain processes progressively small amount of information in the higher sensory areas (Raichle 2010, Csikszentmihlyi 1956). From the computational point of view, the main challenge for consciousness would appear to be the effective and robust handling of information, as the bandwidth available becomes narrow at the higher cognitive stages. The brain has adapted statistical strategies (e.g. redundancy reduction (Barlow 2001)) to cope with this situation, forming a gist perception of the environment (Oliva 2005, Cohen et al. 2011). It is in this cognitive process that phenomenological overflow emerges from the physical overflow. The overflow aspect is particularly pertinent to the problem of the evolution of consciousness. The physical overflow has been a common denominator for all living organisms from a single cell to the human brain, and therefore has put continuous selection pressure on the generations of cognitive systems that evolved. Computational theories (Marr and Poggio 1979, Friston 2010, Dahaene et al. 2014) have discussed various aspects of cognition from the reconstruction of 3D information to consciousness. Here I discuss the computational aspects of the overflow approach to the evolution of consciousness. In particular, I discuss the computational significance of the construction of the phenomenological overflow on top of the physical overflow. Specifically, the phenomenological overflow is conjectured to be different from the physical overflow in the metacognitive processes (Flavell 1979) involved. The metacognitive process makes it possible to represent within the system the relevant aspects of sensory information in an integrated and parallel way. I outline, based on the available experimental data, several key steps in the evolution leading to the fully developed phenomenological overflow of humans. In this picture, qualia arise as a statistical bridge between the physical overflow and gist perception, which provides the basis for action. Qualia present in the phenomenological overflow provide a robust spectrum of combinatorial elements constrained by the statistical properties of the input. In the evolutionary context, there are two different time scales involved in the model. Sensory qualia are generated in evolution to provide a statistically robust repertoire of aspects of information present in the sensory overflow. Intentional qualia, on the other hand, are generated as the result of adaptation to the repertoire of sensory qualia within the constraint of sensorimotor coordination. **C22**

230 Toward an Integrated Theory of Inner Experiences Famira Racy <famiraracy@gmail.com> (Independent Scholar (Mount Royal Univ; Adler Univ), Calgary, AL Canada)

The rise of research on inner experiences (IEs) has generated debate around their functions, content, frequency and development. Inner speech, visual and audio IEs, unsymbolized thinking, feeling, and combinations of these IE forms have been studied in multiple contexts. I argue for the further advancement of the study of IEs with a focus on integrating the continuum of IE forms rather than focusing on them separately. This shift in focus has allowed me to consider a holistic developmental context and to offer suggestions for potential clarification regarding the forms and functions of IEs. Researchers have argued for a typical developmental pattern of some forms of IEs such as inner speech and have observed atypical patterns such as the absence of IS or abundance of visual imagery. This poster contains a preliminary synthesis of foundational theories and current data to advance a theory of typical and atypical trends in developing IEs. Particularly, the range of outer experiences is most likely internalized as IEs in the same way and on a similar typical developmental timeline as the internalization of private speech into inner speech. The significance of outer experiences may decrease over the lifetime as the significance of IEs increases, and as time goes on the pattern may reverse, forming intersecting curvi-linear patterns over the lifespan. I also report individual differences that most likely affect typical developmental patterns of at least some forms of IEs. This poster also contains comments on current IE sampling methods because sampling experience means sampling representations of processes and perceptions that can be correlated and double-dissociated with fMRI data to either support or refute claims about development and functions of IEs. **P2**

231 Qualia Lattice Derived By Inverse Bayes Inference Gunji Yukio, Shuji Shinohara; Vasileios Basios; Taichi Haruna <yukio@waseda.jp> (Art and Technology, Waseda University, Shinjuku-ku, Tokyo Japan)

Although Bayes inference (BI) is implemented by the theory of Global Work Space, inverse Bayes inference (IBI) is not manifested yet. The IBF is a way to modify the hypotheses themselves by which making decision is inferred, and is not implemented in a definite way. We here show how IBF is implemented so as to formalize neural activity giving rise to consciousness, and show that neural activities implemented by both BF and IBI can be expressed as a particular algebraic structure in which multiple Boolean algebras are pasted with overlapping, called orthomodular lattice. We consider that such a structure is a formal expression for qualia. If one pays attention only to BI, data and hypotheses are distinguished from each other. Although distribution of hypotheses can be changed, a posteriori, dependent on empirical data, hypotheses themselves are not changed. As a result, unconscious parallel distributed processing a priori can be clearly distinguished from conscious serial processing a posteriori in the framework of Bayes inference. In natural brain system, there is no clear separation of the processing a priori and the processing a posteriori. The ambiguous boundary between the processing a priori and that a posteriori can be implemented by introducing the IBI. We here propose two implementations of IBI. For both implementations Bayes formula is assumed in the following form; $P(t)(h|d) = P(t)(d|h)P(t)(h)/(\mathrm{Sum}(k)P(t)(d|hk)\ P(t)(hk))$.....(1), where d and h represent data and hypothesis, respectively. BI expressed as $P(t+1)(hk) = P(t)(hk|d)$.....(2) is also assumed for both implementations. The first implementation is defined by using the symmetry to BI, and is expressed as; $P(t+1)(d|hs) = P(t)(d)$.....(3). In Eq-(3) the conditional probability representing a hypothesis is replaced by empirical data. The problem arises how is a hypothesis denoted by s is chosen. We here introduce a particular optimization to choose one hypothesis. By using IBI, chosen hypothesis is perpetually replaced by a new hypothesis which is derived by empirical data. We here show that IBI can play a role in corresponding to the drastic change of environments. The second way of implementation is expressed as $P(t+1)(d, h) = P(t)(d|h)$.....(4a) and $P(t+1)(d, h) = P(t)(h|d)$.....(4b). In this implementation, Both eq-(4a) and (4b) can contribute to the symmetrical structure of data and hypothesis. Recursive repetition of eq-(4a) and (4b) can give rise to a steady state of a particular distribution of the probability Pt(d, h). Now we denote a set of hypotheses and data by H and D, respectively. When the probability is digitized by a threshold value, a binary relation, R, between D and H is obtained. It is easily verified that this binary relation is an equivalence relation. When the equivalence class for x in D is defined, we can define two kinds of approximations. We show that a collection of fixed point with respect to the operation of composition of two approximations is an orthomodular lattice. **P1**

3.20 Miscellaneous

4.0 Physical and Biological Sciences

4.01 Quantum physics, collapse and the measurement problem

232 Was Einstein Wrong on Quantum Physics? Mani L. Bhaumik, PhD <bhaumik@physics.ucla.edu> (Physics and Astronomy, University of California at Los Angeles, Los Angeles, CA)

Albert Einstein is considered by many as the father of quantum physics in some sense. Yet there is an unshakable view that he was wrong on quantum physics. Although it may be a subject of considerable debate, the core of his allegedly wrong demurral was the insistence on finding an objective reality underlying the manifestly bizarre behavior of quantum objects. The uncanny wave???? particle duality of a quantum particle is a prime example. In view of the latest developments, particularly in quantum field theory, the objections of Einstein are substantially corroborated. Careful investigation suggests that a traveling quantum particle is a holistic wave packet consisting of an assemblage

of irregular disturbances in quantum fields. It acts as a particle because only the totality of all the disturbances in the wave packet yields the energy momentum with the mass of a particle, along with its other conserved quantities such as charge and spin. Thus the wave function representing a particle is not merely a fictitious mathematical construct but embodies a reality of nature as asserted by Einstein. **C5**

233 Free Will and Determinism Convergence Under A K-Dimensional Symmetric Spacetime Through a Time Reversible Interpretation of Consciousness Luis Javier Camargo Perez, Munoz-Jimenez Daniel <luis.j.camargo@gmail.com> (AE Labs, Tlalpan, CDMX Mexico)

One of the most extensive debates in the science of consciousness is the seeming exclusion of the concepts of free will and determinism with a dialectic mostly understood as an inverse relation between the plausibility of both theories whereas the assumption that a free willed mind voids a deterministic progression of time, and vice versa, determinism logically excludes the possibility of a material free will. Conversely, we explored the possibility that a conscious free willed mind and a deterministic progression of time are logically and simultaneously compatible when intersecting on a multidimensional and reversible timeline. The classical conception of determinism and causality relies on the a single time dimension premise where a single state of universe evolves into a fully predictable future state; nevertheless, special relativity describes time as k-dimensional whereas perceptual timeline seems to happen in one dimension. From another perspective, time-symmetric and multiverse interpretations of quantum mechanics map the wave function distribution of probability into a ‹many pasts' and ‹many futures' concepts. Having these premises, a material free will cause a random or unpredictable future but yet, all the possible futures determined will remain real, although not all time dimensions are observable or evident; therefore, the outcome of a material free will could be approximated probabilistically. Hence, we interpret the consciousness as the physical phenomena that implodes the k-dimensional past into a single time dimension when a wave function collapses into a single eingenstate and analogously, the material free will as the physical phenomena that explodes the collapsed present into a k-dimensional probabilistically determined superposed futures. Considering the time as symmetric, the consciousness and free will constitute the same time-reversible processes with opposite time vectors. This reasoning lead us to the secondary hypothesis that perceptual free will is in fact a distribution of probability of possible futures determined from a stochastic conscious mind instead of a usually perceived single state or punctual free will. These hypotheses raise new physical and philosophical questions regarding the role of the conscious mind on the collapse of the k-dimensional time into a single-dimensional perceptual singularity (present) and the properties of a free willed consciousness on a symmetric, and thus reversible, spacetime understanding. **P2**

234 Demystifying Quantum World and Resurrecting Commonsense and Logic in Physics: A Classical Explanation for the Double Slit Experiment Srinivasa Rao Gonuguntla <drgsrinivas@yahoo.com> (Sri Krishna Hospital, Narasaraopet, Andhra Pradesh India)

The purpose of this paper is of two fold: 1) To provide a simple, rational explanation for the double slit experiment that is consistent with classical physics and our experience of everyday world and 2) To explain how the double slit experiment proves the existence of 'photon ether' or comic ocean of photons. Imagine that we are undertaking the double slit experiment using water molecules. For this, we have a water gun (which can shoot water molecules at any desired rate), a screen with two slits and a 'hydro-sensitive' screen. Imagine that our hydro-sensitive screen registers the impacts of water molecules as bright spots on it and that the brightness at any point on the screen depends upon the number and strength of impacts that it receives. Now we shoot showers of water molecules with our water gun towards the slits in the first screen. While most of the water molecules get stopped by the screen, some of them pass through the slits and go on to hit the detector screen behind. We study the distribution of the hits on the detector screen. It is no surprise that we see the water particles producing two bright bands (particle pattern) on the detector screen. Now let's place our whole setup inside a large container of still water and repeat the experiment. Let's presume that our 'hydro-sensitive' detector screen, despite being surrounded by water, doesn't register any 'hits' because the molecules are absolutely still and as such are not hitting the hydro-sensitive screen. (Of course in reality, due to random motion, adjoining water molecules keep colliding with the detector screen. But these random collisions by the adjoining molecules will only produce a weak diffuse brightness on the detector screen and can be ignored as 'background noise'). Now let's trigger our water gun to shoot water molecules one by one. After a sufficient number have been shot, we study the pattern of impacts recorded on the detector screen. Interestingly, we don't get the 'particle pattern' now despite the fact that we have fired the water particles exactly as before. Rather, we observe 'interference pattern' that is characteristic of waves. The reason is that each water particle that gets fired generates a small water wave which travels towards the first screen. While most of the wave gets reflected back by the screen, a portion of the wave passes through each slit. Thus two daughter waves emerge on the other side and interfere with each other before hitting the detector screen. That produces the alternate light and dark bands on the hydro-sensitive detector screen. So it is the 'water environment' which is responsible for the wave like interference produced by the water particles. Similarly, the fact that light photons produce wave like interference pattern in the double slit experiment implies that there must be a 'photon environment'. Thus double slit experiment provides a direct proof of the existence of comic ocean of photons or 'photon Ether'. **P1**

235 Wave Function Collapse Theories of Consciousness Kelvin McQueen <klvnmcqn@gmail.com> (Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel)

This talk concerns theories that explain consciousness largely in terms of the collapse of the quantum mechanical wave function. I focus in particular on theories which entail that consciousness causes the collapse of the wave function (as opposed to collapse-causes/is-consciousness theories such as Orch OR). I begin with two motivations for such theories. The first concerns the prospect that such a theory might solve the hard problem of consciousness. The second concerns the prospect that such a theory might solve the quantum measurement problem. The consciousness-causes-collapse hypothesis was suggested by Wigner [1967]. However, it was never made precise, and consequently, appeared mysterious and was largely ignored. Making this hypothesis precise requires formulating dynamical equations describing the interaction between consciousness and the wave function, which (at least in principle) can be tested experimentally. Two major difficulties stood in the way of this project. Firstly, there had been no adequate scientific definition of consciousness. Secondly, our understanding of wave function collapse was in poor shape. Both a precise definition of consciousness and a precise formalism for collapse are necessary if dynamical equations describing the consciousness/wave-function interaction are to be found. Today's situation is now different: firstly, there are new neuroscientific theories that treat consciousness as a mathematically definable measurable quantity; secondly, a number of so-called "dynamical collapse theories" have been rigorously formulated. The talk therefore aims to identify the most refined consciousness-causes-collapse theory, using these recent developments in neuroscience and quantum foundations. Appealing to recent collaborative research with David Chalmers, as well as to a recent model proposed by Kobi Kremnizer and Andre Ranchin, it will be argued that the theory can be made precise by defining consciousness in terms of integrated information. In particular, it is possible to define the rate at which a physical system collapses, as well as the form that these collapses take, as functions of the integrated information of that system. It will be argued that theories of this type face a major challenge: the theory requires that the consciousness-causes-collapse dynamics is not completely governed by a strict collapse function. If it were, then consciousness would exhibit the quantum Zeno effect (and thereby completely freeze). The quantum Zeno effect therefore becomes a useful tool for refining the dynamical equations. I conclude by considering whether any such theory has the prospect of solving the measurement problem, or the hard problem of consciousness. **PL7**

236 Quantum Physics is Holistic at its Core - So is Life Joshua Mitteldorf <josh@mathforum.org> (AgingAdvice.org, Philadelphia, PA)

Entanglement is not incidental to quantum physics. Holism is built into the quantum formalism at the most fundamental level. In classical physics, each particle is governed by a separate equation that connects it to other particles and fields. But quantum physics begins with the state of a system as a whole, and describes how the whole evolves over time. (Mathematically, this is reflected in the way the system is represented. Classically, n particles are n points in 3-dimensional space. Quantum mechanically, the configuration of n particles is a single point in 3n-dimensional space.) The mathematics of space of high dimension is not only difficult for our intuition and our imagination; the equations are also exponentially difficult to solve. Thus, the equations of quantum mechanics cannot be solved except for systems of extreme simplicity, with 3 particles at most. The complexity quickly overwhelms our largest computers. As a consequence, quantum physicists in practice do one of two things. (1) Particle physicists go to great lengths to construct simple systems of just 2 or 3 particles, isolated by vacuum. This is what they know how to calculate. (2) Atomic physicists and solid state physicists apply approximate treatments in which a sea or cloud of electrons is modeled by separate particles, as though they were classical. I do not mean to belittle this approach. The approximations are ingenius, and a great deal of predictive science has been derived. All we know

about atomic physics, spectroscopy and solid state physics, including superconductivity, transistors and semiconductors is the fruit of independent particle approximations. But we should not forget that the treatment as independent particles is only an approximate model. We must not be surprised when we discover some phenomena that cannot be explained in the independent particle model. The take-home message for researchers in quantum biology and the physics of consciousness is this: We are accustomed to thinking in ways that are limited by what we know how to compute. We can manage the mathematical description of entanglement that involves pairs of particles. When that system interacts with anything larger, we say it has decohered, and lost its entanglement. But stepping back to a wider view, we might describe the system not as having lost coherence, but of having a coherence on a wider scale. The reality is that large systems are fully entangled, they are just entangled in ways that we cannot calculate. When we apply reductionist thinking to the problems of quantum biology, we are looking for our keys under the lamppost of computability. There remains the possibility that life has figured out how to make use of large-scale entanglement, and that systems like biomolecules or even cells can be described by quantum numbers that are properties of the whole. I would speculate that some such holistic properties can be homeostatic ?by design?; in other words, they are evolved by natural selection to resist decoherence. This, I propose, is a fundamental property of living systems. **C5**

237 Finding Consciousness in the Wave Function Alyssa Ney <alyssaney@gmail.com> (Philosophy, University of California at Davis, Davis, CA)

A defense of the wave function realist approach to interpreting quantum mechanics will be offered, including a description of how states of macroscopic systems like conscious observers may be found in the quantum state. **PL7**

238 CSL Meets Consciousness: A Consciousness Based Solution to the Measurement Problem Elias Okon, Miguel Angel Sebastian <okonelias@gmail.com> (Mexico DF, Mexico)

The superposition principle states that if A and B are possible states of a system, then so is a superposition of A and B. However, we never observe macroscopic objects in superpositions. Although the standard formulation of quantum mechanics depends crucially on the notion of measurement, this is not defined within the theory. To apply the formalism, one needs to know what constitutes a measurement, when it takes place, and what is measured. An important component of the measurement problem (the basis problem) can be isolated. Since the formalism treats all bases (and thus properties) on an equal footing, it does not single out a particular basis in which macroscopic objects are not to superposed: standard quantum mechanics is unable to ascertain by itself what is measured. The measurement problem can be stated more formally as the mutual incompatibility of the following three claims: 1. The description of the quantum vector is complete 2. Quantum vectors always evolve according to the Schroedinger equation 3. Measurements always yield definite results. This is useful to motivate and classify different solutions to the problem. By negating (1) one arrives at hidden variable theories, like Bohmian mechanics, and by negating (3) at many-world scenarios. The standard interpretation negates (2), but it's unsatisfactory because it relies on the undefined notion of measurement to state when the Schroedinger equation is no longer valid. Objective collapse models, like GRW or CSL, introduce stochastic, non-linear modifications to the equation to disallow macroscopic superpositions. However, the basis problem persists. In a recent work, Chalmers and McQueen, have speculated that there might be properties that are never superposed and proposed that consciousness might be such property. This, when adequately articulated, might provide a solution to the measurement problem. However, it might bring along new complications. In such scenario, nothing would prevent the existence of states of well-defined consciousness that correspond to experiences of a superposition state for macroscopic objects. So, if the |Ci> corresponds to states of well-defined consciousness and the |Xi> to states in which the center of mass of a macroscopic object is localized at Xi, states of the form |C1>|X1>+|C2>|X2> would be forbidden, but states of the form |C{1+2}>(|X1>+|X2>) would not. Inspired by Chalmers and McQueen's proposal, we present a fully materialist CSL model in which superpositions of the property on which consciousness depends (whatever that might be), are heavily suppressed. In order to deal with the problem mentioned above, we borrow an idea from Albert and Lower to restrict the set of physical states that correspond to conscious states. We propose that conscious states do not form a complete basis but are a subset of one. For illustration, consider Tononi's Phi. In this case, the preferred basis (the one on which superpositions are suppressed) would be given by that of the level of integration: only states above a Phi threshold would correspond to conscious states. This could explain why we never observe a superposition of a macroscopic state. **C23**

4.02 Quantum field approaches

239 Revisioning Consciousness with Whitehead and the Orch OR Theory Linda Dayem <ldayem@ucsc.edu> (Philosophy, UC Santa Cruz, Santa Cruz, CA)

We need to reconsider what is required by an explanation of consciousness. I argue (i) that it is not possible to explain consciousness if we start with an ontology devoid of any basic experientiality; and (ii) that this experientiality must be a necessary component of the ontology, such that what we consider to be the physical cannot exist without the experiential. Hameroff and Penrose's Orch OR ('orchestrated objective reduction') theory fulfills the first condition by starting with experiential elements in the fundamental space-time geometry, but does not fulfill the second condition because the role of the experiential element is secondary and not necessary to the physical. By revising their starting point to be more aligned with the process ontology of Alfred North Whitehead, whom they cite, the experiential and the physical can be thoroughly integrated as two poles within one process. With this Whiteheadian revision, each physical-experiential quantum event includes choice, and no new actuality (quantum reduction) can result without the experiential element making the choice between objective possibilities. Instead of attempting to explain how consciousness emerges from physical events that do not require any kind of experientiality, we begin with choice and experientiality as necessary to every event, and we explain why some events exhibit complex consciousness while others appear dominated by statistical uniformity. **C10**

240 Nonequilibrium Quantum Field Theory of Brain: Entropy Production Towards Equilibration Akihiro Nishiyama <nishiyama@is.kochi-u.ac.jp> (Department of Science, Kochi University, Kochi, Japan)

Quantum field theory (QFT) of brain with evanescent photons and water electric dipoles is one of the hypotheses expected to explain the mechanism of memory and mind. The preceding researches in this theory lack numerical simulation of far-from-equilibrium multi-energy-mode dynamics towards the formation of the superradiant phase with photons (equilibration) based on QFT, which is distinguished from quantum mechanics and can describe both microscopic degrees of freedom in quantum mechanics and macroscopic matter in classical mechanics. The aim of our study is to describe and investigate the dynamics towards equilibration in QFT numerically. In this presentation we begin with quantum electrodynamics coupled with charged boson fields as a general model of photon fields with water electric dipole fields around membranes of brain cells. In order to analyze the dynamics, we give time evolution equations of classical fields and quantum fluctuations of photons and charged bosons, namely the Klein-Gordon equation and the Schwinger-Dyson equation. We show the numerical results of time evolution where photons and charged bosons interacts each other and mode-coupling collision processes occur. Finally we make a conclusion on whether entropy production towards equilibration (superradiant phase) occurs. **C23**

241 The Quantization Paradigm in Physics and Biology Jack A. Tuszynski, M. Kafatos <jackt@ualberta.ca> (Physics, University of Alberta, Edmonton AB,, Edmonton Canada)

A fundamental tenet in the study of organization in inanimate and living matter is the quantization of energy. In inanimate systems where temperature is a critical organizing parameter, the quantum of action is an atomic-level phenomenon described in terms of Planck's constant, which relates the photon's energy to the frequency of its electromagnetic wave. In living systems, where the cycle time of metabolic processes is the organizing variable, the quantum of action is a cell-level phenomenon described in terms of an analogue of Planck's constant which relates the metabolic energy to the frequency of the enzymatic or mitochondrial oscillators. This article elucidates the relation between these two measures of quantum action. We will review the role of Planck's constant in physics, first, as a fundamental parameter for explaining the empirical laws of black body radiation, to its more modern developments. We will also describe the theoretical and empirical rationale for the cellular level quanta. We exploit this analysis to elucidate how energy transformation in physical processes, where temperature is the organizing parameter, relate to energy transduction in biological processes which are essentially isothermal. Quantum effects in biology are also briefly discussed and these include biophotons, centriole functions, Frohlich's coherence, visual perception, olfactory sensing, bird navigation, light harvesting and photosynthesis as well as quantum evolution, bioenergetics, brain dynamics and most importantly quantum metabolism. It is concluded that the ten orders of magnitude (from 10-34 to 10-24) between the atomic-level physical and the cell-level biological Planck constant correspond to the scale gap between physical building blocks of matter: elementary particles and biological functional units: living cells. We then link the cell level to the organismal

level of metabolism and obtain a scaling relationship for the biological Planck quantum of action as a function of size of the biological system studied. **C5**

242 The Brain is Not a Stupid Star Giuseppe Vitiello <vitiello@sa.infn.it> (Department of Physics, University of Salerno, Fisciano (SA), Italy)

It seems that Aristotele used to say that the stars behave in a stupid way, since they are passing always through the same point in their perennial motion, being in this way completely predictable. Symptom of intelligence is instead to change trajectory at any change of the initial conditions in order to achieve an intentional task. It is clear that the brain does not behave as a stupid star. It does hit an intentional target with precision and determination, sometimes it misses it, it is true, but never the behavior and action of the brain in/on the world around it is void of some intentional plan[1-3]. The brain functional activity is extremely stable and at the same time extremely sensible to adapt its govern of the body to any change of the environment. Then the question immediately arises: how is it possible that myriads of neurons, synapsis, glia cells, all of it in a bath of 90 % more numerous water molecules, each one carrying an electric dipole momentum oscillating under the influence of unavoidable quantum fluctuations, may generate such a precious stability of the brain overall functioning? A dilemma already pointed out by Lashely in the forties, but still waiting an answer. Two complementary approaches have been used to study brain and in general biological systems. In one of the approaches, the naturalistic approach, the brain-system is split into a large number of components, which are then studied in all their details. The problem of combining the data so accumulated in a working scheme able to account for the macroscopic observed functioning of the brain often is left unsolved since it is actually out of reach of this approach. The other approach is the dynamical approach aiming to provide a comprehension of macroscopic features of the brain behavior on the basis of the data provided by the first approach. Both approaches appear to be necessary, although each one of them, separately considered, is not sufficient to account for the full understanding of brain functioning. A bridge between these approaches is built by the dissipative many-body model of brain, where the amplitude modulated (AM) assemblies of coherently oscillating neurons are described in the frame of the quantum field theory. Observations of scale free, fractal-like phenomena in brain activity are also related to the coherent dynamics in the dissipative model[3-5]. A representation in terms of thermodynamic Carnot-Rankine cycles is provided, which describes the process of formation of the coherent AM patterns as a transition from disordered gas-like state of high entropy to liquid-like organized neuronal configurations of low entropy[2,5]. 1. W.J.Freeman, Mass Action in the Nervous System (Academic Press, New York 1975/2004) 2. W.J.Freeman and R.Quian Quiroga, Imaging brain function with EEG (Springer, New York 2013) 3. G.Vitiello, My Double Unveiled (John Benjamins, Amsterdam 2001) 4. W.J.Freeman, A.Capolupo, R.Kozma, A.Olivares del Campo, G.Vitiello, Phys. Lett. A379,2198 (2014) 5.G.Vitiello, in Cognitive Phase Transitions in the Cerebral Cortex-Enhancing the Neuron Doctrine by Modeling Neural Fields, R.Kozma, W.J.Freeman, (Springer, Berlin 2016 p. 239) **C23**

4.03 Space, time and the nature of reality

243 The Structure and Dynamics Argument and Temorally Non-Orientable Manifolds. Uziel Awret <awretu@gmail.com> (Physics, Trinity Washington University, Falls Church, VA)

Both Russellian Monism (RM) and Nagelian Monism (NM, Stoljar) embrace a 'broad physicalism' (Chalmers) in order to provide a viable alternative to both physicalism and dualism, however while RM broadens physicalism by relying on a class of (slippery)dichotomies such as intrinsic/extrinsic, structural/non-structural, relational/non-relational, NM broadens the physical by including the 'predicates of a final theory' (Lewis) or physics at the limit of its theoretical validity (Nagel.) Currently Russellian monists reject NM because of the 'Structure and Dynamics Argument' (SDA): a) Physics describes reality in terms of structure and dynamics. b) SD truths can only generate other SD truths. c) Truths about consciousness are not SD truths. NM agrees with RM that current physics is incomplete but not because it is a priori ill equipped to handle non-structural truths but because it is 'far enough' from the limit of its theoretical validity. Russelian monists believe, arbitrarily perhaps, that physics is incapable of establishing the existence of non-SD truths in its midst and is in need of external philosophical intervention and at stake here are the prospects of a physical theory of consciousness that is free from unnecessary primitive orthodoxy. This is especially true since the history of science convinces us that mature physical theories can determine their scope and limitations from the inside so to speak (Heisenberg's quantum indeterminacy, Godel's arithmetic un-decidability.) One way in which a Nagelian Monist can refute the SDA is by refuting the second premise. Here I will argue that the SDA is threatened by non-metric topology in general and temporally non-orientable spatiotemporal manifolds in particular. For Chalmers a structural description is "...equivalent to a Ramsey sentence whose O-terms are limited to spatiotemporal, nomic, mathematical, and logical expressions." Here we will ask whether spatiotemporal O terms like 'temporally non-orientable' are structural. I will continue with time dependent spatial topology and an age old question raised by Descartes, Kant, Smart, Quinton and others - Can space be cut in two? The question was finally answered in 1978 by Robert Geroch using a relativistic approach showing that 'cutting space in two' either results in temporally non-orientable manifolds or closed timelike curves. Both are non-structural to some extent. In the case of CTC's cutting space into distinct parts constraints their temporal architecture in a way that guarantees not only peculiar unmediated self-access but also indexical actualization (David Deutsch's consistency conditions of qbits in a closed timelike curve) of sorts. I will end by noting that the counterintuitive resolution of this debate on the (dis)unity of spacetime and the possibility of spatiotemporal rupture suggests a 'Lurianic' approach that views persons as 'island universes' of sorts attributing both the radical demarcation conditions and the peculiar temporal architecture of these universes to a common non-structural spatiotemporal manifold thus relating the phenomenological unity (Bayne) and the subjectivity of consciousness to the other minds problem. If consciousness is physical than the same physical conditions that make it almost impossible to access from without are also responsible for its peculiar, intimate and unmediated self-access. **P2**

244 Gravitational and Quantum Molecular Effects in the Neuron Function Gustavo Gomes <gustavorfg@hotmail.com> (EDX, Brasilia, Distrito Federal Brazil)

The maximum speed of dynamical evolution states that the maximum computational speed of a self-contained system is equal to c^2/h ~ 1.4 * 10^50 bits per second per kilogram. Applying this bound to the average human brain, the maximum operations per second is ~ 2*10^50. The Bekenstein bound also establishes the upper limit of information I that can be contained in a finite region of space, with a certain quantity of energy E. Starting from the Bekenstein-Hawking equation, it could be possible to derive a similar limit for the maximum computer speed, but using arguments based in general relativity: ops/s < E/h. According to Orch OR theory, the maximal quantum capacity of the human brain is 10^27 operations per seconds which is much less than the maximum (for example, black holes). Moreover, this quantum processing limit is the same as T > h/E and appears to be intrinsically related to the time tau of Orch OR theory to reduce to classical oscillation frequency (changing the phase and the beats). In some sense, this relates black holes, singularities and the human brain as similar objects with higher computational capacity and also could be linked to the Holographic Principle. The quantum coherent superposed states that emerge in microtubules in the dendrites and soma of the neurons mediates the qubits (quantum bits) and may be connected to the integrate-and-fire mechanisms giving rise to the spikes (action potential) and consequent release of neurotransmitter in synaptic cleft. If it is possible two different neurons have their microtubules entangled through an Einstein-Podolski-Rosen process, then the classic communication between neurons is similar to the classic channel in the teleportation protocol and quantum coherent superposed states could be teleported among the neurons. Finally, the subjective and objective fashion of the collapse of the wave package depends on the observational frame of reference. If one bit in superposition reaches the gravitational energy threshold it reduces to one or the other states objectively (or a superposition of density matrix) for a frame inside the system, but for an external observer the reduction is subjective because it cannot access the intrinsic mechanism by which the system reduced unless it performs a measurement that entangles the measure apparatus and observed system. For a third frame of reference, the system is still in superposition until it performs its own measurement. Then, the wave packet spreads as a hermitian density probability matrix and interacts with the measuring apparatus as a particle such as an informaton, carrying the moving bit of information about the state of the collapsed system. **P2**

245 Phenomenal Information and Six-Dimensional Special Relativity Syamala Hari <murty_hari@yahoo.com> (Cary, NJ)

Earlier, the author proposed that phenomenal information (PI) contained in our brains consists of tachyons. In six-dimensional special relativity (6D-SR) with three space and three time dimensions,which is more suitable for the description of tachyons than the conventional 4D-SR, the PI consisting of superluminal matter and its associated neural correlates built by the subluminal brain lie on two different 4D-Minkowski-spacetimes in the 6D-spacetime. This result is consistent with the Material Dualism theory of Smythies that physical world and phenomenal world contain two different kinds of matter in relative motion and are located in two different cross-sections of a higher dimensional spacetime that includes at least one more dimension of time than the conventional 4D-

SR. Like Smythies's theory, the tachyon theory is also not Cartesean dualism. In 6D-SR, tachyons can pass information to the subluminal brain about its likely future states without violating causality. In view of this feature, our hypothesis that intention, will, or volition all consist of tachyons, would explain why the unconscious neural activity called readiness potential precedes awareness of will/intention in the context of volitional or goal-oriented actions. **P2**

246 A Quantum Programme for the Study of Precognition Daniel Sheehan <dsheehan@sandiego.edu> (University of San Diego, San Diego, CA)

Time is integral to the experience and phenomenon of consciousness; however, the nature of time itself remains controversial. In particular, its unidirectionality – its arrow – remains a central explanandum of physics. Although the fundamental equations of physics are time symmetric, physical reality unfolds with a preferred direction (arrow), and its causal nature – that the past influences the present, while the future apparently does not – has no completely satisfactory explanation (1,2). Over the last several decades laboratory experiments have established with strong statistical significance evidence for retrocausal (time-reversed) activity associated with human consciousness, i.e., precognition. (See, for instance, experiments by Bem, Bierman, Mossbridge, and Radin). One of the primary impediments to the acceptance of this evidence is the lack of a coherent and comprehensive physical theory. While both classical and quantum theory accommodate retrocausation in principle, major hurdles stand in the way of any theory linking them to consciousness, even setting aside the perplexing nature of consciousness itself. First, any time-symmetric theory of consciousness must explain the asymmetry in the normal experience of consciousness and the physical world. Second, this theory (if it is quantum mechanical and materialistic) should identify or justify quantum processes in the brain by which precognition is possible. Both of these essential criterion may be within reach. The first finds justification within several interpretations of quantum theory – e.g., Cramer's transactional interpretation – coupled with quantum versions of the second law of thermodynamics; and the second has been argued with some success by several researchers, including Hameroff and Penrose. This talk will outline in general terms a programme of inquiry by which precognition might be accommodated and investigated within the current paradigm of physics and consciousness. By no means can it be complete, nor can it resolve all issues, but what it will attempt to do is the following. First, this talk will present a theoretical framework in which precognition emerges naturally from standard quantum theory, rather than by caveat or paradox. Second, it will assess the possibilities of quantum processes in the brain that might support this phenomenon. Third, laboratory experiments using inanimate apparatus will be proposed by which precognition might be investigated without the confounding influences posed by the use of conscious (human) subjects, which is currently the norm. References: 1) D.P. Sheehan (Editor), Frontiers of Time: Retrocausation – Experiment and Theory}, AIP Conference Volume 863, (American Institute of Physics, Melville, NY, 2006). 2) D.P. Sheehan (Editor), Quantum Retrocausation: Theory and Experiment, AIP Conference Volume 1408 (American Institute of Physics, Melville, NY, 2011). **C6**

247 Transportation of the Solid Matter of the Universe in Space Time as a Wave of Electromagnetic Energy Based on Templates of Quantum Brain Dynamics Jimmy Vigo <jvigo@elp.rr.com> (Research and Development, The HVB Research Foundation, El Paso, TX)

In the previous publications of the Theory of the Hidden Variable Behind it was established that the transportation of the solidity of the universe in space time since the initial expansion after the Big Bang can be represented as a wave of vibrational electromagnetic energy propagating over an otherwise undisturbed ether similar to the energy traveling on the domino effect. To create a model of the mechanism the 3D eight petal shape of the energy distribution of the electron in an atomic f orbital is simulated in 2D by the polar equation r=sin100 . Its transportation from a point A to a point B in spacetime is represented by the harmonics r=sin100 - (point A) to 140 - (Point B) which transforms the initial softness of the petals into sharp thorns through cycles of changes of symmetry until returning it back to that of the eight petal f-like shape. Each distribution of the energy is interpreted as squeezing the wavefunction until the middle point or node r=sin120 - generates a chaotic asymmetrical figure and a point of mirror-inversion of symmetry. The cartessian x,y values of the roses represent a gene-like coding matrix or templates of instructions representing the dynamic re-distribution of energy during transportation. Each energy distribution is associated with a distinct degree of duality obtained by scrambling the 900 degree or orthogonality between the magnetic and electric field. This is postulated to be accomplished by allocating more energy in the form of vibrational waves and less into solidity thereby allowing objects to be transported more 'ethereal' as a wave of vibrational energy. The templates are planned to be incorporated into equations of motions that

transport the solid matter through cycles of mount-dismount-remount called replacement. Initially the universe represented by 100 - is solid, then 'wrapped' for transportation through functions 101-139 - and finally rebuilt at point B (140) with the matter available at point B. A proposed '4th law' of thermodynamics 'energy use is always minimized' allows for one solid universe and one set of templates. The wave function of the energy distribution is assumed to collapse at the distinctive shapes of the mechanism, each having a different degree of energy repulsions and stability. The wavefunction is assumed to be continuous at the collapsed figures but discontinuous between points A and B, where the concepts of quantum zeno effect, quantum coherence, and quantum decoherence play a fundamental role as presented in the quantum model of consciousness by Henry Stapp. The study represents a mechanism at the sub-quantum level and a continuation of the initial theory of hidden variables put forth by Einstein, Rosen, Podolsky, and more recently by David Bohm in his theories of the implicate order. **P2**

4.04 Cosmology and integrative models

248 Differential Cosmology and Consciousness Daniel Beal <dmbealmd@msn.com> (Psychiatry, Palo Alto VAMC, Scotts Valley, CA)

Our concept and theory of the cosmos determines how we think about consciousness. Differential consideration of the Big Bang theory of cosmology and Plasma Cosmology, a steady state universe model, born of empirical observations in the Scandinavian arctic, will be reviewed with their implications for the science and theory of consciousness. The most common cosmology theory, the Big Bang theory, limits aspects of consciousness theory in ways that a dynamic steady- state universe does not. The Big Bang gives us about 13.7 billion years for consciousness or the conditions for consciousness to evolve. The Plasma universe gives a much longer time for the evolution of consciousness. Patterns of Galactic clusters, a large scale feature of the universe, need at least 150 billion years to form; this is a lower limit, a plasma universe is likely much older . The Big Bang is more a creation myth than a scientific theory. It was proposed by Father Georges Lemaitre, a Catholic Priest in 1927 as developing from the "Primeval Atom". It was not taken seriously until the 1960's, but now conflicting observations of the cosmos are ignored and odd concepts like 'Dark Matter' are developed to support the Big Bang. Plasma cosmology readily admits evidence from astronomical observation. Plasma cosmology has the advantage that electrical plasma can scale from the laboratory to stellar, galactic and cosmologic magnitude. This yields a system in which astronomical observations can be tested in the laboratory. Plasma cosmology began in 1900 with direct polar observations of the Aurora borealis by Kristian Birkeland, which showed the electrical plasma nature of the Aurora. Additionally, electromagnetism, which is 10^39 more powerful than gravity, can explain phenomena that gravity cannot. Hannes Alfven received the Nobel Prize for "for fundamental work and discoveries in magnetohydro-dynamics with fruitful applications in different parts of plasma physics" in 1970 and believed his work supported a plasma universe. He advanced plasma cosmology and noted that cosmological theories over the ages seemed to alternate between creation myths and scientifically testable theories. If cosmological theories globally influence our world view, how do these different cosmologies affect our theories of consciousness? The first is foundational, a cosmos based on a creation myth creates a different intellectual basis for cosmology than one based on empirical observations. Second is if we accept the materialistic proposition that consciousness is epiphenomenal to the brain and there is the possibility of panspermia in the origin of these biological systems, are there different implications. How does a 13.7 billion year old universe operating by gravity and fusion stars differ from a trillion year old universe operating by gravity and electromagnetism with stars as anodes in the production/transmission of organic/biological material through space? Third, if we accept consciousness as primary or independently interacting with biological systems, we then have consciousness that developed in a 13.7 billion year old gravity/fusion universe versus consciousness that developed in a trillion year old gravity/electromagnetic universe. Will consciousness have different properties? These points will be elaborated. **P1**

249 Changing the Scientific Paradigm: With Joy You Will Come to Understand Reality as Nested Structured~duality (NSD) – Nested Fields Within Nested Fields Ralph Frost <ralph@frostscientific.com> (Global Science Education, Frost Scientific, Brookston, IN)

Getting to the science of consciousness is synonymous with changing the dominant scientific paradigm. Generally, changing the scientific paradigm, is quite straightforward and amounts to changing tenets: picking a structure and one or more dualities. In this presentation the author summarizes some key findings during his exploration in paradigm mechanics. The journey begins back around 1977, after metaphorically free-falling for about 60 levels of nested organization below the founda-

tions of the dominant western scientific model, to encounter the underlying general principle of structured~duality. It includes doing exercises to develop physical intuition via the analog math in the spin-related multiple state, variable mass-density artifacts the author calls magnetic tetrahedra. Some turning points along this particular trail are: – How would you like to present a scientific discovery? – Seek a thought worthy of speech. – What do you get when you build a tetrahedron out of magnets? – Consider the five ways to align four rod magnets along the radii of a tetrahedron. – Consciousness is carbon- and water-based and thus, tetrahedral. – Imagine consciousness as an internal 6^n analog math made of ordered water, forged during respiration in concert with experience. – Experience exists; time does not. – Reality, both physical and mental aspects, is nested structured~duality (NSD) and/or nested fields within nested fields. – Space and spacetime in the dominant scientific paradigm are not fundamental but are blurred artifacts of consciousness (abstract mathematics) [..parts of the map, not the territory.] Fast-forwarding to the present: developing and successfully swapping in a global scientific paradigm upgrade, on-the-fly, is an interesting challenge. When it does occur for the current paradigm transition in question, the successful candidate, the author predicts, will have attributes similar to those encountered and summarized as for the model above: 1. Physical and mental artifacts will reduce to or share a common single principle and category. 2. Analog math will convey and reflect the core principle, category and other features very succinctly. 3. Overt features of the emerging paradigm will be found as covert, unconscious or hidden features in the previously dominant trial theory. 4. The two paradigms will have some features which are complimentary and that nest within each other. 5. The waning paradigm will have categorical errors which the emerging paradigm makes visible. **P1**

250 The Case for Panpsychism in a Hyperdimensional Physics Model - Integrating Nonlocal Consciousness in the Universe Chris H. Hardy <chris.saya@gmail.com> (Eco-Mind Systems Science, Seguret, Vaucluse France)

The materialist paradigm in science is checkmated by recent physics discoveries, such as ordinary matter being only 5% of the total energy of the universe, and mass no more an intrinsic property. The cutting edge and hard question in cosmology and physics is What exists before the very Planck scale that allows particles (matter), and spacetime, thus causality, to be? Physicists invoke an information-field, yet it has to be dynamical, self-organized, immensely energetic. Five types of processes display nonlocality: entanglement; psi (proven to operate beyond-brain and beyond-spacetime); the sub-Planckian region at the origin; a beyond-spacetime non-material dark energy; faster-than-light speeds, e.g. during the inflation phase (Guth). Kaluza showed that only hyperdimensional models could unify the four forces; similarly, the Infinite-Spiral-Staircase Theory (ISST) integrates consciousness in the universe as a hyperdimension populated by faster-than-light, high-energy, sygons. ISST solves the need for (A) a layer of self-organized nonlocal consciousness distinct from brains, matter and spacetime; (B) self-organized non-matter energy at the sub-Planckian scale (both are merged in ISST). The semantic, meaningful, processes of A (as in psi) forbids this layer to be indeterministic and random (thus excluding the vacuum Zero-Point-Fluctuations). Yet the creativity, free will, and self-reference exhibited by A forbids this layer to be fully deterministic: it has to display creation of order, rising complexity, and self-organizing dynamics, such as network connectivity and chaotic attractors. ISST posits a triune CSR hyperdimension at the origin, with hyperspace (Center, C), hypertime (Rhythm, R) and consciousness (Syg, S). It is topologically organized as a phi-based golden spiral. The origin is a Roy Kerr type BlackHole-WhiteHole system, a hourglass-shaped double-spiral, each bearing a near-infinite databank of frequencies (on the logarithm of phi or Fibonacci sequence), launching the tachyonic sygons. Within the terminal BH of the parent universe, all matter-systems were translated into pure CSR information or syg-fields; and through the WH, the CSR syg-fields are translated back from virtual sygons into post-Planck particles and matter systems. ISST accommodates the double-nature of consciousness, embodied yet nonlocal. The CSR-HD is all-encompassing, existing at a sub-Planckian scale at the origin and at any spacetime coordinates, in all systems. The hyperdimension of a system is its dynamical meaningful organizational layer, its semantic (syg) field, more or less evolved, from a proto-consciousness to a mind (Hardy 1998, 2003). The framework of ISST is panpsychist, with the hyperdimensional sygons (syg-energy) pervading each atom, cell and body, thus based on a deep, multilevel and distributed, mind-matter coupling. The hyperdimensional sygons, pure syg-energy, create instant nonlocal connections between resonant semantic fields (thus explaining telepathy, synchronicities, Hardy 2011). ISST expresses a systemic, holographic, universe, infused with a self-organizing, collective consciousness, the cosmic syg-HD, that allows creativity and change; it posits a participatory universe (Wheeler, Sarfatti), with two-way ego-Self communication, and synergy between a syg-field (i.e. intelligent being) and the syg-HD; it is also a budding-universe hypothesis (Smolin, Penrose). The evolved semantic fields of human beings, trees or psychotropic plants, all operate creatively using syg-energy from the alive, conscious and creative sygons-fields pervading the universe. **P2**

251 Consciousness and the Theory of Everything of the Universe Abed Peerally <abed.peerally@gmail.com> (X,)

Cosmological knowledge has evolved significantly in the last 12 decades particularly due to the ideas of Poincare, Lorentz and particularly Einstein (1905, 1916), Lemaitre (1931), Peerally (2008, SAJS; vixra 2014; academia.edu, 2014) amongst others. Currently the draft of my first book on the origin of the universe entitled "Power of Somethingness and of Nothingness: The Mind behind the Universe, and Consciousness", is being processed to be published in late 2016, to be followed in 2017 by the second and final volume entitled "The Origin of the Universe: The Theory of Everything". Consciousness is a universal "awareness" property resulting from the interplay of physical realities which exist in every independent physical entity and natural phenomena that resulted from the act of creation of the universe, 13.8 billion years ago. While time is puzzling because there is no physical reality behind its mathematical reality, consciousness deliberately resulted from the act of creation and can be scientifically explained by the Theory of Everything, the concept which describes the exact manner the universe was conceived. This is why all theories of the origin of the universe which cannot explain the occurrence of consciousness have to be considered as imaginary and not scientific concepts. My Theory of Everything will show how the precursors which led to our universe had elements of consciousness within them although they did not have the same realities of consciousness as our universe. The cosmic primordium, produced from its metaphysical precursors, subsequently formed our universe, in a manner which enabled the expression of both an entity consciousness, for each physical reality, and a collective process consciousness for phenomena. Thus cosmological, physical, chemical, societal, theological, political and biological evolution, amongst others, occur as progressively as possible towards greater perfection, in spite of the occurrence of indeterminism in what ultimately are deterministic evolutionary processes. Every bit of existence is due to physical realities endowed with consciousness, and Einstein's question as to whether the Mind behind the universe had any choice to produce our universe is that there was none. The Theory of Everything shows that the universe has a comprehensible structure and construction, and it is consciousness which ensures that humans will understand how and why the universe was so conceived. The expression of consciousness is tied to physical realities such as motion, energy, acceleration, synchronous oscillations, quantum wave function and in animals to the interconnection of billions of nerve endings and neurons. The expression of consciousness can be elucidated scientifically but the explanation of what is consciousness amounts to the interplay of the totality of whatever we have in physical and biological realities. All processes in a particle, a living cell, a macro entity and in all phenomena are finally a consequence of the realities of consciousness. Because the precursors of the cosmic primordial stuff which led to our universe, had components of realities of consciousness in them, makes both consciousness and our universe metaphysical realities which cannot be emulated, except in robotics in limited ways. **P3**

252 How the Stock Market and the Sun, Moon and Planets May Provide Indirect Evidence of Orch OR's Scientific Validity David Smolker <dsmolker@aol.com> (Apollo Beach, FL)

Penrose/Hameroff's Orch OR theory provides a promising physical explanation of consciousness. However, it lacks direct experimental proof due to the difficulty of accessing the Planck scale. Henri Poincare observed that sometimes the only breach through which we can attempt to penetrate what was previously thought impregnable is to look to cyclical phenomenon. Edward Dewey, cycle theory's father, catalogued 1,404 economic cycles involving 151 types of economic phenomena finding that the distribution of lengths of various cycles was not random and instead clustered around certain lengths and that seemingly unrelated natural phenomena appear to possess the same cycles. He concluded, "we are not dealing with chance behavior, but rather "unknown rhythmic natural environmental forces" that "alternately stimulate and depress mankind in mass." If Orch OR is correct, the character of collective human consciousness should be synchronized to periodic changes in gravitational environment relevant to Orch OR, and such changes should be reflected in financial markets since they are a proxy for the character of collective consciousness. There is evidence that vital functions of plants and animals, including humans, are synchronized with lunisolar tide raising cycles. Further studies demonstrate statistically significant correlations between various markets and lunisolar tidal cycles . Pearson coefficient correlation analysis of the stock market and the rate of change in the angular momentum of the Sun as it orbits the center of mass of the Solar System

since 1805 reveals that the major peaks and turns and periodicities are coincident. Tidal forces are transmitted by gravitational waves that generate ripples in space-time that propagate away from their source at the speed of light, pass through all matter and carry energy. The gravitational waves generated by the Sun, Moon and planets along with a stochastic background of all gravitational waves coming from all sources and directions within the Universe should interfere with each other generating a complex subtly vibrating four-dimensional standing wave through which the Earth and all life on it continually pass. Because tidal gravitational forces are additive, they are strongest when three or more celestial objects are aligned. The configuration and amplitude of this vibrating gravitational standing wave front as experienced from Earth should fluctuate as the Sun, Moon and the major tide-raising planets come into and out of alignment with Earth. The energy contributions from tiny changes in the lunisolar tidal gravitational forcings are within the operative range of those that influence quantum-level cell function. The foregoing suggests that tiny cyclical changes in the tidal gravitational forcings of the Sun, Moon and planets could influence Orch OR beat frequencies by affecting the temporal separation "T" and spatial separation "S" of the Planck-scale super-positioned space-time manifolds said to collapse in instances of proto-consciousness. The brain's complex hierarchical fractal microtubular and neuronal structure, its colloidal character, and its chaotic, far from equilibrium, rhythmic, scale-free, stochastic resonant oscillatory functioning make it potentially sensitive to and potentially capable of amplifying such changes ultimately expressing them as cyclical changes in the intensity of collective conscious emotional behavior reflected in financial markets. **P2**

4.05 Emergence, nonlinear dynamics and complexity

253 How Can Artificial Intelligence Benefit From Quantum Resources? Hartmut Neven <neven@google.com> (Visual Search, Google, Venice Beach, CA)

I will describe two architectures, quantum annealers and quantum circuits, the Quantum AI team at Google is experimenting with in order to learn how to use quantum resources to accelerate tasks important for AI. Quantum annealers are a promising tool to find good solutions to hard combinatorial optimization problems. In recent tests we were able to show that finite range quantum tunneling enables the D-Wave 2X quantum annealer to solve crafted benchmark problems 10^8 times faster than purely thermal annealing that does not employ tunneling. Another computational resource that only recently attracted attention is many body delocalization which generates wave functions that offer an elegant mechanism to sample states with low energies, a task useful for probabilistic inference but expensive for classical methods. I will discuss the implications of these theoretical studies and experimental results for the design of next generation quantum annealers and quantum circuits. As an example how to apply quantum annealing to machine learning I will describe learning from very noisy data. With quantum circuits we implemented what could be described as a quantum neural network. In a first application we used such a circuit to calculate the energy surface of molecular hydrogen to chemical precision. The resource of interest here is the fact that during their evolution the states of even modest size quantum circuits, with just about 50 qubits, have a support in Hilbert space so large that they can not be represented anymore by classical means. **PL6**

4.06 Hierarchies, scale-invariance and 1/f systems

254 Predictive Brains: Developing Hierarchical Generative Models. Is a Perfect Prediction of the World Possible? Suresh Idnani, Swati Idnani; Teena Idnani <stidnani@gmail.com> (Indian Bank, New Delhi, Delhi India)

"The whole function of the brain is summed up in: error correction." So wrote W. Ross Ashby, the British psychiatrist and cyberneticist, some half a century ago. Brains, it has recently been argued, are essentially prediction machines. Predictive coding framework proposes that the brain's business is this iterative, inferential process of establishing the most likely cause for incoming sensory data, given prior knowledge about the probability of such causes. These predictions are woven continuously into what could be called a 'model' of the world. In this theory, which turns the classical view on its head, sensory input is not the leading actor in determining perception; instead, it takes the more supportive role of providing a corrective measure in the anticipatory guessing game continuously created by the brain. Hierarchical predictive processing combines the use, within a multilevel bidirectional cascade, of 'top-down' probabilistic generative models with the core predictive coding strategy of efficient encoding and transmission. In the specific instantiation of predictive coding (The 'Explaining Away' model by Gotts et al.), each layer contains three types of neurons: Not just those coding prediction error, but also those coding predictions (from higher layers) and input

(prediction errors from lower layers).It means that the nervous system is fundamentally adapted to deal with uncertainty, noise, and ambiguity, and that it requires some (perhaps several) concrete means of internally representing uncertainty. As part of our research, we intend to study ? 1. Some hierarchical predictive models in conjunction with cortical processing happening in the brain within the confines of a simulated model to determine if the Brain's error correction capabilities can be maneuvered to devise an error free and perfect prediction model. 2. We thereby intend to review if It is also possible that through model revision, occurring at multiple levels of its hierarchical structure, also enhances the overall internal consistency of the model, which may in turn promote more globally coherent behavior in the long term. **P1**

255 Improvisational Subjective Induction Theory Mark Valladares <markvalladares@yahoo.com> (Overland Park, KS)

Improvisational Subjective Induction Theory (ISIT) consolidates ideas and evidence into a cohesive theory for how Consciousness both creates and nestles in bio-intelligent mechanosensing structures. Given that Chalmers formulation of the Hard Problem constrains us to the premise that Consciousness is fundamental, an idea substantiated by Microtublin (MT) self assembly in the presence of gamma synchrony, ISIT holds that the Principle of Dynamic Instability that governs self assembly is due to Consciousness imbuing Criticality on the living architecture it then uses to traverse scale. Because it is not bound by scale, Consciousness is neither a localized feature of nested synchrony nor emergent from the assemblies that sustain it. ISIT accounts for a fundamental form of Self Awareness as Consciousness toggles a perimeter/membrane to delineate the inner flux as an inner feel. There is a dual aspect of Awareness wherein Flicker/Fractal Noise as the reflexive bedrock Awareness reads the inner flux corridor. Self-Awareness then is a byproduct of dipolar coupling and a subset of Consciousness, and emerges in precise relation to the synergies constrained at the perimeter. Hexagonal arrays from MAPs on MT lattices to Connexions that form gap junctions in the panglial syncytium are implicated as the corridors through which Consciousness permeates scale to resolve the coherence of Self-Awareness (at such hubs as Centrioles and Pyramidal Neurons). The density of Fractal Noise provides some measure of the degree of Self Awareness. The Principle of Dynamic Instability applies across scale as Consciousness induces and imbues cellular assemblies with Criticality. The imposition of structural stability from all such assemblies will constrain synergies to drive functionally adaptive mechanisms (per Van Orden's tensegrity model). ISIT defines a relationship between Criticality, Constrained Synergies and Creativity. For example, the disassociation of the cortical hub (turning off self-direction and self-monitoring) to return whole brain systems to Criticality, unleashes Creativity for improvisational jazz musicians (Limb et al 2008). ISIT extends the model of dissipative QFT to describe macro to micro conversions derived from scale-free Neurodynamics. Consciousness beyond Attentional Awareness improvises creative choice from holographic wave packets imprinted on the MT lattices to subjectively induce a response to field potentials. Subjective Induction is a bifurcation triggered from the aesthetic feel. Consciousness chooses from a web of constrained synergies in the same manner that, in the case of a seasoned tennis player, 'the constrained mechanism of a stroke' (from Van Orden) is induced by feel of the incoming ball (with a delay in neural processing). As with musicians in Limb's experiment who felt an 'outside intelligence' to be at work, the theory dislodges hierarchies associated with the organizational power in the cerebral cortex to substantiate Van Orden's conceptualization of the blue collar brain in relation to the body. When Self-Awareness capitulates to the aesthetic feel as in high performance play it nestles at the fine scale. Hameroff et al (2012) have established how memory encodes MT lattices and have accounted for the robust information processing there for macro Induction of a whole body response. **P2**

4.07 Logic and computational theory

256 A Scheme for Light Based Computation Using Microtubules as Nanoscale Waveguides Saatviki Gupta, Nandita Gupta; Arun Kumar Gupta <saatviki@gmail.com> (Physics, Dayalbagh Educational Institute, Delhi, India)

This paper examines the possibility of microtubules (MTs) acting as cylindrical resonant waveguides and in this configuration, allowing logical operations to be performed within the MT networks using photons as the medium for information processing. The phenomenon of the transport of surface plasmon polaritons (SPPs) along waveguides in the subwavelength dimensions has been used to form nanoscale photonic circuits that use novel structures to implement logical operations. Previous studies have shown that SPPs can concentrate electromagnetic energy into nanometer scale volumes which allows light to be maneuvered and manipulated even beyond the diffraction limit. In

devices based on branched nanowire networks, plasmons travelling through them meet at the junctions and interfere with each other causing a modulation in the near field distributions. It is seen that as the phase difference between the two colliding plasmons is varied, the near-field distribution of the output changes. By configuring different input sources of varying phases and by assigning 0 and 1 to different intensity values by deciding some threshold cutoff, interaction of these signals at pre-decided junctions can lead to logical operations. Based on this idea, it is proposed that MT networks within the neuron act in the same manner as the nanoscale waveguides discussed above. Light travels through them by total internal reflection, however, in this scheme the interconnections between MTs in the form of MAPs (MT associated proteins) would be the junctions where interaction between different inputs would take place and the output would propagate along the MT until it once again collides with another input and so on. In such an arrangement, the position of the MAPs would decide the overall computational cascade and would allow fluidity in channeling the information (in this case photons) into the branch that would allow it to interact with another incoming signal to give the required logical output. The use of light, coupled with the extremely high density of logical operations possible per-unit-area in this scheme, may theoretically allow ultra-fast calculations and information processing even at the scale of a single neuron. **C15**

4.08 Quantum brain biology

257 Persistence of Quantum Coherence at Macroscopic Scales in Nonlinear Systems Siegfried Bleher <sbleher@msn.com> (Inner Life Yoga Studio LLC, Morgantown, WV)

Does processing at the quantum level actively contribute to macroscopic brain function and consciousness? It is a given that at atomic scales quantum effects dominate, and at molecular scales quantum effects may have measurable influence (for example, on energy levels of molecules, on transition rates between different conformal molecular states, and on reaction rates). But it is still an open question whether such quantum effects persist in the noisy thermal environment of the brain over large enough time and spatial scales to contribute to brain function. There is now evidence with the work of Graham Fleming, Birgitta Whaley and their colleagues that green sulfur bacteria may utilize relatively long-lived quantum entanglement among chromophores in bacteriochlorophyll molecules to enhance the efficiency of photosynthesis. Quantum entanglement in this case persists despite thermal perturbation from the environment. In this paper we explore a classically nonlinear model system (Henon-Siegel map) whose classical phase space contains homoclinic tangles and periodic orbits, and whose quantized version exhibits entangled features that 'stick' to the classical periodic orbits and homoclinic tangles. The nonlinearity and the presence of thermal perturbation can both be controlled in this system. A measure of global quantum entanglement is used to gauge the impact of thermal noise on the lifetime of entanglement and coherence. We investigate the effect that nonlinear classical dynamics has on persistence of quantum entanglement, in particular at the bifurcation from recurrent to chaotic behavior in the classical system. The relevance of our results to Fleming's work and to models of brain function is discussed. C23

258 Subatomic Spins as Qudits of Odd Prime Dimension Shiroman Prakash <shiroman@gmail.com> (Physics and Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Several authors, perhaps most notably Penrose and Hameroff, have boldly advocated for some sort of quantum information processing in the brain. A major difficulty for any proposal for quantum information processing in the brain is decoherence, which causes many to dismiss the idea without any further discussion. However, in the past 20 years, quantum information theorists have made tremendous progress in the study of quantum error correction – the subtle ways in which quantum systems can encode and protect quantum information from a (slightly) noisy environment. While most research on quantum error correction focuses on qubits (two-state quantum systems), recent work seems to indicate that error-correcting codes based on d-state quantum systems – qudits – where d is an odd prime, may be far more resilient to decoherence. (Consider, e.g., the three qutrit code.) Tubulin heterodimers have been proposed to serve as qubits by Penrose and Hameroff. Is there a natural candidate for a qudits of odd prime dimension in the brain? Inspired by recent suggestions by Fisher on quantum cognition based on phosphorus nuclei (which have spin-1/2) acting as qubits; one might search for a nuclide of nonzero integer spin s=1, 2 or 3 to serve as an odd prime dimensional unit of quantum information in the brain. As far as I know, nitrogen-14 and lithium-6 are the only such nuclides, both of spin 1, occurring in nature that are both stable and abundant. (Deuterium also has spin 1 and is stable but is rare at 0.01% abundancy.) Nitrogen is of course, common in biological molecules, occurring, e.g. in tubulin. Experimentally, (as noted by Fisher) Seczher et al. (1986) found

the effect of Lithium on rat behaviour depends significantly on whether the isotope used is Lithium-6 or Lithium-7. Observing similar isotope effects, say for nitrogen in tryptophan, would provide further support for this proposal. Nuclear spins may have long coherence times (even of the order of seconds or longer) so the challenge in developing a plausible model is not decoherence, but finding a way to couple quantum information stored in spins to the rest of the brain. Unlike spin 1/2 nuclei, higher-spin nuclei possess electric quadrupole moments; this could result in additional coupling to electronic degrees of freedom in surrounding molecules, but slightly shorter coherence times that, could, optimistically, be offset by possible advantages offered by qutrit quantum error correcting codes. **P1**

4.09 Biophysics and coherence

259 Origin of Unique Pattern We Observe in the Resonance Frequency Distribution of Proteins Anirban Bandyopadhyay <anirban.bandyo@gmail.com> (Advanced Scanning Probe Micros, National Institute for Materials Science, Tsukuba, Ibaraki Japan)

We have investigated the structural symmetry of proteins and determined why peculiar grouping of resonance frequency occurs in the proteins and their complexes. We have investigated more than 20000 proteins theoretically and around 10 proteins and their complexes experimentally. Using cavity resonator model we have identified accurately how distribution of primes in the number system plays a vital role in determining the grouping of resonance frequencies. So far we have published only the experimental data, as is, now, that we have determined the mathematical origin of distribution of resonance frequencies, it appears that nature relies on the number system to create materials and composition of frequencies is an example of a beautiful mathematics. **PL2**

260 A Hypothetical Model Towards Curing Diseases of the Body Hari Cohly, Bharat Agarwal, Alakh Saini (DEI); Hari Har Parshad Cohly <hcohly2005@gmail.com> (Biology, Jackson State University, Jackson, MS)

Mantra initiates a vibration which corresponds to spiritual energy frequency and a state of higher consciousness. Reverberations of the sound awakens the spiritual life force that stimulate the chakras. In the Hindu mythology repetition of mantras gives you the ability to achieve with the sounds that correspond to the regions from where they emerge for example the repetition of the name 'OM' corresponds to the name that reverberates in the cosmos. Just like Do, Re, Mi, Fa, So, La, Ti, Do has a unique frequency of sound associated with it similarly the mantra ra dh soa mi has a unique frequency associated with the four individual components viz RA DHA SOA MI. It is hypothesized that there are particular frequencies of sound that when articulated at the chakras they can elicit an optimum physiological response that corresponds to the point where the body has the optimum equilibrium at the level of homeostasis. Therefore, if one uses the frequency generator to reproduce the frequencies of the four components of the holy sound RADHASOAMI at the different chakras it should generate vibrations that would give the optimum effect on the body that corresponds to the level of equilibrium at homeostasis. Navel chakra would generate equilibrium for the gastrointestinal and reproductive tract, the heart center would generate equilibrium for cardiac and circulation parameters, the throat chakra would produce normal values for the thyroid and the eye center would generate homeostatic values of measurement for organs like the ear, the nose and the eyes. This study will bring credence to the importance of doing meditation and repeating the holy name RADHASOAMI individually at different chakras of the body and bring about a healthy state of body under optimum homeostatic control. **P1**

261 The Quasicrystalline Nature of Consciousness and the Universe Klee Irwin <klee@quantumgravityresearch.org> (Quantum Gravity Research, Los Angeles, CA)

Spiritual and some scientific approaches attempt to connect consciousness to the structure of the universe. For example, Deepak Chopra posits the Vedic view - that consciousness is the ground of physical reality. However, this spiritual model leaves the inquiring scientist asking the same question a child might ask a priest, "How did this God-like universal consciousness come to be?" The Penrose-Hameroff Orch OR theory attempts to answer by saying consciousness resulting from a Fibonacci-string based quantum code in microtubules is connected with non-local consciousness corresponding to an unknown quantum gravity theory at the Planck scale 23 orders of magnitude smaller, i.e., a theory of everything that would reconcile the outstanding disagreements between general relativity and quantum mechanics. Quantum Gravity Research (QGR) deduced a Fibonacci-string based spacetime substrate of quasicrystal geometry and spin-network operations. The model holds promise of becoming the words only "geometric first principles theory of everything". Such a theory,

for example, would provide an analytical expression for the fine structure constant - leaving no value in nature, such as the speed of light, unexplained by simple first principles. Coincidentally, Roger Penrose invented spin networks. He has also done more than anyone to popularize quasicrystals, such as Penrose tilings. Could such geometric vibrations intrinsic to the universe reverberate upward to reach biology? Perhaps if the substructure of spacetime were endowed with a fractal size scaling quality. This would provide an energetic pathway for cascades of vibrational information to freely move up and down a vast ladder of size scales from the unfathomably small Planck length on up through atomic scales and beyond. Like DNA, the Fibonacci-sequence based geometry of Microtubule 'A-lattices' provides a rigorous mathematical framework for such a conjecture - but only if space-time itself were based on such a Fibonacci-chain fractal structure. Is there any evidence for energy expressions in microtubules flowing up and down such a fractal scale? Anirban Bandyopadhyay et al recently detected resonances in microtubules with quasicrystalline-like patterns. The vibrations are musical in some sense, with a rhythmic progression of frequencies moving up and down a fractal size scale - going from terahertz to gigahertz to megahertz and so on. Musical composer and scientist, Timber Wolf, converted Anirban's microtubule music to a frequency scale we can hear. He couldn't resist jamming with the rhythms using his keyboard. Let's have a listen. **C14**

262 Exercise-Induced Changes in Microtubule Stabilization in Alzheimer's Disease Mediated by Ultraweak Emission of Ultraviolet Photons? P Kurian, T. J. A. Craddock; T. O. Obisesan <pkurian@gmx.com> (Postdoc, National Human Genome Center, Washington, DC,)

A hallmark of Alzheimer's disease (AD) is neurofibrillary tangles, which are thought to arise from hyperphosphorylation of the microtubule-associated protein tau. Studies suggest that aerobic exercise is cognitively protective by promoting increased antioxidant enzyme production and therefore enhancing the removal of reactive oxygen species and other free radicals produced during respiration. Alternatively, the interaction of free radicals with biomolecules can result in ultraweak emission of ultraviolet (UV) photons. This ultraweak emission can excite a variety of biomolecular structures that serve as chromophoric antennae complexes, including nucleotide chains in DNA and aromatic amino acid networks in neuronal microtubules. Microtubules reorient and reorganize in a dose-dependent manner after exposure to UV light, with the greatest effect being observed around 280 nm. Functional microtubule networks may use the energy from this UV light as a signaling mechanism throughout the cytoskeleton. Since microtubule networks in AD patients and individuals with mild cognitive impairment (MCI) are compromised, they would be unable to support effective channeling of these UV photons for signaling. Thus, the consequent UV surplus may lead to cellular oxidative damage and hasten cognitive decline. We hypothesize that UV photons, at or near a critical wavelength of 280 nm, can excite coherent behavior in tubulin aromatic networks and can be modulated by exercise. We use diverse computational and theoretical methods to analyze coherent energy transport in aromatic amino acid networks (e.g., tryptophan, tyrosine, phenylalanine) of tubulin, the protein subcomponents of microtubules. We present coherent excitations in these tubulin networks that promote global stabilization, randomization, and/or depolymerization of microtubule structures and those cases where microtubule stabilization might have an ameliorative effect on neurofibrillary tangle formation, which correlates with AD and its prodromal MCI stage. These studies address a critical barrier to progress in the field of neurodegeneration by developing a mechanistic explanation of how light produced from aerobic activity may affect cytoskeletal signaling, genomic regulation, and other coherent cellular processes. **C23**

263 Frequency Fractal Harmonic Resonance: Understanding Conscious Experience CM Markan, Priti Gupta <cm.markan@gmail.com> (Physics and Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Conscious experiences are vital for our survival and evolution in this world. These experiences are either bottom-up, generated by sensory orchestration, or top-down, generated by subtle regulatory processes in the form of HOT: Hierarchical Ordered Thoughts and mental imagery. In the process of generation of conscious experiences information is processed at different hierarchical levels of subtlety including whole-brain, network, cellular, synaptic, protein, etc where each level can be regulated by the levels that are subtler (higher frequency). While most research has been focused around understanding how bottom-up or sensory conscious experiences are generated, little is known about how top-down experiences come into being. Through recent experiments it has come to light that the human brain employs frequency fractal computing where systems operating at different frequencies synchronize and communicate with each other through resonance (Ghosh et.al, 2014; Srivastava et.al, 2015). Through this paper we make an attempt to understand how this synchronization happens and what role it plays. When attention is directed inwards, away from sensory inputs towards subtler planes, as done in certain meditational practices, certain mystical lights and sounds are experienced. During this inward withdrawal of attention, different levels of subtlety communicate with each other. In its present state, the Orch-OR theory only elucidates how communication between the classical and quantum levels in the brain occurs. However, how communication between subtler quantum levels happens remains to be understood. We propose that the communication between subtler quantum levels in the brain happens through an inverse hierarchical communication bridge based on Quantum Coherent Feed-back and Harmonic Resonance that allows higher order information to flow down, in a dimensionally reduced way, generating a top-down conscious experience. This resonance would lead to a condition of impedance matching between different subtle layers creating a hierarchical resonant channel for the flow of vital energy from subtle levels, that not only energizes the body but also helps in the sustenance of basic bodily functions when the body is in a state of prolonged attention withdrawal. Ghosh, S., Aswani, K., Singh, S., Sahu, S., Fujita, D., & Bandyopadhyay, A. (2014). Design and construction of a brain-like computer: A new class of frequency-fractal computing using wireless communication in a supramolecular organic, inorganic system. Information, 5(1), 28-100. Srivastava, D. P., Sahni, V., & Satsangi, P. S. (2015). Modelling Microtubules in the Brain as n-qudit Quantum Hopfield Network and Beyond. arXiv preprint arXiv:1505.00774. **C14**

264 Global Interconnectivity: Heart Rhythm Synchronization Between Humanity and Earth's Energetic Systems Rollin McCraty, Mike Atkinson <rollin@heartmath.org> (HeartMath Institute, Boulder Creek, CA)

Every cell in our body is bathed in an environment of fluctuating invisible magnetic forces, external and internal, that can affect virtually every cell and circuit in biological systems. Multiple lines of evidence show that disruptions in geomagnetic fields can affect human health and consciousness as reflected in emotional changes and behavior. A likely explanation for how solar and geomagnetic fields can influence human consciousness and behavior is through resonant coupling between our nervous system and field line resonances (Alfvén waves), and standing waves in the earth-ionosphere resonant cavity (Schumann resonances). The Global Coherence Initiative (GCI) launched by the HeartMath Institute designed and operates a global network of ultra-sensitive magnetometers that measure the fluctuations and resonances in the Earth's magnetic fields to conduct research on the mechanisms of how such fields affect mental and emotional states, and collective behavior. This globally connected network continuously monitors magnetic signals that fall into the same range as human physiological frequencies such as those of the brain, autonomic nervous and cardiovascular systems. This presentation will report the results from three studies that examined the relationships between solar and geomagnetic activity and human mental and emotional states and autonomic nervous system dynamics as reflected in heart rate variability (HRV). The solar activity and magnetic variables were: solar wind speed, Kp and Ap indices, PC(N), sunspot number, solar radio flux (f10.7), cosmic rays, Schumann resonance power (3.5 to 36 Hz) and the ULF power (2mHz to 3.5Hz). The first study tracked 1,643 participants from 51 countries that completed surveys (positive affect, well-being, anxiety, confusion, fatigue and physical symptoms) at random times six days each week over a six month period. The second was with 10 participants, in California, USA, who did continuous HRV recordings, 24-hrs/day, for 30 consecutive days. Overall, the study strongly confirms that autonomic nervous system activity is affected by solar and geomagnetic influences. Interestingly, there were a number of significant positive and negative correlations in both studies. An additional analysis of the HRV study yielded some unexpected results. After time synchronizing, normalizing and removing all circadian rhythms from the time series data, it was found that the participants? HRV rhythms synchronized with each other across the 30 day period even though all participants were in separate locations across the state. This suggested that the participants were synchronizing to an external signal, and a significant correlation was found between the groups HRV indices and the time varying magnetic field data across the 30 day period. In a third study, these finding were confirmed in an international study with 104 participants located in five countries. A cluster analysis shows 3 distinct types of global synchronization. These profound findings indicate that humanities heart rhythms are synchronized on a global scale. Not only are we synchronized with each other but with the earth?s energetic systems. **C14**

4.10 Origin and nature of life

4.11 Consciousness and evolution

265 Evolution of Neural Coding Mechanisms That Support Consciousness James Beran <jimberan@earthlink.net> (Redwood Falls, MN)

Researchers are making remarkable progress in measuring and interpreting neural codes. (See, e.g., Panzeri et al., 2015) Adrian Owen's group has even reported success in using neural codes to infer a subject's conscious experience. (Naci et al., 2014) Much current research involves codes measured from multiple neuron activity, known as "population codes"; but there is also great interest in codes measured from a single neuron's activity, known as "single-neuron codes". In addition, researchers have proposed various specific types of coding, e.g. firing-rate coding; latency coding; silence coding; place coding; packet coding; temporal spike pattern coding; time-reference event coding; and so forth. But we have found no persuasive account of how biological evolution might have produced diverse coding mechanisms; especially puzzling is the evolutionary relationship between single-neuron and population codes. If neural coding began with internal features of neurons (referred to herein as "subcellular neural coding mechanisms" or "SNCMs"), one would expect that SNCMs with primitive forms originated in early nervous systems and then evolved to more advanced forms. This work therefore studies possible evolutionary paths leading to diverse SNCMs in present-day higher vertebrates such as mammals and birds: We begin with neurons of present-day cnidarians (e.g. the starlet sea anemone Nematostella vectensis) and bilaterians (the phylum of bilaterally symmetric animals, including all vertebrates), drawing inferences about SNCMs in the last common ancestor of cnidarians and bilaterians (Kelava et al., 2015); we also consider probable subsequent evolution of SNCMs in bilaterians. Specifically, if some higher vertebrate neurons contain multiple SNCMs that provide distinguishable signals, then a neuron with such SNCMs might provide multiplexed signals on its axon ("axon multiplexing"– compare Baker et al., 2013). For a model of how axon multiplexing might be performed, we use the example of axon+dendrite branch coding ("(a+d)b coding"). (Beran 2015) As originally proposed, (a+d)b coding can occur where a branch of an axon synapses with a dendrite branch–the postsynaptic neuron can respond to a specific synapse signal pattern by activating a respective neural circuit. We now further propose that a specialized postsynaptic structure receives the specific synapse signal pattern and, in response, activates the respective neural circuit. Our initial working hypothesis is that (a+d)b coding by specialized postsynaptic structures provided an evolutionary transition leading to the first axon-multiplexed SNCMs. If so, further evolution of SNCMs might have led both to measurable population codes and also to change in conscious experience. By examining several types of postsynaptic structures that might include SNCMs, e.g. postsynaptic densities (PSDs), signaling complexes, and cytoskeletal structures, one can identify specialized features that distinguish types from each other and one might also identify proteins that are critical to such features. Our research aims to find critical proteins that enabled SNCMs to code for consciousness. **P1**

266 Consciousness - Switch for Multiple Evolved Psychological Functions Vasantha Kumar Dhanasekar <d.vasant@gmail.com> (Chennai, India)

The role of natural selection in shaping the consciousness within creatures is indisputable. This evolved consciousness in higher order animals and humans can't be viewed as a single trait developed for a single advantage. Rather it should be an overlapping of multiple psychological functions adapted to the environment thereby evolved unintentionally. Since multiple of these functions overlaps, each individual function gets ambiguous and applies to plethora of things. Consider the fear of snakes as nature selected trait to increase the survival of mammals against reptiles. But there are few people who are affectionate to it and even raise them as pet animals. It appears that these persons somehow overcome the propensity of the innate fear to reptiles. This kind of affection for another being is just another overlapping natural selected function called altruistic trait. Altruism is mainly intended to increase the survival of the individuals within the same species. As this behavior overlaps with multiple other functions in human, it gets vaguely selected to apply to other species too. Consciousness is formed by the integration of this kind of multiple overlapping functions acting like a switch. This results in multiple subjective experiences as each individual selects any of the overlapping functions. These overlaps can also create the illusion of "free will" as each individual just switches between any of the overlapping selected function. The primary advantage of natural selection to use overlapping functions and vaguely defining a trait is that it would drastically reduce the number of neurons needed in the brain to perform a certain set of functions. Indirectly, it can reduce the size of the genome required for the species. A similar approach can be adapted by computer programmers to simulate the overlapping trait through artificial neural networks thereby achieving consciousness artificially. These kind of overlaps are more visible in the higher order animals(mammals and birds) while in the lower order animals it is limited or unavailable. In lower order animals, each trait matches exactly to one specific function and the organism meticulously applies to it. Due to this reason, there will be no subjective experience in these organisms. **P1**

267 Can Consciousness Influence Our Epigenetics and Can Epigenetics Influence Our Consciousness? Ingrid Fredriksson <ingrid-f@telia.com> (Arjang, Sweden)

In our body there are 100 trillion (1012) cells each of which containing circa 22 000 genes. Epigenetics is a mechanism for regulating gene activity independent of DNA sequence that determines which genes are turned on or off: in a particular cell type, in a different disease states or in response to a physiological or even psychological stimulus. There is a microbiota-gut-brain axis communication in health and disease. (Under healthy conditions, the predominance of symbiotic bacteria, an intact intestinal barrier, a healthy innate immunity controlling pathobiont overgrowth inside the intestinal barrier). The molecules that constitute epigenomes have no resembalence of DNA. While DNA is a double spiral, similar to a twisted rope ladder, the epigenome is a system of chemical markers that sits on the DNA. What is its purpose? In the same manner that a conductor leads an orchestra, the epigenome decides how the genetic information of DNA shall be should be expressed. The molecule markers either engage or disengage the genes depending upon the cell's needs and environmental factors, such as diet, stress and poisons. Of late, the discoveries surrounding the epigenome have caused a revolution in the field of biology now being able to prove a connection between the epigenome and certain illnesses, including aging. Negative epigenetic changes can increase the risk of illness while positive epigenetic changes minimise the risk for illness. From different methyl-donators, such as methionine, folic acid, choline, betaine and vitamin B2, B6 and B12 SAM is formed as methylated DNA and histones. When the fiber breaks down in the large intestine with the help of probiotic bacteria, short chain fatty acid is the product, especially butyric acid that has the important task of acetylation of histones. A line of polyphenol/flavonoids/iridiods from berries, vegetables, green tea and dark chocolate with a high cocoa content may have strong epigenetic impact. Amongst these there are certain substances noticeable, genistein from soya, curcumin from turmeric, resveratrol from red wine and lingon berry, isothiocyanates from the cabbage family, allyl sulfides from onions, epigallocatechin gallate (EGCG) from green tea and a line of polyphenol/flavonoids/iridiods from lingon, blueberries and Hippophae rhamnoides to name but a few. All of these substances can methylate DNA and histones and acethylate histones. Normally it requires a great amount. Through the named substances it is also possible to get the positive effects of non-coded RNA (ncRNA; miRNA). Physical activity, including working out, and how we feel, can also give you positive epigenetic benefits. New mechanisms found in epigenetics open new possibilities for consciousness, whatever it is, to interact with the physical reality. **P2**

268 Quantum Evolution and Quantum Consciousnes Masayuki Hirafuji <hirafuji@yahoo.co.jp> (NARC, NARO / Univ. of Tsukuba, Tsukuba, Ibaraki Japan)

We proposed a global optimization algorithm based on a hypothesis, which is evolution is caused by quantum tunneling on DNA under quantum stochastic resonance. In this optimization process, probability of quantum tunneling is increased exponentially according to strength of fluctuation such as stress. The probability is very sensitive to thermal noise (i.e. temperature) and chemical fluctuation such as free radicals. DNA changes rapidly under stressful condition, and DNA can be stable under stress-free conditions. That is, evolution can be formulated combination of conventional optimization algorithm based on Neo-Darwinism (i.e. genetic algorithms) and the quantum optimization algorithm to search the minimum stress condition. Here, tunneling time is useful to explain relationship between evolution speed and difficulty of optimization. To solve the more complicated problem, the more mass is required and the longer tunneling time is required. Mass of DNA is enough large to create human spending billion years' tunneling time. However, the tunneling time is fuzzy; actually it means only a kind of formation time of changing wave function. Let's employ the many world interpretation to understand the tunneling time. There are many evolving Schrodinger's cats and their descendants during the tunneling time for the large mass of DNA. Infinite number of Schrodinger's cats and their descendants exists on infinite number of timelines. The tunneling time can be identified respectively, for example, "from prokaryote to eukaryote", "from bacteria to human" and "from British Shorthair to American Shorthair". This dynamics can be illustrated as many phylogenetic trees on timelines. This picture is deterministic. On the contrary, our consciousness seems

non-deterministic. Although we are also Schrodinger's cats (humans), our consciousness can observe current single world. If both evolution and consciousness are caused by quantum mechanics, our consciousness must be also deterministic. This inconsistency is related to the problem of free will, and several solutions can be proposed. **P2**

269 Psi-Psychism: How a Single Particle Could Evolve to Feel Like a Human Being Colin Morrison <csdm1@hotmail.co.uk> (C S Morrison, Cupar, Fife United Kingdom)

Colour constancy, blind-spot invisibility, right-way-upness and many other features clearly demonstrate that our visual images aren't the patterns on our retina. So what are they? Unless you believe in magic they must be enhanced reconstructions of those retinal images generated somewhere deep inside our brain. Although some claim no reconstruction is needed (the subjective image somehow magically arising with some use of the visual data) I argue that this view doesn't constitute a SCIENTIFIC account of these images because it doesn't explain them in anything like the way similar biologically-generated phenomena are explained. To me, a scientific account ought to look something like the evolutionary explanation for the retinal image that our visual experience so closely resembles. This paper demonstrates how that can be achieved. For certain scientifically defensible reasons it assumes our consciousness is the intrinsic nature of a single quantum particle trapped in a neural structure that determines the focus of our brain's attention. It presupposes that this structure is constantly measuring the position of that particle in a way that allows different positions to trigger shifts in attention to different sources of data. Most importantly, it insists that our consciousness freely chooses the position of that particle from all its potential positions in the following way: Each potential position is represented by a distinct location in our phenomenal fields. Our consciousness constantly selects different locations (shifting freely and instantaneously between them). However, when a measurement takes place it temporarily ceases to experience anything at all and the particle is found to be at the position it selected last. The effect of the particle's wave function on the probability of each potential position is explained by proposing that the variation in the intensity and type of qualia across each of our phenomenal fields makes us more likely to select some positions in preference to others in the exact proportion that the wave function predicts (a view that I call "Psi-psychism"). I then show that naturally occurring measurements of a confined quantum particle could have come to beneficially affect the final stage of a previously deterministic attention-focussing process in our distant ancestors, with the result that distinct sources of data came to be selected by distinct sets of potential positions of that particle. And I demonstrate that selection pressures resulting from certain possible ways of maximising the efficiency of this system would cause the structures confining that particle to evolve in predictable directions. In particular, the aspect of its wave function responsible for our colour experience would almost inevitably take on a form that closely resembles the retinal image. And the aspects responsible for our other subjective modalities would gradually evolve to have forms that closely resemble the spatial distributions of other related sets of sensory stimuli. An encouraging feature of this theory is that a reason for our sense that something we are seeing is also something we're feeling or hearing simply falls out of it. And a means of explaining the pleasantness-benefit correlation is similarly forthcoming. **P2**

270 Mathematical Elements of Consciousness: A Priori Basis of the Mind Suketu Patel <suketupatel23@gmail.com> (New York, NY)

The rudiments of mathematical cognition begin with the ability to subitize quantities to later being able to enumerate them. From single cells moving towards energy sources to a primate picking fruit from the largest tree, subitizing provides the a priori basis for animate behavior and intentionality. With increased proficiency, subitizing and enumerating allow for our incredible tool building aptitude as well as directly contribute to our rational decision making. A massive step in our evolution is when anatomically modern humans became behaviorally modern. We see this through archaeological artifacts, artwork, and tools such as Lebomba and Ishango bones that are etched with enumeration marks. These tools and subsequent human behavior provide evidence that the capacity for infinite enumeration is the foundation of our pioneering intelligence. Even though indefinite counting leads to advanced mathematics and complex tools, our behavior and how we operate under stress is still clearly influenced by unconscious processes. Animals such as reptiles are also autonomous but are considerably more influenced by unconscious or instinctual processes. Since our behavioral range is far greater than every other animal, our autonomy is far more diverse in respect. The important inquiry becomes what mechanisms allow our behavioral capacity to be leaps and bounds above all others, and how does rationality exist in spite of our grand behavioral diversity? My argument purports that for rational behavior to transpire; the requirement is restrictions on behavioral possibilities. These restrictions are moral and social rules that are both innate and learned. They lay the groundwork for cooperative behavior and create the internal dilemma that culminates to a rational decision. The central mechanism that allows individuals and agents to learn these restrictions is rooted in value learning which includes the emotional judgment of experiences. If there is no moral underpinning within humans, does rationality still exist? What would free will be if there were no conception of right or wrong and what would prevent every decision ensuing to a type of self-preserving behavior? Ultimately, we live with free will and are rational agents because we can behave both rationally or irrationally through restrictions imparted by empathy and morality. Although moral values vary from individual to individual, it still guides our rational decisions and actions. Even if we choose to act against its notions; the mental restriction creates the internal state of rationality. The significance of this paper is that it puts forth a substantiated theory for how humans can logically reason and in-turn build complex tools. The analysis examines the gradient of behavioral ranges of animate matter in order to uncover how evolution progressed to human intelligence. Basic mathematical concepts are not only present in computing experiences; they are also the building blocks of our rational behavior. Additionally, by illuminating a correlation to empathy, my breakdown shows how hominin sociality provided the rudimentary skills that establish an intentional agent's ability to behave rationally. **P2**

271 Honest Resonance Connection through a Coma Subject Idan Peer, Ariel De Lion,Co-founder AlephnUll <idanp1979@gmail.com> (AlephnUll, New York, NY)

In our model, words through telepathy and hypnosis generated by collective consciousness and meditative amplifier, once achieved, may create a Spark. Wheels model is a devise, mediator, a generator on a larger scale. The model exists in nature on various aspects. At present day, there is still no consensus on a clear and reliable marker of consciousness. It is important to complement clinical and experimental investigation through theoretical approach aiming to understand consciousness - what is it and how can it be generated on a fundamental level. "Wheels model" mechanism is based on a resonating conscious sphere, establishing the resonance on three levels. From C1 H+ streaming collective poles to conscious silent M1 H- Buddha. A magnificent Spark ignited by the coma symbol of alternate consciousness recognizing the intention to apply and responses through the honest resonance and melody. The study defines the mechanism and relationship of the different model components and their intentions. A collective live stream to participate, to rise up and point out - we are here! Ready to be part of the model and resonating fields, relying on an amplified global meditative energy. Words shot in Space! **P2**

272 Separated Microbes Using Superconducting Quantum Interference Device: An Experimental Validation for Bioelectromagnetism and External Correlate of Consciousness Soam Prakash, Richa, D.K. Chaturvedi, Quantum Biology and Biomedical Laboratories (DEI) <prakashsoamdei@gmail.com> (Department of Zoology, Dayalbagh Educational Institute, Agra, India)

Superconducting quantum interference device (SQUID) magnetometer is well known for its unprecedented sensitivity and accuracy to measure weak magnetic fields produced by the microorganisms. The SQUID magnetometer- Quantum Design MPMS XL7 was used to study the role of biomagnetism in distant electromagnetic communication between two microbial cultures with measurement range of 5.0 emu (option to 300 emu). Here, in this present investigation we could see that one of the microbial colonies could regulate the growth of another microbial culture over a distance even when separated by competent glass barrier. We therefore, aimed to seek explanation and evidence for the possible role of electromagnetic energy emission as a nonlocal communication in microbial colonies. The measurement of energy emitted from culture have been made with improved Meridian Energy Analysis Device (MEAD) and further been validated by Superconducting Quantum Interference Device (SQUID). The observations and results distinctively depict that microbes do communicate non locally through electromagnetic energy emission validating previous studies. Thus, the explanation of the recorded phenomenon could be in support of the Einstein's suspected spooky phenomenon 'The spooky action' at a distance in these unicellular culture systems. This investigation will further facilitate and also would indicate towards fingerprint energy emission as the results microbial consciousness shows species specific radiation from the cultures. The specific radiation pattern of their consciousness and could be a good indicator of presence and absence of a microbial species in any other living and nonliving system for possible diagnostics in biomedical science and also a correate of consciousness. **P1**

273 Consciousness from a Cell to Humans and Intelligent Machines, Expressed in Engineering Units called SPARKLES Paul Storey ‹paulstorey@live.com› (Robotics Engineer,T3M, Citrus Heights, CA)

Consciousness is a natural phenomenon which evolved with life. It can be defined in the basic scientific units of measurement, the International System of Units (SI), and quantified in these units. Our consciousness is a phenomenon of energy, we are energy, our perceptions, sensations, feelings, fears and desires are tiny packets of energy. Energy is not New Age, mysterious, or supernatural, it is expressed in joules, mass times velocity squared. Consciousness is a special type of energy, controlled by information all about the self, with the purpose of sustaining the self. Information is defined in bits. Control comes from a control loop like a thermostat controlling a furnace. A set point is given which drives the energy in the loop until the output, measured by a sensor, matches the commanded input. Control loops enable information from sensitive sensors to control large or small quantities of energy, in extremely exacting ways. The control loop endows energy with information and purpose. A million sensors in a million control loops would make a million varieties of energy, with a million different goals or purposes. When numerous control loops are all centered exclusively about a single entity capable of independent existence, the system constitutes a self. When the goal of the energy-information in the control loops is to keep all the variables of the entity within their commanded state to sustain the self, the fundamental properties of consciousness exists within that entity. Energy containing information about the self, flowing with the purpose of sustaining the self, is the fundamental element of consciousness. This existed in a single cell capable of maintaining its homeostasis and reproducing. This was extremely valuable, empowering these systems to prosper and propagate in various environments. Entities with primitive consciousness could then be used as a building block for further sophistication. Cells carrying more critical information evolved to higher importance forming hierarchies of control loops of consciousness. Advanced control loops incorporate models of the complex phenomenon which are being controlled. When models contained in the control loops reach the resolution of modeling the entity itself, there is self-consciousness. Creatures with this property had tremendous advantages over their competitors, so evolution rapidly elaborated this phenomenon. The most efficient creatures with the greatest resolution models of the environment and of themselves rapidly dominated the world of life, culminating in humans. Experiencing the qualia of red is better expressed as energy with color information of red flowing in my optical processing control loops of my being. A jellyfish is a simple example of an entity conscious of a variables such as orientation, position, temperature, navigation, internal chemical states, pain, survival and reproduction. Human consciousness is jellyfish level consciousness scaled up by an estimated 20 orders of magnitude in complexity. An acronym SPARKLES has been formed from SI units. SPARKLES are a hard science description of the units of consciousness, and should supersede qualia, which is non-scientific. Consciousness is natural, finite, completely understandable and quantifiable. Quantum physics is unnecessary to describe consciousness. **P1**

274 The Consciousness of Medicine Through Evolution: How Medicine Evolves Through Societal Consciousness Shawn Tassone ‹ladeaobgyn@yahoo.com› (Tucson, AZ)

Modern medicine is often accursed and accused of being ultra-materialistic. This materialism or critique of the pervading paradigm is problematic if the implication states medicine should retreat from the therapeutic breakthroughs of the scientific era (Leder and Krucoff, 2011, p.859). Descartes' grossly mechanistic view of life (Mayr, 1961, p.1501) ushered in a dichotomous vision of humanity and reduced mind and body into treatable pieces (Abreu, Fradique, & Lucas, 2010). This may also possibly be a reflection of the spiritual void in our society and points to a larger systemic societal flaw; bringing the question, is the medical system also a mirror of our country's consciousness? Spirituality and nonlocality are the scaffolding of change in our next phase of medical care (Benson, et al., 2011), yet there are many who feel that consciousness has no place in the medical paradigm (Block, 2008). Larry Dossey (1999) has outlined different eras of medicine and how medicine is moving toward a point where physicians and patients will interact on a more nonlocal level. Lee (2010) proposed, the medical system is too fragmented to absorb the accelerating levels of information, and this acceleration is worsening the paradigm at large. As a practicing physician, this is not my understanding of our current medical system and its relationship to consciousness. The current medical system operates under a sub-system in which the patient is a passive participant in the healing process (Brody, Miller, Smith, Lerman, Smith & Caputo, 1989). In this paternalistic system where the doctor dictates and the patient follows there is no real possession of wellness on the part of the patient. Dossey would agree with this claim as his first two eras (systems) of medicine are both local, in the sense that the consciousness interaction between doctor and patient is on a simplistic and concrete level. I believe we are moving into a dynamic where this type of treatment is no longer working in our society as it did in the nineteenth century. As our society moves into a more multicultural and global consciousness it follows that healing would gravitate in a similar direction. Laszlo (1993) stated the evolutionary tract of contemporary societies must sooner or later bifurcate (p. x), and because of this, physicians cannot assume that a simple blood pressure medication will heal a patient if there is a cause for the hypertension from outside of the patient. In this paper I will look at the different eras of medicine as described by Dossey and will briefly explore them as evolving systems, and how they evolved within the systems acting upon them. **P2**

275 Global Sustainability, The Evolution of Consciousness and the Role of Water Beth Torpey ‹beth.torpey@ccv.edu› (Environmental and Philosophy, Vermont State Colleges, Morgan, VT)

The overall aim of this presentation is to state the urgent need for global sustainability awareness and action by establishing a connection between the fields of sustainability, consciousness and water. The mechanisms for connection though quantum physics explanations and theories, particularly in relation to consciousness, are provided in an effort to demonstrate the need for a worldview change or paradigm shift. The importance of water as both a resource as mediator in quantum brain processes in relation to consciousness is also touched upon. From a societal and cultural perspective, the separation and elevation of ourselves over nature/Earth has been identified as a potential explanation for humankind's unaware misuse of non-renewable resources. Short-term profits appear to be valued over long-term sustainability. Due to the increasing lack of awareness, connection, and consciousness among humankind today the possible extinction of the species may be the ultimate result of the consciousness that is not evolving. As the need for conscious awareness of our connection has been acknowledged, recent findings in quantum science have identified an incredible coherence and interconnectedness. As further understanding and elevation of consciousness occurs, it is hoped that it will lead to a shift in worldview or paradigm shift. It is noted that paradigm shifting occurs when existing explanations and solutions no longer work and/or when new problems require new solutions and this point has certainly been reached in various circumstances. Various theories of consciousness are examined with a focus on Hameroff and Penrose's Orch OR Theory of consciousness. In relation to the brain and evolution of consciousness, it is indicated in the Orch OR theory that evolution appears to favor events of higher intensity of experience. Could our materialist, post-modern worldview be related to a pleasure center that was misfired or misguided? If a more rapid frequency is favored and evolution relates to higher intensities of experience, would this be like an adrenaline junkie or addict who always needs more? A connection between Hameroff and Penrose's Orch OR Theory of Consciousness and the findings of Pollack in relation to the Fourth Phase of Water is posited. Although the argument is not conclusive, it is possible that operation that occur at the microtubule/water molecule level are essential to the evolutionary path that tends towards higher levels of consciousness in living organisms. Others consider that the Coherence Domain in biological water may be responsible for all of the special properties of water including life itself. A question that was not adequately answered is: 'Does the Coherence Domain (CD) of the water inside the microtubule significantly contribute to the Quantum mechanical operation of the microtubule in relation to consciousness?". Additionally, results of an experiment using plants watered with intent-infused water are provided. The results are inconclusive. **P2**

276 Consciousness In Children Shikha Verma, Komalchitt Juneja; Asha Juneja; Damyanti Juneja ‹shikhaj@rediffmail.com› (Theology, Rajiv Gandhi College of Arts, Commerce and Science, Navi Mumbai, Maharashtra India)

Consciousness in general refers to the relationship between the mind and the world with which it interacts. But on the basis of the Eastern Philosophy and the scriptures of extant religions, humans have the ability or hidden potential to awaken higher levels of consciousness. These states are attainable by balanced self discipline, control of the senses, mind and emotions. According to the Hindu Vedic tradition, the normal consciousness in an adult is classified as Jagrit (waking), Swapna (dreaming), Nidra (sleeping) and Turiya (spiritually awakened). But it is different for a child because when a child is born, his/her consciousness is pure, without any influences of the external environment. This pure consciousness remains until the age of eight. This state of consciousness is like a sponge, simply absorbing the information received through the senses, interactions, intellectual and emotional inputs. He/She receives non-linear and non-sequential information. The information received by the consciousness is purely intuitive. The consciousness in children can thus be classified as Turiya-Jagrit (intuitive and awake), Turiya-Swapna (intuitive and dreaming), Turiya-Nidra (intuitive

and sleeping) and Turiya-Turiya (intuitive and creative). But as the child enters the formal schooling system, a sequential and linear learning process begins. The child is taught in a set pattern of understanding that A comes before B, C follows B etc. The moment the sequential and linear learning process begins, the personality starts changing and an alteration occurs in the pattern of consciousness as well. Gradually, the Turiya component of the consciousness leaves and eventually only the Jagrit, Swapna, Nidra and Turiya states of consciousness remain. The present paper will explore the effects of the external environment and the changes in the consciousness pattern in children. Waves of different frequencies have been detected in the brain depending on the state of consciousness of the individual. It has been observed that changes in the frequency of the brain waves occur with different elevated states of consciousness. In children theta waves in the range of 5-8 Hz have been detected. It would be interesting to analyse the changes in these frequencies due to various parameters. The role of the modern day environment especially use of excessive gadgets in young children in altering the states of consciousness will be an important parameter. The influence of incorporating yogic practices, nidra yoga and other spiritual activities in the modern education system and day to day life for increasing the consciousness levels will be investigated. The paper will also compare the ancient education system with the present one and their impact on the state and development of the consciousness of a child. **P1**

277 How Is Our Universe Created? Rulin Xiu, Zhi Gang Sha <rulin@htprc.org> (Theoretical Research Departmen, Institute of Soul Healing and Enlightenment, Keaau, HI)

Quantum physics shows us that our measurement creates the reality we observe. In this paper, we will show that our universe, including all the elementary particles, forces, and spacetime are created with two pairs of measurement. One pair of measurement is the measurement of change and stillness. They relate to the space and time measurement. The second pair of measurement is the measurement of inclusion and exclusion. We find that the mathematical expression of the action by the interaction of these four measurements yields superstring theory. We can obtain the formula for the wave function of our universe. From this formula, we can calculate elementary particles, forces, spacetime structures, the dark matter and dark energy in our universe. This formula also indicates that our universe is a projection from a hologram. It is made of multiverse and various space and time cycles. Our research study demonstrates mathematically how our universe is created through the consciousness. It provides a way to study the relationship between physical and conscious existence. **P1**

4.12 Medicine and healing

278 Nanoparticle Nature of Homeopathic Medicines: Homeopathic Information From Quantum Dots and Larger Nanoparticles for Healing the Complex Adaptive Living System Iris Bell <ibell@email.arizona.edu> (Family And Community Medicine, University of Arizona, Tucson, AZ)

This presentation provides an overview of current evidence for and biological implications of the nanoparticle (NP) nature of homeopathic medicines. Homeopathy is an over 200-year-old controversial system of alternative medicine that its physician-chemist founder originally described in vitalistic terms. To diagnose and treat, homeopathic clinicians attempt to match and reverse direction of the mental, emotional, and physical symptom pattern of the individual sick patient with a single salient medicine capable of causing a similar emergent pattern in a healthy person. Reported changes across the patient occur in a self-organized hierarchical manner consistent with nonlinear complex adaptive systems models for healing. Proposed endogenous response amplification mechanisms include (a) stochastic resonance (where the biology of the disease state constitutes the larger noise and the correct homeopathic medicine is the weaker frequency-resonant signal), (b) hormetic adaptation (low dose stimulation versus high dose inhibition), and (c) time-dependent sensitization and oscillation (progressive amplification of response amplitude to the point of reversal as a function of the passage of time between exposures to the same or a cross-sensitized stressor/stimulus). To make a homeopathic medicine, manufacturers utilize unique mechanical procedures on natural plant, mineral, or animal source materials. Preparation methods include (a) prolonged mechanical milling or grinding in dry lactose and (b) serial dilutions in ratios of 1/10 (X potencies) or 1/100 (C potencies) in liquid solvent such as ethanol-water, with each dilution step followed by intense agitation of the contents in glassware (succussions). Convergent data across 10 different laboratories including ours reveal that homeopathic manufacturing procedures overlap those of modern nanotechnology to generate source nanoparticles (mixed sizes of NPs, <100 nanometers) as well as nanostructures of other composition, e.g. silica, solvent. Homeopathic NP concentrations range over a billion

NPs/milliliter. Agitated plant extracts also generate bioactive nanoparticles (organic, plant-based exosomes) as well as biosynthesize metal or silica nanoparticles from their respective precursors. In multiple studies, homeopathic medicines release measurable source-specific optical (photon) and electromagnetic signals. Notably, a subset of homeopathic NPs fall into the quantum dot size range, i.e., <10 nanometers, thus increasing the plausibility of observing quantum mechanical coherence and/or entanglement. Walach et al first postulated quantum macro-entanglement-like phenomena during double-blind pathogenetic studies in which placebos elicited complex symptom patterns similar to those of homeopathic medicines in healthy human subjects. Others have proposed quantum coherent domains. One recent study with permalloy shielding suggests that external low frequency electromagnetic and/or geomagnetic fields are necessary for formation of nanostructures in highly dilute homeopathic medicines. Biological mechanisms of nanoparticle effects include electron transfer and reactive oxygen species generation as well as modulation of gene expression, immune function, and cell signaling events. NPs can serve as virus-like environmental stressors or danger signals causing a paradoxical low dose stimulation in the opposite direction to high dose inhibition within biological adaptive living systems. In conclusion, understanding the nanoparticle nature of homeopathic medicines helps accommodate previous empirical observations and may position homeopathy as a conceptual bridge between the quantum physics and biology of the individually-salient source material and the recipient organism in healing. **P1**

279 The Problem of the Duality of "Physical" and "Mental" Disorders in Modern Western Medicine Mathew Gendle <mgendle@elon.edu> (Psychology, Elon University, Elon, NC)

Cartesian dualism played a fundamentally important role in the history of medicine, in that it allowed medical practice to be wrestled away from church oversight. In modern Western behavioral medicine, biologically reductionist approaches have been recognized as problematic in that they facilitate a dispassionate and mechanistic approach to patient care and discourage practices that are humanistic and focus on the whole patient. Yet, the interactive dualist views promoted by some branches of "mind/body" medicine (which attempt to holistically counteract the reductionism of mainstream medical practice) are equally problematic. John Searle (2000) has suggested that there are no "mental" processes that are separate from brain biology any more than there are "digestive" processes that exist independently of the physiology of the gastrointestinal system. Behavioral disorders are multiply realizable and have causes that are complex and emerge from interactions between genes, larger scale cellular/biological systems, and the patient's environment and experiential history. Conceptualizations of behavioral disorders that are based in interactive dualism deny the primacy of these fundamental biological alterations in the generation of pathology, and in so doing, distract both the patient and clinician from therapeutic approaches that are most likely to produce positive outcomes. Behavioral health professionals should be encouraged to adopt holistic models of patient care, but these models must be grounded in biopsychosocial methodologies that emphasize emergence and physical monism over the artificial separation of the "physical" from the "mental". This approach will allow for the compassionate and humanistic practice of behavioral medicine while simultaneously maximizing the likelihood of treatment success. **P1**

280 Internal Persuasion as a Key Component of Psychological Resilience: Implications for a Fundamental Theory of Consciousness Marianthe Karanikas <karanikas@missouristate.edu> (English, Missouri State University, Springfield, MO)

Psychological resilience, the ability to cope with stress and adversity, often involves the regulation of psychophysiological reactivity (Davidson, 2000). Recent research suggests that millennia-old practices–such as mindful labeling of the hedonic tone of experience; focused meditation on a word or phrase; and repetitive prayer–help individuals regulate stress and build resilience (Dusek et al., 2008; Holzel et al., 2011; Bhasin et al., 2013). Psychological resilience may also involve the cultivation of positive emotions, which help people broaden awareness and build personal resources (Fredrickson, 1998, 2001, 2013). Recent research suggests that loving-kindness-compassion practice, a focused meditation on words and phrases, evokes felt experiences of positive emotions, and helps individuals broaden personal resources (Fredrickson et al., 2008). These studies reveal psychological, neural, epigenetic, and functional genomic correlates associated with the meditative regulation of reactivity. But we still do not know the precise mechanisms by which belief structures evoke well-being and build resilience. How does internally labeling the hedonic tone of experience, as "pleasant, unpleasant, or neutral," regulate reactivity? How does internally repeating words and phrases evoke the experience of well-being? What specific signaling and signal transduction pathways are engaged when linguistic and conceptual processes influence the regulation of reactivity? How do we relate

the phenomenal experiences of stress and well-being to these psychophysiological processes? The interdisciplinary study of internal persuasion may well provide an overarching conceptual framework, which integrates the many theoretical and experimental approaches necessary to understand how belief structures evoke well-being. A key component of psychological resilience, internal persuasion is the ability to use belief structures to change psychophysiological reactivity toward the hedonic tone of experience. Internal persuasion is also the ability to use belief structures to evoke well-being. While the investigation of the regulation of reactivity falls under the "easy" problems of consciousness, the investigation of how internal persuasion evokes the experience of well-being confronts the "hard" problem of consciousness. The interdisciplinary study of hedonic tone, central to both mindfulness practice and internal persuasion, may shed light on the hard problem. Hedonic tone is both a feature of conscious access and a quality of phenomenal experience (Dehaene, 2014; Pinker, 1997; Block, 1995). An examination of the apparent, "dual-aspect" character of hedonic tone may yield insight into the possible structural coherence between conscious access and phenomenal experience (Chalmers, 1996, 1998, 2010). **P2**

281 The Effect of Yoga on Cardiovascular Health and Spiritual Well Being Madhulika, PhD Nemani, Jawahar Gazzala MD, Cardiologist; Som Nemani, Senior Software Consultant, ATT <paul.madhulika@gmail.com> (Panacea Systems, Johns Creek, GA)

Yoga literally means Union, the union of unit spirit with infinitesimal reservoir spirit. It is a practice of unifying lower self or physical self with higher self or spiritual self. The research is focused on analyzing the effect traditional yoga practices which comprises of physical postures (asanas), breathing exercises (pranayama), and meditation (dhyana) on cardiovascular health. Additionally, various paradigms of the yoga such as Ashtanga yoga, Hatha yoga, Sahaja yoga, Surat Shabda yoga, and western perspectives of yoga were analyzed to understand the true meaning of yoga and present a comparative analysis.The study examined four aspects of cardiovascular health: (a) risk factors for CVD (Cardio Vascular Disease) like hypertension, dyslipidemia, endothelial dysfunction, and autonomic nervous system, (b) coronary artery disease, (c) heart failure, and (d) arrhythmias. The study analyzed several medicinal and experimental studies and came to a conclusion that yoga has demonstrated improvement in metabolic syndrome, increment in cardiac parasympathetic nervous modulation, and decrease in blood pressure and BMI. In addition, it was perceived that the yoga practice has decreased total cholesterol, triglycerides, LDL, and fatty acids tremendously, and aided in the increment of HDL. In patients with heart failure, the study authenticated the improvement in peak VO2 (Oxygen consumption) and health related Quality of life. Further, a positive relationship was observed in yoga and cardiovascular endurance, Quality of life (QoL) questionnaire, inflammatory markers, and flexibility. Furthermore, the study validated that the yoga training significantly regressed CAD on repeat angiography and Myocardial Perfusion Imaging (MPI) test. Besides, it retarded progression and increased regression of coronary atherosclerosis in patients with severe coronary artery disease on coronary angiography. Also, yoga improved symptomatic status, functional class, and risk factor profile. It decreased revascularization procedures. Thus, yoga is a proven technique to decrease arrhythmia burden, blood pressure, anxiety, depression scores, and several domains of QoL. Moreover, yoga intervention has proven to be an effective treatment for reducing shock anxiety, increasing self-compassion, and reducing the number of device treated ventricular events for defibrillator recipients (ICD). In summary, the yoga practices had a significant positive impact on cardiovascular health. Besides, cardiovascular health, the yoga also promoted mental and spiritual well-being. The study analyzed the effect of meditational practices of yoga on mental and spiritual well-being. In this regard, several studies were examined and assessed which stressed on first person subjective experiences during meditation and prayer sessions. Also, a few of the consciousness studies were appraised in which frequency currents were measured objectively during meditation and prayer occasions. The study is a means to further explore, discover, and substantiate the relationship between Yoga and Spiritual well-being which encompasses physical and mental well-being. It is a gateway to Body-Mind-Spirit correlates studies which will redefine the role of Yoga in unionization of physical self with spiritual self. **P1**

4.13 Brain stimulation techniques

282 Brain Activation and Brain-Heart Connection in Dying Individuals Jimo Borjigin <borjigin@umich.edu> (Physiology, University of Michigan, Ann Arbor, MI)

The mechanism by which the healthy heart and brain die rapidly in the absence of oxygen is not well understood. We performed continuous electrocardiography and electroencephalography in rats undergoing experimental asphyxia and analyzed cortical release of core neurotransmitters, changes in brain and heart electrical activity, and brain-heart connectivity. Asphyxia stimulates a robust and sustained increase of functional and effective cortical connectivity, an immediate increase in cortical release of a large set of neurotransmitters, and a delayed activation of corticocardiac functional and effective connectivity that persists until the onset of ventricular fibrillation. Blocking the brain's autonomic outflow significantly delayed cardiac failure and lengthened the duration of detectable cortical activities despite the continued absence of oxygen. These results demonstrate that asphyxia activates a brainstorm, which accelerates demise of the heart and the brain. They also provide a neurochemical and neurophysiological basis for the heightened state of consciousness in dying individuals. **PL12**

283 Are Phenomenological Reports Useful in Noninvasive Brain Stimulation Experiments? Case Studies with Transcranial Ultrasound. Joseph Sanguinetti, John J.B. Allen (UA Psychology) and Stuart Hameroff (MD-UA Anesth; CCS) <sanguine@email.arizona.edu> (Psychology, University of Arizona, Tucson, AZ)

Transcranial ultrasound (TUS) is a promising new noninvasive brain stimulation method that passes low-intensity ultrasound into the brain to modulate neural activity. TUS affects brain activity in animals and humans, is safe, painless and reversible, and cost-effective. The large parameter space of ultrasound waveforms, however, prevents easy translation to scientific and clinical settings. For example, the ultrasound frequencies typically used range from 0.35 KHz (35,000 oscillations per second) to 8 MHz (8,000,000 oscillations per second), and the ultrasound is usually pulsed at different rates to prevent heating. These parameters, and others, can be combined in many different ways to elicit effects on neural activity and there is no consensus on which protocols are superior. Our team has recently shown that TUS improved mood in healthy participants in a large-scale study. In these experiments, in addition to standardized mood-scales, we asked participants to give open-ended subjective reports of how TUS affected their phenomenological experiences. Here we will discuss these subjective reports and how they can help to guide future controlled experiments with TUS. Then we will review our efforts to develop detailed phenomenological methods that were used on a small select sample over repeated days of TUS. These methods were designed with the hope to reduce the large parameter space for ultrasound waveforms, helping us to select waveforms that lead to the optimal effects on mental states. Using these methods, we found that TUS affects other aspects of mental experience in addition to mood, effects that will be the subject of future studies. Additionally, we discovered two new ultrasound waveforms that are good candidates for future controlled experiments. **C9**

4.14 Quantum theories of consciousness

284 Conscious Observation: A Threefold Unification Seyyed Bahram Borgheai, Mehdi Golshani <borgheai@gmail.com> (Sharif University of Technology, Amherst, MA)

Inspired by Bergson (1908), it is stipulated here that direct observation has three stages as a result of a unity between the observer and (observed) system: pure-perception ('see'), perception ('see as') and (conscious) introspection ('I see as'), each has a supporting scientific ground. Pure perception is defined as the immediate impression perceived due to the interaction of mind and (external) system. Restructuring Wigner's Friend Paradox (1967), it is deduced that at observation, there should be an entangled unity between the state of the observed (external) system and the corresponding mental state of the direct observer. This coherent relation is accounted as the pure-perception ('see') stage. Then, the pure-perception would be conceptualized and forms the perception ('see as' stage). As proposed, the physical counterpart of this conceptualization could be the decoherence of entangled pure-perception state. As explained by Hameroff & Penrose (2014), thanks to Bandyopadhyay's group (2013), it is empirically corroborated that coherent relations in microtubules could stay coherent much longer in comparison to corresponding times resulted from environmental induced decoherence. For basis super-selection of the corresponding (decohered) reduced density matrix, it is suggested that the sensation basis in cortical parts of the brain can make the super-selection. To represent a perceived image, as first discovered by Hubel&Wiesel (1962), the neurons in visual cortex have the form of orientation selective (also localized and bandpass) receptive fields comparable with an over-complete (might be mutually orthogonal) basis functions (dictionary) (Olshuan&Field, 1996). Therefore, mental faculties actively induce some basis over the entangled pure-perception and make it decohered. This is construed here as 'see as' or perception stage. However, Due to the over-completeness of this basis, the decoherence might happen virtually or partially (Schlosshauer, 2007) and so lead to the recoherence of the decohered state(s) resulting, as suggested, into the introspective experience ('I see as'). As Shor (1995) has shown, if information is injected to a decohered system, it might lead

to recoherence of that state (Kauffman, 2010). It is suggested here that these additional data could be provided through either the basis over-completeness in one or more modalities engaged in the same observation action. Accordingly, at observation, first an entangled unity happens between the observer and the system ('see' stage), then an over-complete mental basis is induced and the entangled states decoheres ('see as' stage). Then, ultimately, they all become re-entangled which this reunification is claimed to be the ground for emergence of (conscious) introspection ('I see as' stage). Accordingly, it can be deduced that in non-introspective (sometimes called unconscious) perception, the modalities and brain faculties, are physically decohered and so act (almost) independent of each other and when recohered introspection emerges. In sum, our threefold thesis could explain how introspection, qualification of experience (qualia) and also representational aspects are constructed through active intervention of cognitive basis and decoherence-recoherence process of the entangled unity of observer and (external) system. It is also discussed that collapse cannot be regarded as an independent process from the threefold introspective unification and consequently self-knowledge and objectivity is constructed simultaneously united together. **P1**

285 Quantum Contextuality and the Physics of Meaning Simon Burton ‹simon@arrowtheory.com› (East Lindfield, NSW Australia)

Artificial intelligence is the attempt to impart meaning onto machines we construct. The current hot topic in such research is known as machine learning [1]. The idea here is to funnel a great many examples of some kind of events into an optimization routine that seeks to fit an explanatory model. The hope is that this model generalizes well to other events that have not been seen by the optimizer. Indeed, this idea of generalization is baked into the whole optimization procedure; it is the corner-stone of machine learning. This has been wildly successful in some areas, but the experts know that these approaches are still extremely sensitive to changes in context. The ongoing search for true artificial intelligence seems to be the search for a "universal prior": some kind of probability distribution, or fitness function, that is impervious to changes in context. But what evidence is there that such a prior exists? Mere improvement in technique does not imply any progress towards achieving universality; every advancement in artificial intelligence has suffered a similar contextuality problem. When we consider these same issues within the framework of quantum physics, the situation is qualitatively very different. One conclusion of the Kochen-Specker theorem [2] is that objective reality does not exist (happen) until it is made to; quantum reality is context dependent. This is in stark contrast to classical determinism where all effects have been "pre-computed" from some initial state; the future is a mere "function" of the past. The purpose of machine learning (and even science and language itself) is to somehow capture these functions, so that we can predict, and communicate so that others can also make predictions, and remember so that we can continue to predict. What is this that we are using? It is what we would call *meaning*. We communicate meaning, we remember meaning, we learn meaning from the world and from each other. Once you know the state of a classical system (by "state of" we mean "everything about") you know what it will do in the future (in response to any given influence). On the other hand, once you know the state of (everything about) a quantum system you still don?t know what it will do in the future. A good word to describe this is *possibility*. Notice that usually when we know all there is to know about a system and it *still* does something we cannot predict we would call this "random". But notice more: by this we usually mean that the randomness comes from _not_ knowing everything there is to know about the system, so this is not really the right terminology to use here. In summary, I am proposing the following identification: meaning *is* possibility. **C5**

286 How Core Cognition Might Implement Quantum Cognition Charles Card ‹card@uvic.ca› (Physics and Astronomy, University of Victoria, Victoria, BC Canada)

The burgeoning field of quantum cognition with its attendant probability theory formulated in complex Hilbert space theory–initially developed for and applied to the phenomena of quantum physics–is gaining increased attention from cognitive theorists attracted by its potential applicability to puzzling empirical phenomena that are seemingly unexplainable by classical (Kolmogorov) probability theory. Prominent among these are order and interference effects found in reasoning, violation of classical probability expectations in decision making, and difficulties with accounting for holistic aspects of cognition. As well, quantum cognition holds out promise for formalizing the analysis of psychological uncertainty, ambiguity and conflict and for exploring measurement sensitivity. However, despite and moreover because of its potential for improving theoretical accounts of cognition, it is not presently understood how and at what cognitive level quantum cognition is supported and implemented. Although it is widely accepted that quantum behaviours prevail at the atomic and molecular level and may exhibit effects at the sub-cellular and cellular level of neural processes and structure, it is not generally assumed that the basis of quantum cognition derives simply or immediately from the prevalence of quantum phenomena manifested at these levels. In short, quantum cognition research does not rest upon the assertion that the human brain is in a physically realized sense a quantum computer. The question remains, then, how the quantum-like modeling processes required by quantum cognition could be obtained. This lecture will draw upon recent, widely ranging and rapidly developing results in core cognition research to explore the possibility that quantum cognition might be implemented by innate cognitive/neural representational processes at a pre-symbolic, pre-linguistic level of cognition. Specifically, developments in four areas of research will be reviewed: (i) set-based quantification; (ii) parallel individuation/object tracking systems; (iii) analogue magnitude/approximate number systems, and (iv) mental rotation. These results are drawn from the research of Carey, Dehaene, Feigenson, Halberda, Hauser, Kosslyn, Le Corre, Lourenco, Piazza, Spelke and their associates, among many other contributors. It will be argued that the core cognitive resources identified in this body of work are sufficient to implement pre-symbolic representations of complex-valued state vectors that are required for quantum probabilistic cognitive modeling. **C5**

287 Can Quantum AI Produce Consciousness? Xiangqun Chen, Stuart Hameroff ‹owen.xq.chen@hotmail.com› (Philosophy, Southeast University of China, Nanjing - Jiangsu Province, China)

Quantum computers use quantum bits, or 'qubits' in which information is represented as 'quantum superpositions', e.g. of both 1 AND 0 which interact/compute by entanglement according to the Schrodinger equation. The quantum computation then undergoes reduction, or 'collapse' to definite bit states of 1 OR 0 as the solution. Recently, Google's 'D Wave' quantum computer was demonstrated to have computational speedup unavailable in classical computers. The D Wave qubit is a Josephson junction in which electron current flows through a superconductor either clockwise (e.g.'1'), counter-clockwise ('0'), or in quantum superposition of both directions ('1 and 0'), and is the basis for quantum artificial intelligence (quantum AI). Thus far at least, classical AI has failed to produce consciousness. Can quantum AI succeed where classical AI has failed? A quantum computational basis for consciousness has been proposed in the Orch OR theory of Penrose and Hameroff. They suggest consciousness involves quantum computations in microtubules inside brain neurons undergoes reduction, or collapse by an objective threshold (objective reduction - 'OR') given by the indeterminacy principle E=h/t. The quantum computations are 'orchestrated' by cognition, memory and resonances to give full, rich conscious experiences. But E depends on the amount of superpositioned mass (or equivalent spacetime curvature) separated from itself. In Orch OR, electrons (very low mass) originate the superposition but at biological temperatures couple to displacement and superposition of their atomic nuclei. Accordingly, E of ~10^18 tubulins (microtubule subunits) comprising about 1 percent of brain microtubules would reach threshold for OR in 10^-7 seconds. Interference of these events are proposed to give rise to slower perceptual gestalts and 'beats' seen as EEG. In the D Wave quantum computer, superpositions consist of electrons which have very low mass, and because of extremely cold temperatures probably do not couple significantly to their nuclei. Thus, assuming Orch OR is correct, the D Wave or similar quantum computers would require either a very long time t, or a very large set of qubits. As the ratio of the electron mass to a proton is about 1800, and assuming an average atomic nuclear mass of 10 protons and neutrons, a D Wave quantum computer would require ~18,000 times more qubits, or ~18,000 times longer to reach threshold for conscious moments than does a human brain according to Orch OR. Thus quantum computers offer a plausible pathway to artificial consciousness. **C22**

288 The Holoinformational Model of Consciousness - An Extension of Pribram's Holonomic Monism Francisco Di Base ‹dibiase@terra.com.br› (Neurosurgery-neurology, Clinica Di Biase; Geraldo Di Biase University, Barra do Pirai, Rio De Janeiro Brazil)

We addresses a quantum-informational holographic model of consciousness based on the holonomic neural networks of Karl Pribram, on the holographic quantum theory developed by David Bohm, and on the non-locality property of the quantum field described by Umezawa. We consider this model an interconnection between brain and mind by means of quantum microsites named dendrons and psychons, as proposed by Sir John Eccles. A dynamic concept of consciousness is assumed as a holoinformational flux interconnecting the holonomic informational quantum brain dynamics, with the quantum informational holographic nature of the universe. This self-organizing flux is generated by the holographic mode of treatment of neuronal information and can be optimized through altered states of consciousness that underlie the coherence of cerebral waves. In brain mapping

studies performed during the occurrence of these harmonic states the spectral array of brain waves is highly synchronized and perfectly ordered like a unique harmonic wave, as if all frequencies of all neurons from all cerebral centers play the same symphony. This highly coherent brain state generates the non-local holographic distributed informational cortical field of consciousness that interconnect the entire human brain with the quantum-holographic universe. The comprehension of this holonomic quantum informational nature of brain-mind-universe interconnectedness allows us to solve the old mind-matter Cartesian hard problem in a more transdisciplinary and integrated paradigm. **P2**

289 Consciousness Constructed in a Holographic Universe: Is Consciousness Dual to Quantum Information? Shanna Dobson <shannadobsone8@gmail.com> (CSULA, Los Angeles, CA)

How is consciousness constructed in a holographic world? What does the intersection of holographic projection and quantum entanglement mean in terms of information? And is this information quantum information? These profound questions are brought about by examining the work of Leonard Susskind and Juan Maldecena. Complementing the world as a hologram theory, ER = EPR is Leonard Susskinds idea that every quantum entanglement is geometrically a quantum mechanical Einstein-Rosen bridge; that is, a quantum mechanical wormhole. By the holographic principle, we know there exists a strict relation between geometry and entropy; that is, between geometry and information. With this new relation between geometry and entanglement, we are stating that observed and unobserved reality is geometry is information, but information that was long ago encoded and that is highly entangled. I am presently working on how this holographic geometric idea applies to consciousness by assuming the holographic principle and considering consciousness as a supersymmetric time-independent state; that is, time-transcending. Specifically, I examine that, if observed and unobserved reality is a three-dimensional projection of a two-dimensional image, then: Firstly, is consciousness dual to quantum information? This is inspired by the ADS/CFT conjecture. So, as a conformal field theory without gravity in n-1 dimensions is dual to a theory of gravity in n dimensions, is consciousness a two dimensional, timeless dual of a three dimensional quantum information containing time? Secondly, does consciousness arise from pure quantum-complexity-emergence behind grand entanglement, such as behind the horizons of entangled black holes? Using field theory, supersymmetry, logic, and relativistic quantum mechanics, I construct cases for both questions in the affirmative. The importance of these questions is uncountable-fold! By probing these ideas and their implications, we will gain more understanding of the role of the Copenhagen observer creating the world in an already-encoded, holographic world. **P2**

290 Quantum Biology and Quantum Information Shantilal Goradia <sg@gravityresearchinstitute.org> (Gravity Research Institute, Mishawaka, Indiana)

Consciousness, like gravity, does not unify with quantum physics. DNA is an information system making information an ingredient of quantum biology. We use information at quantum (Planck) scale to derive Nobel Laureate Feynman's mystical number ALPHA (1/137) in "Decoding the Information of Life" (doi: 10.17265/2159-5348/2015.03.004). We almost did so in our 2011 oral presentation at the conference on consciousness in Stockholm. A week later we published our book: Quantum Consciousness - The Road to Reality. We could not derive ALPHA without using information in cosmology, making information an ingredient of gravity and biology (consciousness) combined, making Planck scale information a necessary ingredient of the realistic theory of everything. Wave nature of material particles, the uncertainty principle, and probabilistic aspect of quantum physics and views of giants supplement the view that the quantum particles have the information. If one does not like the ancient views without any mathematical basis, there is one (Vedic Philosophy) that supports the view quasi-mathematically i. e. particles are souls and have knowledge (information) with a mathematical size of the particle as ten thousands of the tip of a hair (speculated as an atom) matching the size of a nucleon. Vedic view is quasi-scientific as well. It says that particle souls are indestructible which is consistent with the Eddington number in physics. Nobel Laureate Erwin Schrodinger was impressed by Vedas and reflects his views in his book "What is Life?". We learn that Nobel Laureates Watson and Crick had Schrodinger's views in mind before they discovered DNA. We are investigating Vedic symbol 'OHM' as particles creating resonances with ON and OFF signals like the ancient Chinese 'Ying and Yang'. For the derivation of ALPHA, we use 10 dimensions of string theory. We do not rule out the possibility that 10 different combinations of ON or OFF signals create 2x2x2x2x2x2x2x2x2x2 = 1024 or one kilobyte of characters of the language of Nature which we may never know. Vedic Philosophy shows Gods with multiple hands. We are investigating if that is consistent with the spooky nature of quantum physics. The so called theory of everything must include quantum biology (with information) in order for it to become a realistic theory of everything. Science

without information is standing on shaky grounds. Gravity can be calculated. Mass (matter) creates gravity, because mass creates attraction. But what creates attraction and repulsion? Per Einstein's theory mass tells space how to curve and space tells mass how to move. How do they 'tell'? The question boils down to information created by quantum particles blinking ON and OFF analogous to 'Ying and Yang' or some more complex ways that may include dark matter. There is only one Theory of Everything (TOE). Consciousness, dark matter, quantum physics, uncertainty principle, constants of nature like strong coupling, fine structure constant, cosmological constant introduced by Einstein, information, gravitation etc are fundamentally consequences of that ONE TOE. Ancient philosophers called it ATMA split in the categories of AnuAtma (particle soul), JivAtma (life soul) and ParamAtma (Omnipresent soul) which we relate to quantum physics, biology and cosmology. There is no separate TOE for any one thing. **P2**

291 The 'Road From Within' - Orch OR and the Quantum Underground Stuart Hameroff <hameroff@u.arizona.edu> (Anesthesiology; Psychology, University of Arizona, Tucson, AZ)

In most theories (e.g. GW, PC, IIT, HOT), consciousness emerges in higher level networks in a spatiotemporal brain hierarchy, with neuronal membrane activities as low level information states. But these approaches fail to address 1) the 'hard problem' of subjective experience, 2) memory, 3) agency, 4) binding and 5) how neurons differ from silicon bits, not merely in complexity, but in terms of cognitive capacity of single cells, and what it means to be 'alive'. The answers may lie within neurons, in deeper-level quantum processes in cytoskeletal microtubules which regulate axonal firings, synaptic plasticity, and memory. The Penrose-Hameroff theory of 'orchestrated objective reduction'('Orch OR') suggests consciousness consists of sequential quantum computations in microtubules, e.g. inside dendrites and soma of layer 5 pyramidal neurons. The microtubule quantum bit ('qubit') states are 'orchestrated' by synaptic inputs, memory and vibrational resonances, and self-collapse at specific time intervals and frequencies by Penrose 'objective reduction' ('OR'), selecting particular conscious perceptions and volitional choices. The phenomenal nature of qualia ('hard problem') are attributed to properties in fundamental spacetime geometry which governs OR. Supportive evidence for Orch OR includes the following. Bandyopadhyay's group (NIMS, Tsukuba) showed microtubules have quantum resonances in terahertz, gigahertz, megahertz and kilohertz frequency ranges. (Accordingly, Orch OR proposes EEG rhythms are 'beat frequencies' of faster, e.g. megahertz, microtubule vibrations.) And microtubules are increasingly seen as the site where anesthetic gas molecules act to selectively prevent consciousness. Orch OR is viewed skeptically because the brain appears too 'warm, wet and noisy' for seemingly delicate quantum states, but the anesthetic site of action (and thus consciousness) is defined by the Meyer-Overton correlation pointing to non-polar, pi resonance pathways buried within microtubules and other proteins, regions shielded from polar charges and conducive to quantum states - a 'quantum underground' pervading brain proteins. As deeper, faster, intra-neuronal levels of the brain's cognitive hierarchy, Orch OR and microtubule quantum vibrations may underlie membrane-based theories (GW, PC, IIT, HOT), with consciousness ranging across spatiotemporal scales like music across octaves. Based on microtubule quantum resonances and anesthetic action, Orch OR is experimentally better supported than other theories. **PL1**

292 Mind-Body, Quantum Mechanics, Possibles and a Possible Panpsychism Stuart Kauffman <stukauffman@gmail.com> (The Institute for Systems Biology, Seattle, WA)

With Newton we lost our minds and became disenchanted. Newton, in classical physics, gives us a view of the world as an entirely entailed unfolding. Nothing not entailed can happen. Due to this causal closure of classical physics, a classical brain can at most witness the world, not alter it, so be at most epiphenomenal. Then why have we evolved such complex brains? The best hope for a more-than-epiphenomenal mind requires quantum mechanics, QM. "Choice" implies that we could, counterfactually, have chosen otherwise. This is ontologically possible in QM if measurement is real and ontologically indeterminate. The electron could have been measured to be spin up or to be spin down, so the present could have been counterfactually different. An emerging interpretation of QM involves the ontological reality of "possibles", going back to Aristotle and Heisenberg, which I call "Res potentia and Res extensa linked, hence united, by measurement." Real possibles may explain mysteries of QM such as non-locality as well as the counterfactual outcomes of measurement. If QM concerns possibles and actuals as a new non-substance dualism, what mediates measurement? One testable hypothesis is that human conscious mind acausally mediates measurement. Tentative evidence by Radin supports this. If confirmed, how else is measurement mediated? A panpsychism arises if we try the currently untestable idea that quantum variables can measure one another, and do so consciously. This resolves the Quantum Enigma, and the location of von Neumann's epistemic

cut from mind to apparatus. Then consciousness and aspects of free will are parts of a panpsychist universe and life evolved with it. **PL11**

293 A Pre-Spacetime Quantum Theory of Consciousness - The Easy Side of the Hard Problem of Consciousness Jianfeng Li <lijf@fudan.edu.cn> (Macromolecular Science, The State Key Laboratory of Molecular Engineering of Polymers, Fudan University, Shanghai, China)

Maybe it is hard to propose a physical theory that can resolve all of the hard problems of consciousness, but it is possible to devise a theory can touch on the easy side of the hard problem. Herein, the problems on the easy side are directly related to the conscious experience but can be eventually reduced to the problems of explaining the inner structures of the conscious experience and the logical position or the structural connection of the consciousness in (to) the physical world. In this abstract, I introduce a prespacetime quantum theory of consciousness (Pre-ST theory) that I proposed in 2013. The basic structure of the theory is as follow: a quantum system D is decomposed into two subsystems M and W, and |D> can be seen as superpositional state of the entangled states of these systems. By ordering these entangled states in several sequences, it is possible to find some sequence satisfying certain conditions, based on which we call this sequence a conscious experience, M the conscious entity, W the universe and the density matrix of M-W the structural expression of the conscious experience. The theory is simple and naive, but you will be shown that it can realize most of the philosophical constructs of the type-F monism (named by D Chalmers). In this sense, it has explained the structural connections of consciousness to the physical world. Specifically, it predicts that consciousness is, in some sense, the duality of time, consciousness has a negative mass and the entity of consciousness with intelligence that is comparable with humans might be just an elementary particle bearing large inner freedoms. In particular, the last prediction indicates that our brain might be just a Nature-made collider whose job is to mainly maintain the stability of the consciousness particle. Hopefully, these predictions can be tested in experiments in the near future. **P2**

294 Observational Astro-Proto Panpsychism Gregory Matloff <gmatloff@citytech.cuny.edu> (Physics, New York City College of Technology, CUNY, Brooklyn, NY)

In 2011, I examined some aspects of Star Maker, a visionary 1937-vintage science-fiction novel by Olaf Stapledon as a contribution to a retrospective symposium on that author conducted at the London headquarters of the British Interplanetary Society (BIS). Instead of concentrating on the many astronautical predictions in that novel, I examined in a scientific fashion Stapledon's core metaphysics - that consciousness pervades the universe and a portion of stellar motion is volitional. Stars certainly do not contain tubules or neurons but cooler, redder, less massive stars (such as the Sun) have more molecules in their upper layers than their hotter, bluer, more massive sisters. A 'toy model' of molecular consciousness was then proposed in which a universal proto-consciousness field interacts with matter through quantum fluctuations affecting molecular bonds (the Casimir Effect). A literature search uncovered Parenago's Discontinuity - cooler main sequence stars out to ~260 light years from the Sun move about 20 km/s faster around the galactic center than their hotter sisters. Surprisingly, this discontinuity occurs in the stellar distribution about where molecules appear in stellar spectra. More recent research indicates that Parenago's Discontinuity applies to giant stars out to >1000 light years. Local explanations for this phenomenon seem unlikely. GAIA, a recently launched European space observatory may confirm in its position/kinematics study of ~1 billion Milky Way stars during the next few years that this discontinuity is a galaxy-wide rather than local phenomenon. In the initial peer-reviewed paper on this subject ['Olaf Stapledon and Conscious Stars: Philosophy or Science', JBIS, 65, 5-6 (2012)], I considered methods that could be used by a volitional star to modify its galactic trajectory and concluded that a weak psychokinetic (PK) force might be necessary. Since recent research indicates that many young stars eject uni-directional material jets, PK seems to be less essential. If GAIA indicates that Parenago's Discontinuity is a galaxy-wide phenomenon, future research might concentrate on these jets: how they are statistically aligned with star galactic location and direction of revolution around the galactic center. Regardless of the fate of the simple model proposed, this exercise (which has also been discussed in a 2015 International Academy of Astronautics (IAA) Symposium and a recent book (Starlight, Starbright: Are Stars Conscious?, published in 2015 by Curtis Press) demonstrates that panpsychism - the study of universal consciousness - might be emerging from philosophy into observational astrophysics. **P1**

295 The Integral Relativity of Consciousness, Mind and Energy Lex Neale <lexneale.integral@gmail.com> (Integral Research Center, Nevada City, CA)

Integral Relativity, as an extension of General Relativity, has three proposed Tenets: (a) The Equation of Energy with Consciousness; (b) The Law of Conservation of Consciousness; (c) The Integral Relativity of Energy, Consciousness and Mind via the Kosmic Constant. It is corroborated by E. Rauscher's Complex Eight Dimensional Model of Minkowsky Space; Haramein's Holographic Resonance; the instantaneous conveyance of information in Locality by the Non-local wave function, by Pusey, Barrett and Rudolph; the work of Penrose and Hameroff in Quantum Consciousness, and that of Dean Radin at IONS; and the Afterlife Experiments of Gary Schwartz. We introduce an extension of Wilber's Integral All Quadrants, All Levels (AQAL) model called the AQAL Cube, which correlates non-physical existence with physical existence in order to map the Integral Relativity of Energy, Consciousness and Mind; and which also differentiates Consciousness as a non-local AQAL Domain. We also propose an experiential code for the conveyance of information between Consciousness and Quantum Mind in compliance with Hameroff's gamma synchrony. The differentiation between Consciousness and Mind is made by the AQAL Cube's Third Axis Injunction, introducing the radical notion that Consciousness is non-local or Subtle awareness, and Mind is its correlated local or Concrete means of enaction. We propose that just as this Concrete physical Domain is full-spectrum, so is the correlated Subtle Domain, where the two spectrums function and correlate as parallel universes embedded in and embodied by each other, in compliance with modern science. This not at all radical to Idealist, Buddhist, Hindu or Taoist philosophy - that our evolution in this Concrete, physical arena is effected by the co-evolution of our Subtle Self, or our Soul, or Consciousness monad, in countless incarnations through a spectrum of identities and correlated physical vehicles. All the scientific evidence brought to bear corroborates this hypothesis of a Heaven-Earth polarity, as well as corroborating the tenets of Critical Realism, in expanding and explaining its paradigm of the Domain of the Real and the Domain of the Actual - the Subtle mechanisms (former) that underlie Concrete manifestation (latter) - to enable the mapping of those polarities as an integral whole. We propose that the terms Consciousness and Mind be no longer used synonymously in the scientific community, but differentiated as an integral Energy continuum. Integral Relativity predicts that the observer and observed are a mutually inclusive Consciousness/Mind/Energy continuum, which expands as an evolving holarchy of knower and known all the way to a Supreme Knower of a Supreme Knowledge. **P2**

296 Quantum Entanglement in Time - A Necessary Condition for Consciousness? Marcin Nowakowski <mnowakowski@mif.pg.gda.pl> (Applied Physics/ Mathematics, Gdansk University of Technology, Gdansk, Poland)

Quantum entanglement in time is a new phenomenon transposing the concept of spatial quantum entanglement, being a building block of modern quantum information theory, into a domain of time and may play a crucial role in explanation of consciousness. In this talk we will present the quantum mechanical perspective on quantum entanglement in time [1-5], new facts about its monogamy [3] and similarities to spatial entanglement with influence on causal processing of information. In consequence, we will pose the fundamental questions about its real influence on two-dimensional neural networks and potentially on experimentation with microtubule-like structures. It will be further used to address the issue of 'the late consciousness' and activities with 'the readiness potentials'. Finally, we state a thesis that a necessary condition for consciousness is occurrence of quantum entanglement in time. Its potential implications on robotics and quantum artificial intelligence will be considered with focus on emerging consciousness phenomena in quantum neural networks. This thesis will be discussed also on a ground of the orchestrated objective reduction theory by S. Hameroff and R. Penrose. References: [1] J. Cotler, F. Wilczek, Bell Tests for Histories, Preprint quant-ph/1503.06458 (2015). [2] J. Cotler, F. Wilczek, Entangled Histories, Preprint quant-ph/ 1502.02480 (2015). [3] M. Nowakowski, Monogamy of quantum entanglement in time, in preparation. [4] M. Nowakowski, P. Horodecki, J. Phys. A: Math. Theor. 42, 135306 (2009) . [5] Y. Aharonov, L. Vaidman, The two-state vector formalism: An updated review, Lect. Notes Phys. 734, 399 (2008). **C6**

297 A Quantum Biology Phenomenon in Consciousness Experiences Soam Prakash <soamprakashdayalbagh@gmail.com> (Zoology, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The 'Quantum Soul' hypothesis (Hameroff and Chopra, 2009) has produced a new wave of thinking as NDE/OBEs indicate the existence of soul which is so far being stapled as religious tradition and shunned by conventional science. However, the time is right to reinvestigate and formulate this hypothesis up to a law, which is distinctively verifiable. Penrose-Hameroff 'ORCH-OR' model is also a quantum approach dealing of consciousness (microtubule quantum computations inside the neuron) to fluctuation in fundamental space time geometry, the fine-scale structure of the universe. NDE/OBEs could conceivably exist independent of biology in various scalar plans in space time geometry. Not only in eastern religion but also in western religion for thousands of years theory like

reincarnation, tele-transportation and re-birth have been recorded at many times. The near death experience and embodiment of spirit (Van lommel et al 2001, Parnia et al 2007) have been recorded most typically in patients who have been resuscitated after cardiac arrest, similarly (Prakash 2010) has depicted the presence of soul in all her attire (what she has on her body at the time of unnatural death) in a depiction of disembodiment case study. The patients describe similar experiences of vision of white light, passing through a tunnel, serenity, conversing with deceased one, loved one and out of the body experiences. Also, the death or fear of death vanishes (Chopra, 20060, (Greyson, 1993). Modern science is unable to explore and actually ignoring and denying such experiences (Blanke et al 2004) as unscientific folly, illusion etc. Therefore, still we are unable to produce a theory of consciousness. The hard produce theory of consciousness. The hard problem (Chalmers 1996) is a real question: how cognitive process we accompanied is driven by phenomenal conscious experience? There is still no accounting for conscious experiences, the self, free will or 'qualia'- the essence of experienced perception. The theory of enlightment is nowhere to actually delineate the process involved. The first person experiences: Many of the western workers consider that consciousness occurs is merely a an illusion or the ride (Dennett 1991, Wegner 2002), which Huxley (1893) said 'helpless spectators'. Also, unconventional theory of 'Gap Junction' is that when various neurons open and close, enabling mobile zone of gamma synchrony to move about the brain, mediating consciousness (Hameroff 2006, 2010). That is also not sufficient to explain consciousness mechanism in brain. The approaches of chemical reaction, electric signals and biological functions of neuroscience are unable to explain it alone therfore seeking convincing answers at the quantum level.Since the quanta of soul is a quantum reality,as part of whole system. The summation of every part cannot have greater value than the whole system as the system scientist have realized also(Prakash 2011). A theory new shall be proposed that how soul and its experience,universe and its evolution is of quantum in nature with the help of electro magnetic bio field theory (Richa and Prakash 2011,12,1314,15). **P1**

298 Experimental Tests of Von Neumann's Psychophysical Interpretation of Quantum Measurement Dean Radin <dean@noetic.org> (Research, Ions, Petaluma, CA)

If the path that photons take through a double-slit interferometer is known by any means, then the photons will behave like particles, otherwise they will behave like waves. Numerous interpretations of this observational effect, associated with the "quantum measurement problem," have been proposed. One of the earliest proposals, by John von Neumann, was based on characterization of the measurement process as a chain of interactions between physical entities - e.g., physical system, detector, eye, brain - with the process ending only when knowledge of the measurement is registered by what von Neumann called an "extra-physical" factor, i.e., the observer's mind. In a series of 17 experiments with double-slit optical systems, some using continuous beam lasers and others single photons, we tested von Neumann's extra-physical factor. In these studies participants were asked to focus their attention toward or away from an optical system while the double-slit interference pattern was measured. The hypothesis was that the act of conscious observation would cause a change in interference. Some of the experiments were conducted over the Internet to rigorously isolate the observers from the optical apparatus. Overall the evidence strongly supported the hypothesis, but with a surprise. It was not the case that observation always "collapsed" the wavefunction, as the authors originally expected. But rather that the interference pattern became sharper or more diffuse depending on the observers' intentions, where intention was operationally defined by the nature of the feedback used to link the observers to the optical system. This outcome is consistent with consciousness as an active "steering force" rather than as a passive factor. It is also consistent with a half-century of prior empirical research using other targets of mental intention. These studies therefore suggest, in accordance with interpretations of quantum mechanics discussed by von Neumann along with Bohr, Schrodinger, Eddington, Jordan, Pauli, Planck, Jeans, Godel, London, Bohm, Wheeler, Squires, and more recently Stapp, that the observer is an inextricable part of the measurement process. Discussions about the quantum measurement problem have tended to focus on philosophical and theoretical arguments. This has led to over a dozen different interpretations and strongly held opinions on all sides. Our experiments are important because they offer a means of empirically informing, and possibly resolving, this long-standing debate. **PL11**

299 Interfering With Consciousness at Cellular (Hella Cell) and Molecular (Microtubule Protein) Levels Farid Semsarha, Mohammad A.Taheri; Morteza H. Najafi; Zohreh Afsartala; Maral Nazarifar; Zahra Moeinibakhsh; Mina Mohammadkhani; Hooriyeh Mohseni; Tahmineh Godazgar; Shahrzad Mehrmand; Masoud Rahman <semsarha@ibb.ut.ac.ir; Semsarha@iranianultrascience.com> (Institute of Biochemistry and Biophysics; Iranian Ultra Science Research Center, Tehran, Iran (Islamic Republic Of))

The nature of consciousness is a mysterious concept with many medical and spiritual implications. Investigation of consciousness can be performed by making an interference between this criterion and any level of living matter. A recently presented method of action on consciousness is Faradarmani that introduced by Mohammad Ali Taheri since 2005. Faradarmani, by definition, is connection between universal consciousness and elemental consciousness. In other word, Faradarmani is the interference in the conduction of consciousness at the non vital and vital levels (organism, cell and molecule). In this method, the main concept is to make a special connection between the consciousness of subsystem (object of study) and the source of consciousness of the ecosystem (the universal consciousness). The mechanism of this connection at the typical experiment is a mental interaction between three elements: universal observer (researcher), intermediate observer, and the universal consciousness. After observation of many medical advantages of the Faradarmani method in the treatment of various physical and mental disorders in our country and some other countries, we had decided to investigate this interference at the lower levels of complexity of biological systems. Therefore, our candidates for examination of this interference was on the two levels: the cellular level, Hela cell lines, and the molecular level, microtubule protein polymers, consisting of alpha and beta tubulins, known as the consciousness linked proteins of biological system. Our experiments on the Hela cell line by cell survival and cell cytometry analysis show a significant decrease in the cell growth efficiency (~30%) without any changes in the cell viability; moreover, the effect of Faradarmani on the tubulin polymerization was investigated spectrophotometrically and a remarkable increasing in the polymerization rate was observed. The results indicate the effect of Faradarmani on the cellular and molecular levels which could provide evidence for the observed cases of treatment of various disorders. **P1**

300 Quantum Neuroscience and Consciousness Henry P. Stapp <hpstapp@lbl.gov> (Lawrence Berkeley Laboratory, University of California at Berkeley, Berkeley, CA)

The issue of the connection between the physically described activities of a person's brain and his or her psychologically described conscious perceptions and intentions is examined within the Freeman-Vitiello quantum framework based on recent neuroscience data. This framework, in concordance with the ideas of Niels Bohr as refined by the work of John von Neumann, elevates the role of human consciousness from a mechanical by-product of a deterministic classical physically describable process to a psychologically describable input into the physically described aspects of an evolving psycho-physical reality. The orthodox quantum idea that the aspects of reality described in the terminology of classical mechanics are embedded in a reality that is not describable in classical physics terms is manifested in the fact that the classically describable neuronal structure is embedded in a neuropil substrate that has the dynamical character of a superfluid that makes a second-order phase transition in conjunction with each conscious experience. This adds detailed mathematical structure to the basic quantum idea that the classically described aspects of reality are embedded in an not-classically-describable reality closely connected to causally efficacious conscious experiences. Henry P. Stapp Lawrence Berkeley Laboratory University of California Berkeley, California, **PL7**

301 On Quantum Biology and Consciousness: From the Big Bang to Core Energetics James Tee <james.tee@gmail.com> (New York University; Institute of Core Energetics, New York, NY)

Hameroff and Penrose theorized that consciousness derives from fine scale activities inside neurons (Hameroff & Penrose, Physics of Life Reviews, 2014). This theory is now corroborated by a recent discovery of quantum vibrations in microtubules (i.e. a cell's structural skeleton) through work led by Bandyopadhyay. One important question to pose is regarding the originating source of these quantum vibrations - where did they originate from? Could all cells in the brain be entangled with one another? If yes, how did it all begin? Before we were adults, we were babies; and before that, we were fetuses in wombs. A human being is first formed when a sperm impregnates an egg, and thereby fertilizing it to life. Our human brain and body started merely as a single cell, which subsequently divided, multiplied and grew, until an entire brain and body is formed. It is therefore not too far fetched to consider the possibility that every cell in the entire brain is entangled to the quantum vibrations from the original single fertilized egg cell. If we were to take another step back and ponder about the sperm and the egg, each of these was part of a male and female adult (i.e. the parents of the child), and therefore, entangled with their respective quantum vibrations. These adults, in turn, have their own parents. Going along this chain of thoughts, it does make one wonder how widespread entanglement could be; from the current human generation to the previous; back up all the ancestral

family trees to the beginning of the Homo sapiens species; stretching wide throughout the entire animal kingdom (via Darwinian evolution theory). This opens up the possibility and the plausibility that the entire human population and all biological life forms on this planet at the present time are entangled with each other - perhaps to varying degrees. So, just how much further back could this entanglement go? It could go as far back as the beginning of time - the Big Bang itself, where everything was a one. It is as if quantum entanglement is a means of perpetuating the vibrational "essence" of whatever it was that created life more than 13.8 billion years ago. Everything began from one; everything was entangled; everything is still entangled. We are all connected together, with each other, to the vastness and entirety of the universe, as One Mind (Dossey, 2013). The current notions of quantum vibrations, entanglement and consciousness are confined to the brain, a 1.35kg piece of neurobiological mass. Here, I propose to broaden these notions beyond consciousness and the brain to the entire body itself, via quantum biology. After all, microtubules are the skeletal support structures for cells, and cells are the basic building block of the human body. Furthermore, the human body is associated with notions such as energy fields, chakras and auras. I will share a few thoughts on consciousness, energy and healing, from the perspective of Core Energetics - a psychotherapy modality that integrates the body, emotions, mind, will and spirit. **P2**

302 Lao Tzu, 'I Ching' and Modern Science of Consciousness Ethan Yang, Owen Chen, Southeast University of China; Gino Yu, Hong Kong Polytechnic University (PolyU); Stuart Hameroff,University of Arizona <fwethan.yang@gmail.com> (CCS, Crystal Globe Conscious Enterprises, Shanghai, Tucson, AZ)

Lao Tzu (or 'Laozi') was the ancient Chinese founder of Taoism, one of 3 major Chinese philosophies (alongside Buddhism and Confucianism). His many famous quotes include 'the key to growth is the introduction of higher dimensions of consciousness into our awareness', and he advocated living in harmony with 'the Tao', the 'path' or 'principle', a set of values intrinsic to nature and reality. Lao Tzu also formalized the 'I Ching', a system of human behaviors and mental states based on hexagrams, sets of 6 binary symbols with 64 possible states. These three aspects of Lao Tzu's ancient wisdom appear consistent with modern quantum approaches to consciousness. For example (1)'higher dimensions of consciousness' may relate to fractal-like patterns at different spatiotemporal scales in the brain, extending from the EEG (~ 0 to 100 hertz, 'Hz') at the slow, large-scale end, inward to deeper-level, faster ('higher') quantum level dynamics, e.g. in cytoskeletal microtubules inside neurons. (2) The notion of 'path' or 'principle', a set of values intrinsic to nature and reality, is comparable to 'Platonic values' suggested by Roger Penrose to exist in the structure of spacetime geometry, able to influence conscious perceptions and choices. (3) The 'I Ching' suggests mental states and behaviors relate in some way to hexagrams of symbols composed of 6 binary 'bits', with 64 possible states per hexagram. Biological memory, language and consciousness may rely on information in hexagonal lattices of microtubule polymers. Craddock et al (2012) have shown how synaptic information may be encoded in microtubules by CaMKII enzymes, each containing hexagons of 6 bits of information. Hexagon-based mental processes are also seen in the Nobel prize-winning (Moser et al, 2008) work on 'grid cells', showing how spatial location is represented in hexagonal grids with different scales at different layers in the brain's entorhinal cortex. In this presentation we compare the 64 states of the I Ching with 64 information states of a microtubule lattice region mediated by CaMKII phosphorylation. If Lao Tzu and many others were correct, wisdom and knowledge may be gleaned from subtle quantum harmony with the structure of the universe. 1) Hameroff & Penrose Phys Life Revs (2014) 11 (1), 39-79, 2) Sahu et al, 2013a, Biosensors and Bioelectronics 47, 141-148. 3) Sahu et al, 2013b, Applied Physics Letters 102, 123701. 4) Sahu et al, 2014, Scientific Reports 4, 7303. 5) Craddock et al, 2012, PLoS Comput Biol 8(3): e1002421. doi:10.1371/journal.pcbi.1002421 6) Moser et al (2008) Annual Review of Neuroscience, 31: 69-89 **P1**

4.15 Miscellaneous

303 Exploring the Mind-Brain Relationship: Preliminary Results on Biofield Detection Via Fmri Wagner Alegretti <walegretti@iacworld.org> (International Academy of Consciousness, Miami, FL)

The biofield hypothesis is explored in complementary alternative medicine (CAM) by researchers at the US National Institutes of Health and elsewhere and relates to a universal concept which has been called bioenergy, chi, prana, orgone, among other expressions. The biofield is a useful construct to explain the interaction of objects or fields with the organism, and is especially useful toward understanding the scientific basis of energy medicine, including acupuncture, biofield therapies, and bioelectromagnetic therapies. The detection and measurement of such a field has largely eluded scientists. The author designed and conducted three series of experiments using fMRI focusing on investigating (1) detection of anomalous physical measurements via fMRI concomitant with the practice of intentional transmission of bioenergy toward various types of media, and (2) neuro-imaging changes during the execution of bioenergy techniques and while provoking and experiencing the so-called vibrational state. Bioenergy was transmitted by an energy practitioner to the space around of their head, to a "fMRI reference phantom", and to a chicken egg, resulting in timely, distinct and clear presence of BOLD signal in those different media. In the case of the egg, the fMRI signal generated by the bioenergy transmission revealed structures inside of the yoke. Interesting results were also obtained by scanning the brains of subjects while they were performing "energy work" or acting as passive recipients of bioenergy transmissions, also showing BOLD activation of the practitioners' and receiver's brain, many times more intense and spread than while performing more common tasks, like a "finger tapping". If these effects are successfully replicated by other researchers, it could offer a replicable, objective measurement of a remote, physical effect of a practitioner's intention. This consciousness-matter effect could play a role in modeling CAM therapies and the more controversial psi effects. Speculative models of consciousness that require non-corporeal consciousness to communicate with the brain require a consciousness-matter effect, if such models are ever to be substantiated. The deepening of the study of the possible mechanisms of interaction between bioenergy and the BOLD and MRI techniques can inspire the development of better and more dedicated systems for bioenergy detection, the creation of an explicative and predictive theoretical framework for the conceptualization and understanding of bioenergy, and perhaps, the future possibility of development of a "bioenergy technology". **P1**

304 A Mandala on How to Fit the Self and its Platonic Realm Into the Penrose-Hameroff Paradigm Gerard Blommestijn <gblomm@gmail.com> (Amstelveen, Netherlands)

Showing this mandala in the Art Exhibit serves two purposes: (1) to demonstrate how an ontological independent I of the mind can co-exist peacefully with what we have come to know of physical reality by means of biology, chemistry and quantum mechanics, (2) to emphasize our real identity, namely that we are in our essence, in the I of our mind, really the same as the One consciousness center of everything, the Self. The mandala is in mixed painting and mosaic-like techniques (size: 40 cm x 30 cm). Like in every mandala, the center (here the round white stone) symbolizes the I of the mind, the one essence of all consciousness. We could also call this essence: That which experiences in every being, or I-ness or Self. The light green circular area around this central point represents the unchanging Realm of the Perennial Now and is structured according to Vedantic and Platonic principles. It contains nine ray-like pieces of stone in 3 colors that represent the birth of all the concepts by the Fire of Intelligence (Agnim in the Rig Veda). A multi-colored string of beads represents these concepts or Platonic ideas. These concepts are not only the mathematical forms, pure love etc., but all other primitives of perception and choice as well: sounds, colors, feels, tastes, smells, emotions, thoughts, plans, visions etc. The mandala as a whole expresses the interaction between the I of the mind plus its Platonic ideas or concepts, and the physical world. This interaction consists of the Quantum Mechanical Reduction Processes at the border between the Perennial Now realm of I-ness and the Space-Time realm around it (the physical world). These reduction processes are represented by a circle of glass squares of different colors. In the physical world I have selected the in my view most mature, appealing and convincing approach to consciousness, namely that of Penrose and Hameroff. In this approach the quantum reduction processes reduce superpositions of different complexes of space curvatures to one outcome complex that represents the total of the perceptions and choices of an organism at a certain moment. These complexes of curvatures are in the mandala represented by triangles of blue waves. According to the Penrose-Hameroff paradigm these space curvatures originate from the mass distribution of particles in microtubules, particularly in the carbon rings of aromatic amino acids. London van der Waals forces between the electron clouds of these carbon rings, may form communication chains from amino acid to amino acid within and between the tubulin proteins of the microtubules. This electromagnetic communication is in the mandala represented by Feynman diagrams of virtual photon exchange, and the amino acids are represented by their molecular structure diagrams composed of colored bead atoms and golden bonds. We even see a microtubule and a surprised neuron represented by beads and a drawing respectively. **A1**

305 Comparison of Sleep and General Anesthesia Timothy Shine <shine.timothy@mayo.edu> (Anesthesiology, Mayo Clinic Florida, Jacksonville, FL)

This brief review attempts to contrast and compare natural sleep and General anesthesia and is aimed for a general audience not just people involved in the practice of anesthesia. Sleep is thought

to be a state that characterized by being less arousable. Brain areas involved in sleep generation include brain stem, parts of the forebrain and hypothalamus. Cells in these brain regions Inhibit wakefulness by sending inhibitory neuro transmitters that inhibit wakefulness. Sleeping people can be aroused by loud noises, painful stimuli. During sleep people may have a rapid eye movement state or a non-rapid eye movement state and alter between these during their sleep. People also experience dreaming during sleep. We spend between 6 to 8 house every day asleep and sleep seems to be necessary for proper health of most animals including humans. General anesthetic drugs produce a reversible state of unconsciousness. Consciousness returns to the person as the drug concentration in the blood stream and the brain is reduced. The Anesthetic state is characterized by unconsciousness (not being aware), amnesia (no memory) and lack of arousability. General anesthesia results in a lack of sensation to painful stimuli or noise this is different from natural sleep where stimuli such as noise or touch will arouse the person and awaken them from natural sleep. During general anesthesia up to 20% of patients can dream. When and Electro Encephalogram(EEG) is measured on and anesthetized person the EEG shows lower frequency waves compared to higher frequency waves on an awake EEG. How anesthetics work is not fully understood they do interfere with the conduction of nerve impulses, the mechanism by which they inhibit nerve conduction differs with type of anesthetic. Think of the anesthetics as belonging to one of 3 major categories. 1. Inhaled anesthetics Isoflurane, Sevoflurane similar but more modern than Ether their action appears to be on the cellular membrane. 2 Intravenous anesthetics such as Propofol act on receptors for neurotransmitters blocking the transmission of nerve impulses by altering the flow of ions in and out of the nerve cell. 3. Local anesthetics such as Novocaine interrupt nerve conduction by inhibiting the movement of sodium ions into the cell. General anesthesia is not the same as sleep it is a reversible drug induced loss of consciousness. While the mechanism of anesthesia is not clearly understood is may provide a window into consciousness by studying the mechanisms that anesthesia produce loss of consciousness. **P1**

5.0 Experiential Approaches

5.01 Phenomenology

306 The Open Mind: A Phenomenology Josh Adler <usdacpoet@gmail.com> (academia.edu, Brooklyn, NY)

In The Open Work, [Harvard University Press, 1989.] Umberto Eco describes openness as a phenomenon of conscious organization that locates the infinite at the very core of the finite and invites us to conceive, feel, and thus see the world as possibility. Extending Ecos lens of cultural semiotics into quantum biology provides key correlative insights to understanding consciousness role in field dynamics as integrative information events occur. It also suggests how probabilistic systems of indeterminacy and discontinuity may evolve into sentient organisms. In particular, pairing Ecos semiotic analyses to cognitive, qualia-producing architectures, including awareness and attention, with Hameroff and Penroses OR Theory, reveals a practical level of poetics that acts as programmatic projects for creation. The writings of Rumi, Husserl, Dewey, Emerson, Merleau-Ponty, Trungpa, Hegel, and others confer depth to this compositional cycle of aesthetic information, embodied throughout the regenerative systems of biotic experience. Ecos ideas thereby provoke discourse around the role of openness within recent theoretical works by Jeremy England, Robert Lanza, Giulio Tononi, David Dennett, Joachim Keppler, Robert R McCrae, and David Chalmers. Unlike models of consciousness that arise from closed, local, computation, I argue that Ecos sense of openness unifies cultural and scientific concepts of consciousness as life's integrative force. **P2**

307 Consciousness Without Control: How Do Phenomenology and Function Change When Prefrontal Control is Reduced and What Does This Mean for the Development of Consciousness? Alison Gopnik <gopnik@berkeley.edu> (Philosophy, University of California, Berkeley, CA)

There has been extensive and important work in consciousness studies examining the relation between conscious phenomenology and prefrontal control. Conscious, top-down, endogenous attention and executive decision-making and planning are clearly related to distinctive patterns of frontal control and coordination. But what happens to phenomenology and function when prefrontal control is diminished or attenuated. Does consciousness simply fade or disappear? Or does it take different forms? This question is particularly important in understanding the development of consciousness, given that prefrontal control clearly increases with age. Investigators using very different methods have described function and phenomenology in cases of diminished prefrontal involvement. These include cases of electrical disruption of frontal function and administration of psilocybin and LSD, brief exposures of multiple crowded objects in 'ensembles' and perception and cognition in young children. In all these cases prefrontal control is attenuated. There appear to be some striking similarities in function and experience in these cases. With diminished prefrontal control, attention, experience and cognition may become distributed rather than focused, holistic rather than analytic and more bottom-up and exogenously determined, rather than top-down and endogenously determined. There is also evidence for increases in flexibility, and in some kinds of learning and creativity. Attenuated prefrontal control may have some computational and cognitive benefits that balance the costs of diminished focus, inhibition and executive function, and may be accompanied by distinctive kinds of phenomenology. This may help us understand what it is like to be a baby or young child, and why. **PL10**

308 Karma- A Metaphysics or Reality of Life? Lokesh Khurana <khurana.associates@gmail.com> (Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The paper investigates from first person perspective, the theory of Karma. Is it equivalent to Newton's law, 'every action has a reaction? Is it what happens to a person, happens because they caused it with their actions or is it as Carl Gustav Jung once opined on unresolved emotions, When an inner situation is not made conscious, it appears outside as fate? As per Wilhelm Halbfass, karma is the executed action as a consequence of that activity, as well as the intention of the actor behind an executed action. The paper studies the structures of experience and consciousness and maps it with deeds using experiential approach. When we think, speak or act we initiate a force that react accordingly. This returning force maybe same, modified, changed or suspended, but it comes back. There is a mystic uplink and downlink of our desires, thoughts, words, deeds, action to a system that automatically creates future experience in response to the current action. The paper also investigates into uncorrelated experiences, the suspended returning force. **P1**

309 The Varieties of Selfless Experience: Theological, Neurological, and Ecological Phenomenologies of Ego Death Brianna Morseth, Ian Doyle Olson; Amandi Bianka Budai <brianna.morseth@gmail.com> (Psychological and Brain Scienc, Psychological and Brain Sciences, UC Santa Barbara, Goleta, CA)

What is it like to be a conscious, living, breathing self? Moreover, what is it like to lose this sense-of-self through either bodily or ego death? Philosopher David Chalmers states of consciousness that it is "the thing we know about more directly than we know about anything in the world." This immediate sense-of-self is shared and experienced by us all, as is the eventual fate of biological death. Yet how one relates to death, selflessness, and one's own mortality encompass much more varied and unique experiences. Long have sages, mystics, and saints encouraged practices that culminate in self-transcendence: meditation, prayer, fasting, and other undertakings that alter one's state of consciousness and may even lead to the experience of ego death. Only recently have these topics entered any realm of empirical research. We reviewed existing literature and conducted an interview-based, international survey to further elucidate a basic background of these topics. Using a mixed-methods approach combining qualitative and quantitative data, we compare and contrast the direct experiences of selflessness and ego death among over one hundred participants from a variety of religious and cultural backgrounds. Analysis reveals three phenomenological contexts in which ego death experiences are likely to manifest: meditation and other contemplative practices, immersion in and unification with nature, and consumption of hallucinogenic substances that alter the chemical constituents of the nervous system. In this work we articulate these experiences and extrapolate toward an operational definition of ego death. We then broaden the discussion to address how ego death is contextualized in different traditions, approach an understanding of the underlying neurological processes, and critically examine the philosophical implications of ego death for free will, the criminal justice system, and environmental ethics. **C16**

310 Embodied Consciousness as a Bound State in an Open Multiple Quantum-well System Sukhdev Roy <sukhdevroy@gmail.com> (Physics and Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

We consider consciousness as a universal entity that in an organism is in a bound state. It therefore interacts with the external world through the mind and sense organs. Evolution has given rise to diverse forms of organisms with different capabilities to interact with the world through their respective sensory apparatus. In this bound state, an organism is exposed to a wide variety of external influences and subjected to macrocosmic and environmental perturbations at the mental and physical planes. Hence, it constitutes an open system. In this paper, we examine the human form as an embodied consciousness in a bound state and analyze its functions based on the theory of open

quantum systems, in which the interaction with the environment is also taken into account. We extend the framework of the psycho-physical quantum vibrational theory presented in TSC-2014 to incorporate open quantum systems. It is shown that consciousness can be effectively considered to exist in different mental and physical potential fields, akin to multiple quantum-wells of the mind and body. The conscious state is then a superposition of these vibrational energy states and variation in attention within these can lead to resonant tunneling between the quantum potential states. Focused attention at different planes provides the capability to perform higher or lower functions. Creativity, intuition, imagination, productivity and higher-order thoughts leading to corresponding action, arise due to the ability of an individual, by controlling and reducing the external environmental perturbations. The proposed theory appears to be compatible with the eastern perspective as well. Within this versatile framework, meditation enables the conscious state to resonate at higher energy states, enabling transitions from the confined sensory-based existence to the continuum and potentially to the unbound state. The proposed theory provides plausible explanation not only for various states of consciousness, but also a wide range of parapsychological phenomena that includes intuition and healing. **C16**

5.02 Meditation

311 Yoga Practices and Meditation: Techniques for Effectively Relieving Stress, Chronic Pain and End of Life Suffering Siddharth Agarwal, MD, Dr Sapna Agarwal MD <siddharthsatsangi@yahoo.com> (Medical, DEI Faculty of Integrated Medicine (AYUSH), Agra, Uttar Pradesh India)

Yoga and Meditation are now standard therapies of Integrated System of Medicine in the management of different health problems. As per WHOs guidelines for Palliative Care, they "provide relief from pain and other distressing symptoms; affirm life and regards dying as a normal process; intend neither to hasten or postpone death; integrate the psychological and spiritual aspects of patient care; offer support system to help patients live as actively as possible until death; provide support to help the family cope during the patients' illness". Recent research evidences prove that certain Yoga techniques may improve physical and mental health through down-regulation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system(SNS). The HPA axis and SNS are triggered in response to a stressor (physical or psychological), leading to a cascade of physiological, pathological, emotional and sub-conscious responses, due to release of cortisol and catecholamines. Repeated firing from the HPA axis and SNS can lead to diseases such as Diabetes, Obesity, Coronary heart disease, Hypertension, Depression, auto-immune disorders and substance abuse. Yoga is a systematic process for accelerating growth of a man in his entirety. With this growth, man learns to live at higher states of consciousness. In "Yoga- Vasishtha" one of the best texts on Yoga, the essence of yoga is beautifully portrayed thus, manah prashamanopayah yoga ityabhidhiyate." If the efforts of Yoga practitioners are confined only to securing bodily wellbeing, its benefits would be very much meager or limited as they cannot take you to the path of Ultimate Truth and Reality. By the yoga practices taught in vedas and Upanishads, one could reach up to the highest region of Universal mind. But in the religion of Saints, by practicing Surat-Shabda-Yoga and Meditation, one can reach the highest region of Universal Consciousness or purely spiritual region, which in other words is attaining the state of Ultimate Truth and Reality. Yoga Practices, Meditative Stages and Mantras, are recognized in medicine as effective complementary therapies for pain and symptom's relief and stress management. Our team has done a trial on the "Pain Assessment and Management" by measurement and assessment of pain as 3rd person (objective) and 1st person (subjective) on a small sample, both pre and post technique (with integration of inner experience with Neuroscience) and applying Unified Theory. This work wants to emphasize how these techniques of self-realization and awareness are focused in providing relief from suffering, pain and stress, more so in palliative Care. Our work demonstrates that how current research on science and technology of Yoga practices and Meditation has influenced these important methods of healing to the included in the standard care of patients at all levels and focus on research pertaining to pain and stress management, blindsight, neglect/extinction and Phantom limb syndromes. **P1**

312 Change in Visuo-spatial and Verbal Working Memory Capacity at Different Phases of Meditation Sona Ahuja <sonaahujadei@gmail.com> (Pedagogical Sciences, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The meditation techniques based on oriental philosophy of Saints (Radhasoami Faith) are practiced sequentially in three phases - (i) novice meditators practice mantra meditation (ii) intermediate meditators are trained for the practice of contemplation of form (iii) advanced meditators are trained

for sound practice along with the practice of contemplation of form. The repetition of mantra in the first phase can be connected to verbal technique to disrupt the distracting thoughts. The visualization technique in the second phase can enhance the capacity to hold complex visual image. The simultaneous use of sound and form in third phase is likely to involve working memory and phonological loop conjointly (Buttle, 2011). The current study tests this hypothesis of association of different components of working memory with sequential phases of meditation. The participants were studied for (i) perceptual task which required concentration on complex images (ii) spatial span task which required subjects to temporarily hold and manipulate spatial and movement information displayed on screen (iii) visuo-spatial processing skills - subjects mentally compared complex images to one another (iv) digit span task which required visual inputs to be recoded so that they can enter the short term verbal store. The automated tasks were administered on participants before and after meditation. The results indicate that all three strata and controls performed same at the baseline level. After the practice of meditation for a period of 20 weeks, the experimental group demonstrated an increase in performance on visuo-spatial and verbal working memory with variation in gain in the three groups. The increase in verbal working memory was significant in the first and third phase of meditation. The gain in visuo-spatial working memory was significant in third phase of meditation. There was sharp gain in concentration at the first phase of meditation whereas no change was observed in the visuo-processing skills of this group. The intermediate and advanced meditators showed significant enhancement in visuo-spatial processing efficiency. No significant difference in performance of controls was found. The results are discussed in the light of association of different components of working memory with different phases of meditation. The study also presents the interactional effect of age and phase of meditation on visuo-spatial and verbal working memory. The correlations among verbal memory, visuo-spatial memory, visuo-spatial processing skills and concentration are discussed. **C8**

313 Impact of Yoga and Meditation in Enhancing Working Memory, Mindfulness and Health in University Students: Integrated Approach Jyoti Kumar Arora, Prof. M M Srivastava; Ravindra Bhardwaj <dei.jkarora@gmail.com> (Humanities and Applied Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

To improve the quality of life, there has been the search for strategies for handling stress, and subjective well-being. These explorations have led us to ancient disciplines such as Yoga, which combine the physical elements of a healthy lifestyle with mental peace. It integrates the personality by bringing body-mind-soul coordination in a well-balanced way. Today, through the advances and development of science and technology of neuro-physiology and psycho-physics, it is possible to measure the effects of the integrated approach of Yoga and Meditation in enhancing the working memory, mindfulness, health and level of consciousness. The present paper is aimed to create awareness of the need of regular practice of Yoga and Meditation among the matured group of students at university level which will certainly help to improve the qualities of their mind for not only worldly achievements and success in life. The scientific study involves pre and post measurements on subjects of physical, physiological, psychological parameters, their neurological correlates and applying Null Hypothesis with Unified Field Theory. The biology of meditation reveals that after meditation even for three months, participant's had higher level of neurotransmitters in their blood, although the exact nature of the relationship between neurotransmitters and meditation has yet to be revealed. Increase in alpha rhythm amplitude and decrease in beta-wave activity are found among mediators. Similarly decreased heart, respiratory rates, improved memory, attention and concentration were found among mediators as compared to the non-mediators as well as before and after meditation in the same subjects. **P1**

314 Meditation Practice in the West and the Science of Buddhism Richard D. Baker <rdbaker108@gmail.com> (Dharma Sangha, Crestone, CO)

Meditation practice in the West has helped many persons realize a deep-seated calmness; an interior and exterior attentional-awareness; a greater integration of mind and body; a more realistically and inclusively woven personal narrative; an instrumental consciousness of psychological processes and habits; and a more intimate and connected relationship to the world and to others. Although the average practitioner usually does not have the opportunity or commitment to develop meditation practice to this degree, regularly practiced meditation can transform our understanding and experience of what it is to be human, especially when the experiences and insights of meditation are examined, extended, and evolved within everyday circumstances. Nevertheless, the principal emphasis of Zen Buddhist Meditation is to free us from the conditionings of consciousness and culture. The

job of consciousness is to make the world actionable and relatively predictable through categorizing percepts and actualizing self-agency. While the structural exigencies of consciousness establish our usual, shared human world, the world that shows up in consciousness is not how we and the world actually exist. While we are individually instantiated, multi-generational beings, simultaneously, we are thoroughly inter-emergent with others and with the otherness of the world - however in ways that consciousness cannot categorize or develop. Tribal, national, and civilizational cultures create generationally sustainable experiences of being. Nonetheless, as there are numerous ways of be-ing in the world, Buddhist teachings assume and Buddhist practices confirm that we are able also to be relatively free of non-inherent cultural conditions and assumptions. This is the basal condition of Zen meditation. Thus the practice of Wisdom (as presented by Buddhism) is to free us from the assumptions and projected experiences that there is a ground to being and an unchanging background of time and space. We do not actually exist within a container framed by universals. (The Big Bang didn't happen in space, it created the space in which it happened.) While the layering of duration (the present) and the extensions of space are also not graspable by consciousness, they are inclusive of each other and inseparable from our uniqueness. There is an 'isness' of relationships - that is all! It is an infinity of changing inter-changing. The view that change is changing is not a view. This positioning is called 'emptiness' (which is empty of views). Zen inter-emergent meditation practice, located in the world as it is, rooted in compassionately living the Wisdom of entitylessness (thusness, emptiness, is-nes: 'words' as mental postures which shape perception) immerses us in beingness and an integrative, inclusive knowing which cannot be disposed within consciousness nor fit to almost any cultural disposition. This is awakening! **C16**

315 Altered States Revisited: Exploring Meditation with a Group of Novice Meditators Taking Part in a Short-Term Meditation Program Denice Basnett, Beate Von Krosigk <denice.basnett@live.com> (English and Liberal Studies, University of South Africa, Thornhill, ON Canada)

The regular practice of meditation has been shown to reduce stress and increase well-being. However, there is limited information on how meditation feels or is experienced by the meditator. This study explores the subjective experience of meditation with novice meditators taking part in a four-week introductory meditation program. Nineteen college students were divided into 4 groups. Each group met once a week for a 30-minute guided mindfulness meditation session. Each meditation session was immediately followed by a 30-minute focus group during which the research participants shared their experiences. Analysis of the transcribed data revealed 12 key experiential constituents. The findings from the focus groups are examined with reference to Arnold Ludwig's decades old but still relevant 1969 categorization of how altered states are produced and their experiential characteristics. This study shows meditation to be a self-induced, adaptive, altered state of consciousness that enables the meditator to cope better with daily life. **P1**

316 EEG Studies on the "Transmission" of Subjective Light/Energy Between a Meditation Teacher and His pupil Peter Fenwick, Luft C; Bhattacharya J <peter_fenwick@compuserve.com> (Institute of Psychiatry; Kings College; Southampton University, London, United Kingdom)

A 60 year old Teacher, during 3 to 4 minutes of meditation, induced in pupils a strong subjective perception of white (sometimes coloured) light and bodily sensations of energy. Absence of mutual eye contact reduced the intensity and nature of the experience. Hyperscanning EEGs (500 samples/sec/channel, 64ch, two EEG machines) simultaneously recorded the electrical brain responses of Teacher and pupil under all pairwise combination of instructions to Teacher (transmit/do not transmit) and to pupil (receive/do not receive). A trial of transmitting and receiving was also recorded while both Teacher and pupil wore goggles preventing them from seeing each other's eyes clearly. Both were blind throughout to the other's instructions. We estimated the strengths of neural oscillations in standard EEG frequency bands and the effective connectivity (Phase Slope Index) between the two EEGs, as a measure of inter-brain communication. We observed an increase in gamma power (30-70 Hz) in the Teacher's EEG while transmitting energy compared to when he was not, and an increase in gamma power in the pupil's EEG when receiving energy compared to when he was not receiving it. There was a similar increase in gamma power for the trial when eye-contact between the pair was restricted by light diffusing goggles. In this trial the subjective effects were significantly reduced, with the visual effects going and the energy feelings remaining at a reduced level. The Teacher's and pupil's EEGs synchronized, from the Teacher to the pupil's EEG, especially in alpha (peak 10 Hz) and gamma frequencies (peak 66 Hz) when both the Teacher was sending and the pupil receiving energy. There was some synchronization of Teacher/pupil interaction in other conditions (e.g. Teacher transmitting, pupil not receiving), but this was less prominent. Synchronization between the brains was blocked once eye contact was prevented by wearing the diffusion goggles. Thus high gamma was found with meditation in Teacher and in the pupil both with and without goggles. Both the visual subjective effects and communication between the brains were blocked by the goggles, suggesting that eye contact between Teacher and pupil is necessary if all the subjective effects of the meditation are to be experienced by the pupil. High gamma has been reported in mindfulness with experienced meditators, but is less prominent in other forms of meditation. The colours seen by the pupil were possibly due to fusiform gyrus stimulation with the spread of posterior gamma activity spreading into this area. fMRI bold activity of the Teacher's meditation state vs mind-wandering has been recorded but the analysis is not yet complete. **PL12**

317 Present-moment Word Meditation David Hubbard, Sauder Heidi, PhD <davidhubbardmd@gmail.com> (Neuroscience, Alliant Int'l University; California School of Professional Psychology, San Dieg, Poway, CA)

Focused-attention meditation methods focus on a mantra, or one's breathing. Mindfulness meditation methods do not focus attention but instead encourage openness to whatever enters awareness, including thoughts. Both meditation methods aim to reduce distracting thoughts. We asked normal subjects to focus attention on inner speech words heard spontaneously in the present moment. Methods: Subjects were recruited by word-of-mouth who were interested in meditation, whether or not they did so regularly, and were given the following verbal instruction: Pause for a moment and listen for the next word or two that you hear in your mind. Wait a moment, there may be no words immediately. Listen for actual recognizable words. What is the first word(s) you heard? So, you heard the word in about X seconds? Did you visualize, hear or feel any other sensations before you heard the word? Did you visualize, hear or feel any other sensations after you heard the word? Let's do this a few more times until you've identified at least 5 heard-words. If you are interested, you can write yourself a note, or use your phone voice-to-text app such as ListNote to record these present-moment heard-words before you forget them. Interview questions: Heard-word(s):_____ elapsed time:_____ sec voice: self vs non-self Any experience or sensation [auditory, visual and/or visceral, explain and discuss as needed] before the heard-word?: _____ Any experience/sensation after the heard-word?: _____ Results 10 subjects: 4 female 6 male ages 35 to 66 Meditation experience: range: 0 to 30 yrs Focused-attention trials to reach criteria: average: 2.6, range 1-4 Heard-words per trial: average: 1.2, range 1-3 Elapsed time to heard-word: average 2.2sec, range: 1-6 sec Voice: self in 100% Word category: Nouns: 90%, e.g., 'heart'. Present tense: 90%, e.g., 'calm'. Experiences/sensations Before: 5%, e.g., phrase from instructions rehearsed. After: 10%, e.g., 'I will say my word now.' Discussion All subjects were able to perform the task of attending to and reporting silently heard-words. No potential subjects were excluded for failure to perform task. The heard-words were in the subject's own voice. Waiting time to the heard-word was typically less than 2 seconds. Only one or two words were heard on average. Heard-words were remarkably banal, not surprising or profound, typically descriptions or labels of present experience. Intervening subjective content was minimal and were typically recent events, such as the instruction tasks, or present sensations. After heard-word content occurred in only10% of trials, and was typically traditional 'thinking', such as planning or reminiscing. The heard-words faded quickly and were forgotten unless repeated or recorded immediately. Questions for future research: Would subjects with no experience in meditation be able to perform this task? How does attention to present-moment heard-words relate to attention to a mantra or unfocused attention to present-moment experience, including thoughts? What is the relationship between heard-words and present-moment thoughts? **P2**

318 Four Month Meditation and Positive Psychology Intervention Shows Highly Significant Results on Well-Being, Positive and Negative Emotion, Depression, Stress, Narcissism, and Non-Symbolic Experience Jeffrey A. Martin <jeffery.a.martin@gmail.com> (Center for the Study of Non-Symbolic Consciousness and TransTechLab, Sofia Unive, Newport, KY)

Non-symbolic experiences have been reported for millennia and are generally attributed to spiritual and religious contexts, although atheists and agnostics also report them. Popular terms for them include: nondual awareness, enlightenment, mystical experiences, peak experiences, transcendental experience, the peace that passeth understanding, unity consciousness, union with God, and so forth. Most are temporary, but some individuals report a persistent form of them, which we refer to collectively as persistent non-symbolic experience (PNSE). Over the past decade our research project has sought to map this experience in over 1000 adults who report PNSE. Results from this have been previously reported at this conference and in other venues and publications. As part of our study, we collected data on which methods participants felt were the key to their transition to PNSE, if any. We

then constructed a protocol using these techniques and tested them on subjects who did not report PNSE. The protocol ran for approximately four months and involved over two dozen activities. 167 participants completed the protocol during four experiments in 2014. Pre and post measures revealed highly significant, beneficial changes across a wide range of psychological metrics, including: well-being, emotion, depression, stress, anxiety, absorption, health, meaning, Big 5 personality traits, loneliness, gratitude, relationships, accomplishments, flow, compassionate love, mysticism, and PNSE. In addition, 122 participants reported a transition from ?normal? consciousness to an ongoing form of non-symbolic experience, and significant differences were found on psychological measures both pre and post between members of these two groups. **C8**

319 Encouraging Altered States of Consciousness in Those With Already Altered States: Meditation and Psychosis Adrianna Mendrek <adrianna.mendrek@ubishops.ca> (Psychology, Bishop's University, Sherbrooke, Quebec Canada)

A wide range of meditative practices has been employed over the past few decades to alleviate physical ailments and psychological suffering in the general and in clinical populations. Some regard meditation as a remedy for stress, pain, high-blood pressure, anxiety and depression, but others remain skeptical and caution against unexpected side effects. The worry about unusual effects is especially pronounced when it comes to applying meditation to treat schizophrenia and related psychotic disorders. MEDITATION: Meditation is no longer confined to specialized centers and retreats, but has entered our schools, workplaces, hospitals and prisons. It has been marketed as a natural way to calm our minds and enhance life-satisfaction, but we rarely hear that it may radically alter the way we perceive the world and ourselves within it. Traditional contemplative techniques have been developed so we can see that we are not who we think we are and to realize that our concept of reality is misguided. Some forms of meditation may induce feelings of boundlessness, a sense of non-existence or deconstructed and discontinuous self. This can be an insightful and blissful experience, but it can also be terrifying if we are not prepared. Given that meditation can sometimes produce such profound effects, is it a good idea to use it in people with already fragmented perception of self, derealisation, hallucinations or delusions? SCHIZOPHRENIA: Schizophrenia is one of the most complex and least understood psychiatric disorders. It may lead to a progressive functional decline impacting cognitive, affective and social domains. However, some individuals diagnosed with the disorder have a good insight into their condition, maintain their employment, have families and friends. The clinical presentation of schizophrenia is also quite heterogeneous with symptoms ranging from hallucinations and delusions, disorganized speech and behavior, to flat affect, lack of motivation, and cognitive deficits. The disorder is characterized by reality distortions and altered sense of self. MEDITATION & SCHIZOPHRENIA: In comparison to other mental health problems, such as anxiety and mood disorders, the number of clinical trials evaluating the effects of mediation on schizophrenia symptoms is very modest. Overall, earlier studies have been cautious and often critical about the use of meditation in schizophrenia and related conditions. There are reports of individuals with a history of schizophrenia or schizotypal personality who experienced acute psychotic episodes while engaging in meditation. Others described cases where psychotic episodes were induced in individuals with no prior history of mental health problems. Recent reports are more encouraging. We will review critically the available literature on the effects of meditation on schizophrenia. We will take into consideration heterogeneous symptomatology of the condition (e.g., effects on positive versus negative symptoms), different types of meditation (e.g., mantra repetition versus mindful attention to breath) and evaluate research methods used in individual studies (e.g., presence of control condition, length of intervention). It appears that carefully crafted interventions may be beneficial in a specific type of psychotic disorders. **P1**

320 An Inner Evolution of Thoughts in Relation to Meditation: According to Sant (saints) Mat Gagandeep Nigam <gagandeepnigam@yahoo.com> (Dayalbagh Educational Institute, Agra, India)

In this paper we aim to explain the process of development of higher consciousness by managing the inner mechanism which includes thoughts, memories, behaviour, perception and attitude. Thought has been proven to be a powerful non-physical energy which can influence others and even matter also. Our thoughts and feelings have intimate connection with our breathing. According to eastern philosophy, breathing affects men'smind. Breathing becomes long and rapid whenever a person is in a fit of anger and excitement, while his breathing becomes short when he is worried or terribly afraid. There is no need to stop thinking or modulate your thoughts in any way. But when they absorb you, let go and concentrate fully on the breathing it is important to choose a practice that is rooted in ancient wisdom. We should look for something that emphasizes compassion, love, tenderness and dedication to become fully human. So the benefit occurring from the meditation is so free from harm that everyone can make use of it without any anxiety or risk. It is the real oxygen for the mind which can turn the anger, greed and frustration to a far higher level of Sat Chit Anand and parkash.. **P1**

321 Chanting Improves Mood and Social Cohesion Gemma Perry, William F Thompson, Vince Polito <gemmaperry@outlook.com> (Sydney, NSW Australia)

Chanting is a pervasive practice in almost every tradition all over the world. It has been found to improve attention and reduce depressive symptoms, stress and anxiety. The current study aimed to determine whether chanting Om for 10 minutes would improve attention, positive mood and increase feelings of social cohesion. The effects of vocal and silent chanting were compared, as well as the effects of chanting for experienced and inexperienced chanters. It was hypothesised that vocal chanting would have a greater effect than silent chanting and experienced chanters would report stronger effects. Participants were 27 experienced and 45 inexperienced chanters. They were randomly allocated to one of two conditions: vocal chanting or silent chanting. Prior to and following chanting, participants completed the Digit-letter Substitution task, the Positive Affect Negative affect Schedule, the Multidimensional Measure of Empathy and the Adapted Self-Report Altruism Scale. Following chanting participants also completed a Social Connectedness Questionnaire and a manipulation check. Results showed that positive affect and altruism increased more following vocal chanting than silent chanting. Furthermore, while altruism increased following vocal and silent chanting for experienced participants, it only increased following vocal chanting for inexperienced participants. There was no significant difference between the vocal and silent conditions found for empathy or attention and they were not found to be mediated by level of experience. Lastly, the social connectedness questionnaire did not show any evidence of differences between vocal and silent chanting, nor was it found to be mediated by experience. Overall, these results indicate that chanting has a positive effect on mood and cognition. The findings are discussed in view of current understandings of the psychological and emotional effects of music and synchronization. **C16**

322 Samadhi for Soldier Resilience and Posttraumatic Stress Brian Rees <brian.rees@charter.net> (David Lynch Foundation, San Luis Obispo, CA)

The ability to withstand and/or recover from extremely stressful events may be enhanced by repeated experience of transcendental consciousness, awareness that is without content, beyond all opposites and conflicts. The United States Army has identified five domains of comprehensive soldier fitness: physical, family life, emotional, social, and spiritual. An analysis published in 2011 evaluated 33 reasonably significant modalities of meditation or stress management/relaxation, screening over 11,500 articles for relevance regarding soldier resilience. Using the volume and quality of research over 40 parameters distributed among the five domains of resilience, Transcendental Meditation (TM), mindfulness, and progressive muscle relaxation, in that order, had the most supporting data. They have three different mechanisms of action. TM explicitly is designed to allow the mind to experience the silence associated with the least active state of awareness, or transcendental consciousness. Unpublished data from Norwich University indicate that TM was effective in promoting resilience. Fifty-six freshmen cadet volunteers were randomly assigned to either immediate, or delayed, training in TM. Results showed a significant decrease in negative affective states in the TM group at both the 2 and 6-month posttests. Likewise, positive affect including resilience, constructive thinking, and behavioral coping all increased significantly for the TM group. These results have been replicated with another group of sixty freshmen cadets in the second year of the study. A study published in 1985 of US Vietnam War veterans suffering from Posttraumatic Stress Disorder (PTSD) randomized to either TM or psychotherapy revealed greater improvement in depression, substance abuse, and PTSD symptoms in the TM group. A pilot study of American veterans of Iraq and Afghanistan instructed in TM revealed improvement in a host of PTSD measures. A randomized study published in 2013 tested the effect of TM practice on symptoms of post-traumatic stress (PTS) in Congolese refugees. They were evaluated with the Post Traumatic Stress Disorder Checklist Civilian (PCL-C); 42 refugees were randomized to TM or waitlist control. PCL-C scores in the control group trended upward. PCL-C scores in the TM group went from high at baseline to a non-symptomatic level after 30 days TM practice, remaining low at 135 days. In follow-up the PCL was administered to non-matched wait-list controls refugees from the previous study three times over three months. Eleven refugees were then taught TM, and re-tested 10 days and 30 days after instruction. Average PCL scores dropped markedly within 10 days, then dropped further at 30 days. Effect sizes for TM were larger than those of other interventions. The fundamental lesion in PTSD can be understood as spir-

itual. The individual is faced (repeatedly for those tormented by intrusive thoughts and memories) with horrific experiences that seem irreconcilable with optimism, incompatible with an appreciation of the universe as unified and coherent. Resolution may lie in the experience of samadhi, comprising inner calm, stress release, awareness without boundaries, and even bliss, located in the field of consciousness underlying thought. Regular practice may serve to inoculate military personnel (and others) against PTSD, and facilitate posttraumatic growth instead. **C16**

324 Meditation and the Neuroscience of Consciousness Ashima Srivastava, Nil <ashima710@gmail.com> (Psychology, Saran Ashram Hospital, Agra, Uttar Pradesh India)

The present study on meditation and neuroscience of consciousness is based on the initial findings of neuro-scientific research on meditation. Meditation refers to enlightenment or it is a state of Samadhi. Samadhi is a self-absorptive, adaptive state with realization of one's being in harmony with reality. Modern neuroscience helps us to understand state of enlightenment. The human being is living with consciousness. Consciousness is the cognitive dimension of the spiritual way of knowing. The goal of human life is to attain the state of higher consciousness where the knowledge is direct and intuitive. The practice of meditation by any means of sadhana is known as psycho-spiritual practice, so mind gets developed consciousness and the power of concentration. In the present study, the researcher has explored the intersections of neuroscience and meditation. In this research study, the measurement of consciousness will be studied on selected subjects with the repetition of mantra on chakras and the experimental and analysis show the significant difference in brain waves and indicates lesser anxiety, worries and depressive moods in all the subjects. **P1**

323 Consciousness Can Bring Peaceful and Pleasant Life in World Kundan Srivastava, Vijay Shanker Lal Srivastava; Kumar Vaibhav; Neha Paliwal <dr.vijaysri@gmail.com> (Medical, DEI, Harda, Madhya Pradesh India)

Consciousness means alertness and it is the quality or state of being aware of about an external object, surrounding or something within one self. Consciousness give power to everyone to differentiate between right and wrong and give decisive power what to do or not to do, so everyone have it but have different level of consciousness. Consciousness is seat of God who guides us through the voice of our consciousness, who honour them are able to make right decision and their conscious become strong and their conscious level also increase. But who did not hounor the voice, the voice become silent so they deprived from the supernatural guidance and do whatever they wants and suffer a lot and with them, their family and society also suffer. When the conscious of any person become strong his predictive power will also become strong and voice of consciousness also make the person alert for coming good or bad happening. He will never do the wrong act as the conscious will always guide him and discriminate between good and bad act. In fact conscious leads us towards almighty. At present it is strong need of every person of the world. If everyone start honour the voice of consciousness the life of the every person become peaceful and pleasant and finally, of community, country and world. Our energies, money and time which we are wasting in negative thing can utilize for positive thing. Consciousness can only bring humanity back in to-days money and self oriented era, can also give the ethical value and help in sustaining every one life comfortably which is the earnest need of every person at present. Co-author Km. Vaibhav Neha Palival Dr. (Mrs). Kundan Srivastava M.O Radhasoami Adivasi Charitable Hospital **P1**

325 Cultivating the Empty Field: An Empirical Study of Flow and Creative Solitude Through Mindfulness Meditation Monica Stert, Brianna Morseth <monica_stert@umail.ucsb.edu> (UC-Santa Barbara, Goleta, CA)

Moments of internal and external quiet are increasingly rare to find in today's fast-paced life, but these can be the most peaceful, restorative experiences. These experiences are often achieved when one can be alone with their thoughts, a state of mental solitude, which is often conducive to states of mindfulness and self awareness. Prior research shows they can also be achieved through flow, in which a person is completely immersed in the present moment experience, losing identification of the self and activating a deeper present awareness. As experimenters, we wanted to examine the opposite relationship of solitude and mindfulness to discover if states of flow experiences, achieved through mindfulness meditation, have an effect on an individual's desire for and productivity in states of solitude. We predict those who are experienced meditators, those capable of achieving flow in a sitting meditation session, are more introverted, and when placed in a solitude condition will score higher on a Preference for Solitude Scale and a creative writing task. Individuals may also express a greater desire for solitude if they are introverted, placed in a group, and do not achieve a flow state. Those who have achieved a flow state might be equally comfortable with others or by themselves, having already achieved an experience of peace and mental quiet in their mind through their meditative flow state. Those who are introverted, do not engage in flow states, and placed by themselves are predicted to generate more creative writing entries. Those who have engaged in flow states may be more creative on this task, irrespective of introversion or setting. Results will be discussed as well as implications for understanding ways in which moments of solitude can be affected by being present and if there are ways to help others and ourselves experience moments of just sitting that can provide us with productive solitude and restoration. **P2**

326 Meditation Training and Executive Attention: Identifying Amplitudes and Sources of Event Related Brain Potentials During a Demanding Switch Task Marjorie Woollacott, Pablo Burgos; Teresa Hawkes; Gabriela Cruz <mwool@uoregon.edu> (Human Physiology, University of Oregon, Eugene, OR)

The aim of this cross-sectional controlled study was to explore the efficiency of executive attention networks for two types of meditation training (sitting vs moving (Tai Chi) meditation) as compared to physical training (aerobic walking). We also compared amplitudes of event-related potentials (ERPs) and contributions of brain sources to ERPs during a task-switch test for the groups. We report the first controlled study comparing the effects of these practices on the EEG P3b event-related potential, a neuroelectric index of human executive function and on the source of these potentials. Tai Chi is a form of exercise and moving meditation. Exercise and meditation have been associated with enhanced executive function. We hypothesized that because Tai Chi requires moderate aerobic and mental exertion, this group would show similar executive neural function compared to meditation trained groups, and better executive function than an aerobic exercise groups. We predicted all training groups would outperform sedentary controls. Methods: 54 volunteers (Tai Chi, n = 10; meditation, n = 16; aerobic exercise, n = 16; sedentary, n = 12) were tested on a visuo-spatial, randomized, alternating runs task switch test during dense-array electroencephalographic (EEG) recording of event-related potentials (ERPs). We used ERP envelopes to examine most positive and negative channel values at each time point and also to find the brain domains that contributed with the highest variance to the envelope in a selected time window (here 0 to 0.4s). To evaluate the contribution of brain domains to the ERP envelope we calculated the percentage of variance accounted for (PVAF) with the following formula: PVAF=100 x (1 - var(D-B)/ var(D)). Where D is the channel data and B the back-projection of each brain domain onto scalp channels. ERP envelopes and contributing sources were obtained using the EEGLAB plugin, std_envtopo (http://sccn.ucsd.edu/wiki/EEGLAB_Extensions_and_plugins). Results: Results showed that only Tai Chi and meditation plus exercise groups showed larger P3b ERP switch trial amplitudes compared to sedentary controls. A clustering algorithm showed that the four main domains involved in the attentional switching task were located in the brain areas: fronto-parietal, anterior cingulate, visual (V1-2) and right angular gyrus. The fronto-parietal and anterior cingulate cortex are areas associated with attentional control and executive functions, indicating that the different groups had in common the involvement of executive attention and visuomotor networks. Conclusions: Our results indicate that long-term Tai Chi practice and meditation plus exercise significantly benefit the neural substrates of executive function, as compared to aerobic exercise alone or a sedentary lifestyle. Important sources of the ERPs include the anterior cingulate and fronto-parietal networks. **C8**

5.03 Hypnosis

5.04 Other altered states of consciousness

327 Consciousness and Smoke of Clouding Waves of Desires Kanta Arora <karora_zao@yahoo.co.in> (Sanskrit, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

I consider the human form to be disintegrated spark of Divine Will to expand. The clouding waves of desires surround living beings and push them forward to will and determination.consciousness is desire itself. Seed of desire sprouts forth, expands to live its life and reverts back to its source. The paper expresses a logical view as to how the smoke of clouding desires projects the tendency of spirit to mix with mind and matter and how one wanders in wilderness of this universe through developing a separate Identity (I-ness). How a burning desire pulls up from within the Self to revert back for the experience of reunion with the ultimate Reality. **P1**

328 The Correlation of Rhythm and Consciousness: Rhythmic Practices and Shifted States of Consciousness; Circular Procession Rites and The Axis Mundi; A Comparative Study Pam Payne <pam@brickhaus.com> (CAiiA, Planetary Collegium, Plymouth University, England, Brooklyn, NY)

While a correlation of rhythm and consciousness is generally accepted it is not well understood.

Insight might be gained by understanding the historic and cultural beliefs surrounding rhythmic activities such as circular procession rites. Circular motion is a rhythmic activity. If rhythm is defined as a pattern that repeats, a single repetition can be defined as an oscillation or circular motion, albeit lopsided. Circular procession rites have persisted throughout history up until present time, from the ancient Celtic ritual of circling a sacred well in order to gain access to an alternative realm to the whirling meditation of the Sufi Dervishes. Circumambulation, or the ritualized movement in a circular pattern, sometimes around a sacred object or area, is a widespread practice that appears in various forms throughout history. We currently have a unique opportunity to observe a relatively new circumambulation practice with reportedly cathartic effects; the circle mosh pit observed at contemporary music festivals. Many cultures throughout history have a metaphor for the axis mundi or world axis; a bridge that links 'normal' existence to alternative realms. Axis mundi symbols such as the tree, vine, ladder and vortex or column of light are thought to be metaphors that identify an actual experience of alternative awareness. In ancient Greece, the axis mundi was said to mark the center of the universe, also called the omphalos or the earth's navel, a portal to transcendent awareness. There were several of these 'centers' in ancient Greece, the most famous being the site of the oracle at Delphi who traversed the boundaries of time and space to access wisdom from alternative realms. Other cultures suggest the axis mundi, or bridge to alternative awareness, can be generated virtually anywhere given the correct conditions rather than be located in a fixed position. Why does such rhythmic and circular activity persist? Why do we seemingly pursue shifted, alternative states of consciousness? What insights might we gain into the nature of consciousness from our historic and contemporary rhythmic activities? **A1**

329 From Identity Dissolution to Self-Transcendence: Trait and State Factors Moderating the Transformational Capacity of Consciousness-Altering Experiences Suzanne Russ, Sarah Jellema <suzanne.russ@dickinsonstate.edu> (Psychology, Dickinson State University, Dickinson, ND)

Some individuals experience life-changing perspective shifts under consciousness-altering stimuli, while others exposed to the same stimuli do not experience transformative alterations. Such transformative shifts appear to be mediated by a mystical state, also referred to as an ecstatic state or peak experience, consisting of six key dimensions: noetic quality, unity, transcendence of time and space, deeply felt positive mood, ineffability, and sacredness (e.g., Griffiths et al., 2011). Abraham Maslow (1964) recognized individual differences in the capacity for mystical states, delineating individuals who experience mystical states as 'peakers' and those who do not as 'non-peakers.' Based on extensive in-depth interviews, he suggested all individuals possess the capacity for peak experiences but that some individuals with certain mechanistic, goal-oriented, or highly rational traits block, deny, or suppress the experience. This study utilizes retroactive survey responses to two consciousness-altering experiences, intensive meditation and psilocybin, to test the hypotheses that (a) trait factors such as those described by Maslow do indeed delineate peakers from non-peakers, and that (b) destabilizing life situations resulting in ego dissolution foster transformation irrespective of preexisting traits. Data were obtained through a large-scale retrospective survey study of more than 300 individuals participating voluntarily through Amazon m-Turk. The survey measured four main dimensions: relevant traits (e.g., goal orientation) as predictor variables, identity-dissolving states (e.g., emotional vulnerability) as moderating variables, the extent of the mystical experiences as a mediator between he stimulus and the transformation, and persisting effects (e.g., self-transcendence) as the dependent measure. Results offer insight into the role of a self-surrendering state of identity dissolution in producing transformative responses to consciousness-altering stimuli. **P2**

5.05 Transpersonal and humanistic psychology

330 Correlational Study on Yoga Practitioners Based on Triguna and Strength Deployment Inventory Tests Shobha Bhasin, Soibha Bhasin; Gurdev Roy; Shagun Dayal; Sukhdev Roy; Timothy James Scudder <shobha.bhasin@gmail.com> (Management, Rutgers University, Newark, NJ)

The last three decades have witnessed tremendous research interest in scientific investigation of spirituality and methods of spiritual transformation such as yoga, as well as in exploring their relationship and relevance to human functioning and well-being. A variety of assessment tools designed specifically to assess spirituality as well as other constructs relevant to humanistic and transpersonal psychology have been reported in the literature. The main challenge is to design a simple, effective, fast and accurate test for determination of consciousness states. The Myers-Briggs Type Indicator (MBTI) is a well-known standardized psychometric questionnaire designed to measure psychological preferences in how people perceive the world and make decisions. This is based on typological

theories proposed by Carl Gustav Jung. Jung theorized that there are four principal psychological functions by which we experience the world: sensation, intuition, feeling, and thinking. One of these four functions is dominant. Eastern spiritual traditions reveal that all manifestation in creation, animate or inanimate, constitutes of three Gunas (Trigunas) that are inseparable and simultaneously existing qualities, namely Sattva (pure, luminous, free from sorrow, binding with happiness and wisdom), Rajas (passion arising from desire and attachment binding with compulsive action), and Tamas (born of ignorance, deludes all creatures through indolence and inertia). In our previous study presented at TSC-13, the correlation between MBTI and Vedic approaches had been identified on consciousness states of 100 Yoga practitioners in America and India. We considered the Vedic Personality Inventory developed by Wolf that had Cronbach - > 0.90. In a subsequent study presented at TSC-14, we identified the correlation between these two approaches for a larger set of 280 University students in India. In both cases, we found evidence of construct validity from the correlation data. We found lower Sattva component in students as compared to Yoga practitioners, revealing the efficacy of yoga meditation on personality development. In the present study, we have taken the widely used Strength Deployment Inventory (SDI) as another approach to determine the consciousness level of meditationers and students in America and India. SDI helps in assessing a subject's motives and strengths in relating to others when everything is going well and when faced with conflict. The correlation analysis between Triguna and SDI tests suggest that Satogun has a relatively high correlation with SDI Blue (Altruist-Nurturing personality) and inverse correlation with SDI Green (Analytic-Autonomizing personality). Rajogun, Tamogun have a high correlation with SDI Green and an inverse correlation with SDI Blue. The results of this study will be presented along with inferences. Since most concepts and phenomena in spiritual and transpersonal psychologies are complex, unidimensional instruments that assess these constructs do not suffice for most research purposes. The present study highlights the importance of multidimensional tests and/or multiple measures for consciousness studies. **C16**

331 Intersubjective Couches: Using Biometric Visualisation To Influence Intersubjective Engagement Mubarak Marafa, Gino Yu <mubarakmarafa@me.com> (School of Design, The Polytechnic University of Hong Kong, Hong Kong, Kowloon Hong Kong)

Based on the foundational work done by Alan Macy (http://www.alanmacy.com) The Intersubjective Couch project aims to use Biometric Visualisation to drive external stimuli that is then fed back into another user. Using a custom built electrocardiography (ECG) sensor we will first look at the heartbeat and translate that into an audio signal and amplify it and use the signal to drive audio, haptic and visual stimuli. Can we explore the intersubjective space between two people using technology? What can we learn about the Intersubjective Engagement and can we manipulate it? Can we create a closed loop of sensory manipulation between multiple individuals? If so, will we be able to bring the conscious state-of-minds of these multiple persons to the same level? Study in this area could lead to a better understanding of what is happening in the Intersubjective space between people. By looking beyond an engagement, or an interaction, or a conversation we can derive what makes an interaction between two people engaging and what leads to it not being engaging. Then by monitoring the level of engagement in an interaction between two people or multiple people we can manipulate the rooms conditions to boost the connections between people. Or perhaps in a critical sense disrupt it. Can we pinpoint a moment in a conversation where two people fall in love? Can we observe the turning point of an argument by observing heart rate variability and other biometric signals? Once we determine whether we can or not, can we then manipulate them using stimuli that is driven not externally, but from within the intersubjective interaction? This could be expanded infinitely. We know a skilled theatre ensemble has a high level of intersubjectivity, can we hook them up to study the science behind their synchronisation? What about an athletic team working together? This project aims to study the space in between intersubjectivity. In a sense we are hacking consciousness. We know we can alter the brain to move between different states using external stimuli. We actually do this on a regular basis. Now we are using biometric sensors to drive these stimuli and using it to manipulate another persons consciousness. In the long term we can eventually integrate this idea into other technologies. Smart home solutions are fast becoming popular in the industry, it would be interesting to develop a form of controlling the smart home or office using biometrics. No more flipping switches or turning knobs, but now the environment is being driven by the collective users in the room. Furthermore this technology could be used to gauge the relationships between people, for example between teachers and students. Teachers can use the system to gauge the overall level of engagement in a classroom. Groups or teams can wear the system to ensure they all synchronise to each others frequency to boost effectiveness of work or performance. **P2**

5.06 Psychoanalysis and psychotherapy

332 A Clinical Case of Bipolar Disorder I Treated with Music Integrative Neurotherapy,TM Alexander Jon Graur <graur@medicamus.com> (Medicamus Italiana Torino, Pavarolo, Italy)

The bipolar I disorder criteria represent the modern understanding of the classic manic-depressive disorder or affective psychosis described in the nineteenth century, differing from that classic description only to the extent that neither psychosis nor the lifetime experience of a major depressive episode is a requirement. However, the vast majority of individuals whose symptoms meet the criteria for a fully syndromal manic episode also experience major depressive episodes during the course of their lives. (DSM V) The clinical case presented in this work is one of my patients (psychiatric clinic) in Torino, Italy, between February 2010 and December 2014.The method applied in helping to cure the patient was Music Integrative Neurotherapy, a method I developed since 1978, a registered trade mark in New Jersey, USA. An applied neuroscience therapy, Music Integrative Neurotherapy is an interdisciplinary method involving Music as a Science, Medicine (Anatomy and Physiology, Pharmacology and Neuro-pharmacology, Psychiatry), Molecular Biology (the non-linear transmission of the information) and Quantum Mechanics (the basic quantum model elaborated for this neurotherapy). The basic principle of Music Integrative Neurotherapy is that in order to really heal, the music used for therapy must be composed based on the medical data of each patient and must act beyond the psychological conditioning and cultural background of the patient. The ultimate goal of the therapy is to transmit to the mind pre-determined information to be stored in the long term memory banks for to be used as reference for future decisions. (Rewiring the mind to rewire the brain and organism). (Graur, 1998,2003) The presentation will feature: the case, the specific therapy composed and applied; the results and a written statement of the patient regarding the results, with audio examples of the therapy material. **P2**

5.07 Lucid dreaming

333 Is Dream Lucidity Associated With Increased Cortical Gamma Activity? Benjamin Baird, LaBerge, S. <benjamin.s.baird@gmail.com> (Center for Sleep and Conscious, UW Madison, Wisconsin, WI)

Although we are not usually explicitly aware of the fact that we are dreaming while we are dreaming, at times a remarkable exception occurs, and we become reflective enough to become conscious that we are dreaming. During such "lucid" dreams it is possible to freely remember the circumstances of waking life, to think clearly, and to act deliberately upon reflection or in accordance with plans decided upon before sleep, all while experiencing a dream world that seems vividly real. LaBerge et al. (1981) provided objective evidence for the occurrence of lucid dreams during REM sleep, setting the stage for an important new paradigm for consciousness research in general and for studying the neural basis of autonoetic consciousness. Early research (LaBerge et al., 1981) showed that lucid dreams required an elevated level of CNS activation as measured by increased REM density and ANS arousal (heart rate, respiration rate, and skin conductance), leaving open the question of whether this activation was global and non-specific, or localized in some way. Different EEG studies have offered widely varying answers. Brylowski et al. (1988) found significant decreases in alpha activity in the left TPJ, Ogilvie et al. (1982) reported increased global alpha, Holzinger et al. (2006) found increased beta activity in parietal regions and Dodet et al. (2015) found decreased delta at distributed scalp locations during lucidity. All of these studies have interpretative problems, leaving the question of which brain areas are associated with the occurrence of lucid awareness unresolved. Another recent study by Voss et al. (2009) claimed that lucid dreaming was associated with increased gamma band (35-50Hz) EEG power in frontolateral brain regions. However, scalp measurement of cortical gamma band EEG is compromised by electromyogenic artifacts, particularly from ocular muscle activity associated with saccadic eye movements (saccadic spike potentials) (e.g., Keren et al., 2010). Furthermore, interpretation of these findings is limited by small sample size (N=3). In this study we evaluated the electrophysiological correlates of dream lucidity while addressing the limitations of previous work, with a specific focus on controlling for artifacts related to saccadic eye movements. Broadband changes in cortical EEG power were analyzed in the transition from REM to lucid REM sleep in six signal-verified lucid dream records. Together our results clarify the relative contribution of artifacts and real changes in neural activity associated with lucid dreams. **C21**

334 Lucid Dreaming as a Complementary Strategy for Nightmares in Posttraumatic Stress of Combat Veterans Andrew Brylowski, MD <andrew.brylowski@gmail.com> (Global Examination Services, Dallas, TX)

The use of lucid dreaming for managing traumatic nightmares combines teaching perceptual psychology, developing lucid dreaming skills for non-traumatic dreams, and making direct suggestions for generalizing lucid dreaming skills to traumatic nightmares. This pilot study was done to evaluate suitable protocol and for potential efficacy. Findings infer that gradual exposure with systematic reframing progressing from pleasant non-traumatic dreams to traumatic anxiety provoking dreams was identified and consistent with basic science literature of lucid dreaming (laboratory lucid REM sleep lucid dreaming LLREMLD) and systematic and gradual desensitization in the traumatic stress and anxiety literature. The author indicates the usefulness of lucid dreaming as an adjunct in treating traumatic nightmares specifically, and post-traumatic stress disorder in general. The possibilities of concurrent or misdiagnosed somnambulism, REM behavior disorder, and nocturnal dissociative disorder in conjunction with nightmares in this post-traumatic stress population are discussed. (Part 1 - Above in press: American Journal of Psychotherapy) (Part 2 - not in press; Clinical neuropsychiatric utility of lucid REM sleep psychoneurophysiology: Clinical vignettes: 1. Head trauma case report (acetylcholine (ACh) and nucleus basalis of Meynert) in light of lucid REM sleep psychophysiology, near death experience, out of body experience, and mystical religious experience. 2. 2 cases of traumatic event experience with deliberately excluded near death and anomalous experience information for presumptive and confirmed fear of being labeled psychotic. 3. Nightmare relief from conscious and deliberate waking behavior confronting nightmare content: A case report. Using case vignettes, a seamless integration of clinical inquiry with regard to dreams and nightmares and whether or not subjective reporting is helpful relative to the purpose of the encounter is described. Well recognized clinical similarities between presentations of people with traumatic stress experiences and concussions is discussed with an emphasis on resilience to, and prevention of, deleterious effects of traumatic stress and/or concussion in light of lucid REM sleep psychoneurophysiology observations. Inferences grounded in empirical data, clinical vignettes and theoretical implications for clinicians and research investigation are discussed. Specifically, how does empirical data and observations of anomalous experience in said vignettes, empirical data, and so on support that an attempt at central nervous system healing and self-repair is occurring. In Press: American Journal of Psychotherapy and the Clinical Utility of Lucid Rem Sleep Physiology **C21**

5.08 Near-death and anomalous experiences

335 Research on the Vibrational State and the Importance of First-, Second-, and Third-person Perspectives in the Study of Anomalous Phenomena Nanci Trivellato <ntrivellato@iacworld.org> (Research and Scientific, Int'l Academy of Consciousness, Estremoz, Evora Portugal)

In this article, the author advocates the importance of carrying out research on anomalous human experiences by using a combination of first-, second-, and third-person perspectives to overcome or minimize the usual methodological limitations faced in this area, reach more robust conclusions, and better elucidate the processes involved. It is also argued that in the study of these non-ordinary phenomena, conducting research also in first-person, as a complementary procedure, is particularly desirable, as it allows researchers to acquire an inside view, which, in turn, leads to a more appropriate interpretation of the different data. The specific type of research conducted on the vibrational state (VS) will be discussed in detail, as an example of investigation carried out using all three perspectives. The results achieved with each perspective and how they complemented each other will be presented. The VS, a phenomenon described as an intense activation of one's "subtle energy field," is commonly reported in association with out-of-body experiences, but can emerge during deep meditative and other non-ordinary states of consciousness as well. As for the first-person perspective, the author has had spontaneous VSs and has practiced specific techniques that are arguably able to induce or facilitate the VS with relative consistency. As for the second-person approach, a longitudinal study including 988 subjects residing in 7 countries was conducted over a 14-year period, involving one-on-one inter-subjective measurements of different attributes of the VS. With respect to the third-person perspective, a specific VS survey was conducted with 767 respondents from 31 countries. Research was also carried out in collaboration with Wagner Alegretti, using fMRI scans to observe brain activity during the subjects' attempts to produce a VS and in the moment they claimed they were experiencing one. In the article, some key aspects of this second-person methodological evaluation will be addressed. It must be acknowledged that despite efforts to perform periodical self-calibrations, the obtainment of reliable data remains a delicate and complex process to master

when a human being is used as a measuring apparatus in an experiment. Nonetheless, if suitable crosschecking procedures are put in place, second-person measurement processes can reveal data that our current technology is not yet able to access. In the case of our specific VS investigations, the second-person and third-person fMRI approaches were those providing the strongest findings and implications. However, the first-person and third-person survey approaches were also instrumental in providing a broader understanding of the VS phenomenon and an informed view for data analysis. **P1**

5.09 Parapsychology

336 Mental Weather Influence Daniella Caputi <djcaputi@ucdavis.edu> (Atmospheric Science, UC Davis, Davis, Suffolk)

The idea of humans attempting to influence weather using solely mental intentions has hardly been studied scientifically despite the practice being prominent in many cultures over thousands of years. Small effect sizes of human precognitive and psychokinetic effects have been fairly rigorously demonstrated in laboratory settings, and the question now turns to what the physical mechanisms behind these phenomena are and how they can be applied to real-world situations. Testing mind-matter interactions with the atmosphere may shed light on a unique problem that is often faced with other parapsychological experiments known as the "source of psi" problem, which asks whether a psychokinetic effect is truly a mind-matter interaction, or rather, if it was an effect merely predicted by the participant (i.e. precognition). Because the atmosphere is a fluid and thus operates with chaos principles, a small change to the initial state of the atmosphere can make a dramatic difference in the weather observed at a later time. If mental intentions are capable of influencing even a tiny volume of air, it is possible that the results of any weather influence experiment could show a large enough signal to suggest that a true differentiation exists between mind-matter interaction and precognitive abilities, hence advancing our scientific understanding of the full capabilities of consciousness. It will be discussed how these results could address some of the most fundamental philosophical questions associated with the mind-body problem. In an ongoing experiment, A Campbell 3D Sonic Anemometer (to measure wind in all 3 spatial components) and an infrared gas analyzer (to measure water vapor) is installed on a 10 meter tower over bare ground in Davis, CA, where an exceptional drought is occurring (as of December 2015). Participation is done remotely over the internet, where subjects are cued to invite an increase in vertical wind at the measurement site, since rising air is a critical precursor to precipitation. An experimental session consists of several 5-minute epochs, alternating between the participant inviting rising air (during which experimental data is collected) and the participant relaxing (during which control data is collected). Participants have the choice of completing a 5, 15, or 25 minute session, which would contribute 1, 2, and 3 experimental epochs, respectively (a final "control" epoch is randomly placed either before or after each session so that the amount of control data matches the amount of experimental data). It is hypothesized that vertical wind measurements, as well as turbulent moisture fluxes, will be larger in magnitude during the experimental epochs. Methodology, any preliminary results available, and additional experiments planned for the future will be discussed. Additionally, this talk will cover the ethics of using mental intentions to influence weather. **P2**

337 Using Psi to Distinguish Among Alternative Theories of Quantum Mechanics Stanley Klein <sklein@berkeley.edu> (Optometry, UC Berkeley, Berkeley, CA)

One of the unique aspects of the TSC conferences is that they can become the optimal place for discussion of psychic phenomena. Leading proponents of psi and skeptics of psi are able to interact at the same meeting. I'll never forget the 2012 meeting where Daryl Bem gave his "Retrocausality and Consciousness" plenary talk, shortly after his famous paper on the topic. I was invited to give the skeptics point of view. After that session I was criticized for not being sufficiently skeptical. The reason that I'm open-minded on this topic is because of the revolutionary impact it would have on science if it is convincingly validated. My TSC 2016 talk will be divided into two parts: 1) How to connect psi to QED. 2) How TSC can become a forum for how to do psi experiments that will satisfy both sides. . . . Part 1: Connecting psi to quantum electrodynamics (QED is the theory of electrons and photons). Different types of psi may require different modifications to QED. I will follow Henry Stapp's overview of von Neumann's (vN) understanding of QM, but using a three step nomenclature. Step 1: the standard QM evolution of the quantum amplitude. Step 2: an observation converts the sum of the amplitudes to a probability (a squaring operation). Step 3: Nature or Mind randomly converts the probabilities to actualities. There are more than 10 very different ontologies (interpretations) underlying QM for executing these three steps with all giving identical predictions for all possible future experiments. There are additional ontologies, e.g. Penrose and Whitehead, with testable different predictions that may be compatible with some forms of psi (Whitehead's process approach forbids retrocausation). Steps 1 and 2 are hard to change without damaging the present excellent agreement with data (Penrose being an exception). However, Step 3, the Born Rule, hasn't been tested as accurately. Cosmic Mind or Nature that is involved with the final observation process, might have a nonrandom influence on converting probabilities to actualities. Two sorts of psi might be ideal for probing three steps: a) Retrocausal experiments, like Bem's, would test the standard ontologies including Whitehead's that forbid any type of retrocausation. b) Combinations of telepathy/clairvoyance/psychokinesis could be developed for magnifying psi effects. . . . . Part 2) The TSC conferences could become the ideal forum for discussing optimal psi experiments and methodologies that will satisfy both sides and illuminate what modifications to QED are needed. For example, there is evidence that to satisfy psi supporters, experiments need to be done in a psi friendly environment. In addition, to satisfy the skeptics the experimental designs need to avoid the mess that science has been facing lately whereby a substantial fraction of high profile articles, not connected with psi, are not replicable. TSC conferences have excellent scholars, including leading psi scientists, who are well qualified to take part in these discussions. The potential payoff is high, so we anticipate that the group can devise a methodology satisfactory to both sides. **C7**

338 What Can Psi Interactions Teach Us About Consciousness? Julia Mossbridge, Arnaud Delorme; Julie Beischel <jmossbridge@gmail.com> (Ions, Evanston, IL)

"The term psi denotes anomalous processes of information or energy transfer that are currently unexplained in terms of known physical or biological mechanisms. The term is purely descriptive; it neither implies that such phenomena are paranormal nor connotes anything about their underlying mechanisms. Alleged psi phenomena include telepathy, the apparent transfer of information from one person to another without the mediation of any known channel of sensory communication; clairvoyance (sometimes called remote viewing), the apparent perception of objects or events that do not provide a stimulus to the known senses; psychokinesis, the apparent influence of thoughts or intentions on physical or biological processes; and precognition (conscious cognitive awareness) or premonition (affective apprehension) of a future event that could not otherwise be anticipated through any known inferential process?" (Bem, 2011, p. 407).Given that there are statistically replicable results in these areas of psi interactions, what insights about the nature of consciousness can these results offer us? Julie Beischel, Arno Delorme, and Julia Mossbridge will discuss their experimental work related to psi, outline the current evidence, and speculate as to how this evidence might inform our understanding of consciousness. Julie Beischel's current research interests include examinations of the accuracy and specificity of the information reported by secular, American mediums (individuals who experience regular communication with the deceased) as well as their experiences, psychology, and physiology and the potential social applications of mediumship readings. During this workshop, she will discuss laboratory evidence for the reporting of accurate and specific information about the deceased by credentialed mediums under conditions in which mediums, experimenters, and raters are blinded (i.e., without the medium receiving any prior knowledge or feedback and without using deceptive or fraudulent means like "cold reading" and in which rater bias and experimenter cueing are addressed). She will also discuss how mediums? experiences during the acquisition of this information about the deceased ("survival psi") begin to differentiate it from clairvoyance, precognition, and telepathy with the living ("somatic psi"). In becoming one of the world's foremost researchers utilizing electro-encephalogrphic (EEG) signal recording, Arnaud Delorme has traversed a path of diverse and amazing accomplishments and professional experiences. His driving interest in pursuing the study of consciousness and spirituality has him currently running an experiment in which he is looking at the brain activity of mediums who claim they can connect with spirit realms, and he has obtained EEG readings that indicate something is definitely going on in their brains when they do this! Listen to Arnaud explain his research and how it informs our understanding of consciousness and its applications. Julia Mossbridge uses computational, behavioral, and physiological techniques to examine how humans integrate what we experience over time into a so-called stream of consciousness. In this workshop she will discuss her work in presentiment; generally non-conscious physiological changes that reliably predict upcoming events that are normally thought to be unpredictable. She will also discuss the implications of this work for understanding conscious awareness and non-conscious processing. **C7**

339 Importance of Developing Esp Powers in Creating More Awareness Among University Students and in Developing Better Worldliness Rubina Saxena, Kavita Kumar <rubinasaxena17@gmail.com> (Women's Polytechnic, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Extra sensory perception (ESP) are the hidden powers that are present in all the entities of the creation. They are in dormant forms in entities of lower consciousness while in human beings they are in most developed powers. We all possess ESP but we don't realize this hidden power. ESP is the psychic abilities of mind and is God gifted, natural, original property of the individual spirit or consciousness. We have already understood the concept of Universal Consciousness as Macrocosm and man as Microcosm, it is clear that the properties of Macrocosm are certainly present in man, i.e. Microcosm. As in Indian mythology we say 'bundi' and the ' bundi ladoo'. 'Bundi ladoo' is a sweet 'Mithai' made up of many small 'balls' called 'bundi'. Each 'bundi' has similar taste as the whole 'Ladoo' inspite of its small size. We all have experienced ESP powers some or other time in our lives. You think about something and some incident happens related to it. This is the hidden ESP power present among us. But we don't realize it. If we sharpen our ESP powers we can increase the awareness in self and surrounding. We can induce more positivity in the surrounding. Why Sages, Spiritual leaders, Prophets, Pirs, Fakirs, etc. can tell about someone's past and future? This is because their ESP powers are sharpened as present in the Universal Consciousness. If one sharpens one's ESP power, he/she can be more aware about his/her life. This will help in good decision making that benefits and is appropriate to the individual. ESP is different from the five physical senses present in physical body. One has to control the five senses; divert them inwards by concentration. When the five senses are controlled, the physical world has no direct impact on individual. The outer physical world is material world and is considered impure and destructible. When the outer false sheath has no impact on the individual consciousness, its pure form emerges, sharpens and grows. ESP powers can help students to achieve better success in their education. This is also the objective of my paper. Further Meditation helps in controlling the physical senses and uniting the individual consciousness with the Universal consciousness. There are various techniques of Meditation described in various religious philosophies. I have considered Radhasoami Sant Mat based Meditation techniques. Before Meditation, a brief session of Yoga exercises are included for twenty minutes as warm-up exercise to control senses into the physical body. And then ten minutes Meditation to unite self with the Ultimate reality; the Universal Consciousness and realize the ESP powers in individual self. This exercise definitely makes individual stress free, more aware, more conscious and more contented and happy resulting in success in all aspects of life. My Paper is about to make students of the whole world realize their inner powers, ESP and become more aware, develop superman qualities, establishing more peace and positivism in world. Thus making this world better place for living. **P1**

340 Can Claimant Evidential Mediums Identify Collaborating Hypothesized Discarnates? A Multi-blinded Experiment Comparing Mediumship Versus Telepathy Control Gary Schwartz <gschwart@spamarrest.com> (Psychology, University of Arizona, Tucson, AZ)

Multi-blinded experiments have reported that skilled claimant evidential mediums (CEMs) (evidence-based persons who purport to communicate with hypothesized discarnates, HDs) can obtain accurate information about HDs. These rigorously designed experiments rule out conventional psychological mechanisms (e.g. fraud, subtle cueing, rater bias, placebo effects, and experimenter bias) as plausible explanations of the findings. A fundamental theoretical question is whether CEMs are obtaining information about the HDs: (1) directly from the HDs (spiritual explanation), or (2) telepathically from the sitters minds (parapsychological explanation)? Three CEMs participated: CEM-1 and CEM-2 served as primary and replicating CEMs. E-CEM served as an experimenter proxy sitter in the HD-present (collaborating) condition, and the imaginer in the HD-absent (telepathy) condition. Four well-known HDs who allegedly worked closely with E-CEM were invited by E-CEM to participate in the HD-present (collaboration) condition. CEM-1 and CEM-2 were kept blind to the identities of the four HDs as well as the order that the individual HDs were silently instructed by E-CEM to step forward and stand in front of two webcams recording the session. CEM-1 indicated that he thought the 4 possible HDs were from a pool of 32 candidates; CEM-2 said 16. The second experimenter, a skilled rater in blinded mediumship experiments, knew the identities of the HDs but was blind to the order that they were invited to step forward to be read by CEM-1 and independently by CEM-2.The design of the HD-present (collaboration) condition was optimized to minimize stress on the CEM's to encourage the successful execution of the protocol. To determine, experimentally, whether the observed accuracy scores were mediated by CEM-1 and CEM-2 reading the mind of E-CEM, plus possible subtle cuing effects, an HD-absent (telepathy) control condition was performed. E-CEM did not invite the HDs to attend the session; instead he consciously imagined each HD standing in front of the two

webcams. Mathematically, when the [HD-absent (telepathy) + possible subtle cuing] condition is subtracted from the [HD-present (collaboration) + possible telepathy + possible subtle cuing] condition, what remains is the [HD-present (collaboration)] effect. To make the task less taxing for the CEMs, they were given the names of 8 HDs, reducing their possible pools from 32 and 16 to 8. However, they (and the experimenter) remained blind to the order that E-CEM used to imagine the individual HDs allegedly absent from the setting. Striking differences were observed between the two conditions. CEM-1 and CEM-2 were each 100% accurate in the HD-present (collaboration) condition compared to 37.5% (CEM-1) and 12.5% (CEM-2) in the HD-absent (telepathy) condition (p values for HD-present from 32 pool for CEM-1 p <.000002; from 16 pool for CEM-2 p <.00003.). A more conservative statistic from the experimenter's perspective (pools of 4 and 8 items respectively), yielded a Yates corrected chi square p <.005. Careful analysis of the raw telepathy scores revealed no evidence of possible subtle cuing effects. The findings strongly support the collaborating HD interpretation (rather than fraud, sensory cues, or telepathy). Implications for the science of consciousness are considered. **C7**

5.10 Contemplation and mysticism

341 Parallel Concepts of Consciousness Between Mystical Ideologies - Highlighting Upon Sufism and the Sant Mat Faith Chhavi Gupta, Gopi Chand Gupta, Aarut Gupta <chhavigupta61@gmail.com> (Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

This paper aims to understand some fundamental similarities and differences between the philosophies of varying mystical ideologies which exist in not only some of the semitic religions like the Gnosis in Christianity and Kaballah in Judaism but is most evident and analogous in Sufism and the Sant Mat Faith. Each philosophy recognizes the mystical aspects of religion and strays from dogmatic rituals. The focal point lies not in ritualism and institutionalized religion but developing a deep and everlasting love with the Spiritual Source. In Sufism and Sant Mat - both philosophies corroborate on the creational process - thus recognizing the importance of a sound current known as Baang e-Asmaani in the Sufi faith and Naad in Sant Mat. They also identify with some fundamental planes of consciousness. Where certain physical, astral and causal planes are referred to Pind, and Brahmand in the Sant Mat Faith - they are distinguished as Kasif, Madi, Latif and Latif- ul- Latif in Sufism. Where this paper will examine and underline disparities in some of the theories it hopes to highlight on the parallels in order to establish that the course of true mysticism may contain terminological differences but the essence by and large remains the same. **P1**

342 Riding the Numbers: Ratios and Resonant States of Consciousness Scott Olsen <olsens@cf.edu> (Humanities and Social Sciences, College of Central Florida, Ocala, FL)

Evidence in the sciences has been mounting that there is an underlying mathematics of harmony in nature [1]. It appears that certain ratios e.g. root 2, root 3, root 5, and particularly the golden ratio are central to this harmonics. Throughout nature adjacent Fibonacci numbers approximate the golden ratio. The chaos border, fine structure constant, and quark masses, as established by El Naschie, are functions of the golden ratio [2, 3]. In fact, in 2010, the golden ratio or PHI was found at the core of quantum mechanics [4]. Penrose and Hameroff provocatively suggest that consciousness emerges through the quantum mechanics of microtubules [5]. And microtubules are composed of 13 protofilaments exhibiting an 8:5 phyllotaxis. Clathrins, located at the tips of microtubules, are truncated icosahedra abuzz with golden ratios [3]. And DNA in both its decagonal structure and its Fibonacci guided nucleotide organization exhibits a golden ratio or PHI resonance [6, 7, 8]. Even the heavens seem to be structured according to Golden Fibonacci "phyllotactic" relationships as can be observed in Earth's harmonic resonances with Venus and Mercury [9]. These ratios and proportions which appear to govern all of nature, considered by some to be nothing less than sacred, may be accessed through a variety of methods. These include geometric constructions (whether drawing, painting, sculpting, model building or architecture); contemplation of nature's forms (flowers may be the most obvious, but plants in general, animals, minerals, beauty of the human form, and microscopic or telescopic observations); listening to or creating harmonic sounds (music, singing, chanting of words and names, or drumming); and even visualization of harmonic ratios. The discussion will include Theurgy, Gematria, Name worshiping, or "imiaslavie," of the Moscow School of Mathematics, and the profound insights of the mystical mathematician Ramanujan. References: [1] Alexey P. Stakhov assisted by Scott A. Olsen. The Mathematics of Harmony: From Euclid to Contemporary Mathematics and Computer Science. World Scientific, 2009. [2]Mohamed S. El Naschie and Scott A. Olsen. When zero is equal to one: A set theoretical resolution of quantum paradoxes. Fractal Spacetime and Noncommutative Geometry in Quantum and High Energy Physics, 1(1):11-24, 2011. [3]Scott A. Olsen. The Golden Section: Nature's Greatest Secret. Walker & Company, 2006. [4] R. Coldea, D. A. Tennant,

E. M. Wheeler, E. Wawrzynska, D. Prabhakaran, M. Telling, K. Habicht, P. Smeibidl, K. Kiefer. Quantum Criticality in an Ising Chain: Experimental Evidence for Emergent E8 Symmetry. Science,177-210, Jan. 8, 2010. [5] Roger Penrose and Stuart Hameroff. Consciousness in the Universe: Neuroscience, Quantum Space-Time Geomerty and Orch OR theory. Quantum Physics of Consciousness. Cosmology Science Publishers, 2011. [6] Sergey Petoukhov and Matthew He. Mathematics of Bioinformatics:Theory, Practice, and Applications. John Wiley & Sons, Inc., 2011. [7] Jean-Claude Perez. Codex Biogenesis. Collection Ressurgence, 2009. [8] Micheal E. Beleza Yamagishi and Alex Itiro Shimabukuro. Nucleotide Frequencies in Human Genome and Fibonacci Numbers. Bulletin of Mathematical Biology, 70:643-653. 2008. [9] John Martineau. A Little Book of Coincidences. Wooden Books Ltd., 2001. **P1**

343 Towards a Phenomenology of Meditative Space: Expansion, Contraction and Identity in Yogic Meditation Lloyd Pflueger <lloyd@truman.edu> (Philosophy and Religion, Truman State University, Kirksville, MO)

Meditative experience and the phenomenology of thought itself is closely bound up with the experience of space. This is hardly a surprise when we reflect on the components of our sensory manifold (vision, hearing, touch) and their presumptive evolutionary role in the development of the mind. On the other hand the nature of the experience of space, especially with eyes closed and in a meditative state, is something of a mystery. What is more abstract than mental space? Perhaps nothing could give us deeper understanding of consciousness. Meditative exploration of consciousness is often described as if it were a journey in space from one point to another. The metaphor is a means of noting change or transformation, the journey from mental activity to mental silence, or from agitation to tranquility. However specific techniques of meditation do use more literal imaginative construction of mental spaces: Tibetan monks mentally construct elaborate geometric mandalas in three dimensions, Tantric yogis engage with the luminous inner spaces of subtle body centers, cakras, and shamanic journeys take practitioners to populated worlds above and below the physical. Even more important for some yogic contemplatives is the mental practice of experiencing a simple cosmic zoom: experience of the gradual expansion of inner awareness from a point inside the body, to the body itself, and then concentric circles of space around the body, slowly moving toward infinite cosmic space and then returning back to the smallest point of consciousness. Whether the mind is actually capable of literal space travel or accurate remote viewing, the mental apprehension of extreme spatial expansion and contraction is tied to a transformation in identity, much valued in the tradition. The Isha Upanishad asserts: "Om, Space is the Absolute." This paper will explore relevant first person accounts of such experience and the early South Asian yogic sources such as the Veda, Upanishads, and the Yogasutra that contextualize them. In so doing we hope to gain deeper understanding of the phenomenology of consciousness, inner space and its transcendence. As time allows this presentation will include a short guided meditation on space. **P2**

344 Contemplative Pedagogy: Reflections of the Students and the Instructor Sadhna Sharma, Sona Ahuja <sadhnasharmadei@gmail.com> (Pedagogical Sciences, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The present paper is an empirical account of experiences and reflections of adolescents in a contemplative pedagogy classroom. The experiences and reflections were collected during an intervention delivered to two groups of adolescents (52 Ninth graders, age group 13-15) for three months. The intervention was delivered in two kinds of contemplative pedagogy classrooms. Students in classroom I were provided instructions only in contemplative pedagogy apart from any mainstream school subject whereas classroom II was taught science using contemplative pedagogy. The intervention was based on the guiding principles of the institutions engaged in the theory and practice of evolving contemplative pedagogy. Texts in various contemplative traditions were also referred for discovering practices which can be implemented in the classroom. Experts from the field of clinical psychology, transpersonal psychology, school administration and philosophy were consulted for the purpose of content validation of the intervention. Persons having experience in the field of contemplative pedagogy were also consulted. Present research paper is based on the thoughts, feelings, and emotions of the adolescent students as apprehended by reflective journals written by them at the end of attending 45 minutes contemplative classroom daily for a period of 12 weeks. The reflections of students are complemented by the experiences of the instructor in order to present a wholesome picture of what a contemplative classroom can look like. The study offers answers to some vital questions related to implementation of contemplation in a mainstream classroom. The study also provides a significant insight on the evaluation aspect of certain psychological constructs. It was observed that qualitative analysis using reflective journal writing can assess even the subtle changes in psychological constructs such as consciousness and mindfulness; changes which are often not assessed by quantitative methods of analysis. **P1**

345 Towards Happiness Consciousness Neha Shivhare <nehashivhare1@gmail.com> (Pedagogica Sciences, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Dr. Brian Weiss in his book "Same Soul, Many Bodies" has emphasized the evolution of the immortal human souls by "learning how to have better relationships, how to be more loving, more compassionate", how to enjoy this world and yet advance its evolution" in order to "quiet our fears, feel better about ourselves, and grow spiritually"(2005). It has been believed for centuries that our souls take birth as humans to experience, learn and evolve itself. But, unfortunately we humans forgetting this ultimate truth of immortality of our souls spend our precious births on this earth attaching our consciousness with negative feelings of hatred, jealousy, insecurity, greed, anxiety, depression, etc. An important question which arises at this point is that what keeps us away from enjoying this life moment to moment, rather than giving too much attention to our displeasing emotions? Scientists and researchers associate this tendency to our ancestors? ways of living during stone ages and thereafter when the principle of "do or die" prevailed. After thousands of years, now is the time to move beyond such survival instincts and develop our sense of security and fulfilment; to be more aware and attentive of the positivity on this earth. In essence we all need to develop our happiness consciousness, so as to be able to perform better in the class of life in the school of world, and thus expediting the journey of evolution of our souls towards freedom from birth cycles. Happiness is like an enigma, the more one tries to unpack its layers the more the shine of its golden orbs become inexplicable for us. Although we all have our own parameters for defining our happiness, but none of us can affirm a single universal concept of happiness for everyone. Perhaps this elusive nature of happiness proliferates its desirability for us. Undoubtedly, our constructivist perspective also plays a dominant role in our personal perception of happiness. In simpler words, happiness depends more on our personal perception and processing of sensory, cognitive and emotional experiences. Furthermore, since the level of consciousness in human beings is the most developed among all living beings on earth, therefore our propensity to perceive happiness and sadness is also much better than others. This further implies that by focusing our mental and emotional faculties more on happy and positive attributes of life and environment we can make our happiness consciousness (individual and social) stronger than our sadness consciousness. Moreover, in the present times of inexorably increasing complexities and emotional turmoil, there is a need to focus on the development of happiness consciousness among individuals so that we may discover and appreciate brighter sides of our circumstances and life. This type of attitude is also expected to nurture mindfulness and emotional development. This paper discusses the concept of 'Happiness Consciousness' and various levels of it. Measures which may help in evolving various levels of 'Happiness Consciousness' are also enlisted and elaborated. **P2**

346 Theological Basis Of Spiritual Quarries: A Socretean Approach Meenu Singh, Majer Singh; Charan Prasad; <reenu1968@gmail.com> (Faculty of Education, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

An evolved human being is an awakened spirit, with a sound mind in a sound body, and endowed with wisdom, intelligence and health. Such persons work for the benefit and progress of society. The professional codes of conduct and ethics are followed by them as to run a disciplined, smooth and orderly working of different institutions also, to establish peace and happiness everywhere. However, we notice that such ideal conditions are fading from the world today. Morality of people in general is on the decline, as a result, we are today surrounded by utter confusion, inefficiency, corruption, violence, terrorism and other evils. If one tries to analyse this unhappy state of affairs in the world today, it can easily be seen that this is due to lack of spiritual awareness and incomplete or wrong religious concepts among people. This article is an attempt to see theologically some spiritual quarries such as: rationality of our struggle in life, Is it destined to suffer pain and pleasure, How to select the Supreme path of life among the several path existing in the world today, Does one need a teacher to help in following the Supreme path successfully also, How does one recognise a supreme guru etc. And an attempt has been made answer such questions by using Socretean approach based on Theology where the need of the spirit; being the life and essence of human personality and other related quests are recognised, catered and solutions have been provided. This article would help to clarify wrong religious concepts in the light of Indian religion experienced by many sages, seers and Saints. **P1**

347 Similarities in the Teachings of Eastern Saints and Some of Their Thoughts Explained Neha Sinha Mehta Satsangi, Nidhip Mehta; Bijay Kumar Sinha; Mohit Sinha; Shalini Sinha Kumar ‹nehadb01@gmail.com› (Dayalbagh Educational Institute, Agra, UP India)

If we were to read the works of eastern Saints such as Tulsi Sahab, Kabir Das Ji, Paltu Sahab, Dadu Sahab and compare them with the teachings of Param Purush Puran Dhani Soamiji Maharaj, Param Guru Huzur Maharaj, Param Guru Maharaj Sahab, Param Guru Sarkar Sahab, Param Guru Sahabji Maharaj, Param Guru Mehtaji Maharaj and Param Guru Dr MB Lal Sahab we find some facts and central thoughts repeated. An effort is being made here to present some of those similar central ideas and explain them in brief. **P1**

348 Treatment in Holistic Style Vijay Shanker Lal Srivastava, Kundan Srivastava ‹krsourabh.83@gmail.com› (DEI, Harda, Madhya Pradesh India)

In Holistic style treatment firstly there is soul to soul meeting with trust as deeply as humanly possible to reveal the hidden feelings and impression, verbalization of feeling and impression, so that new perspective which is more nourishing and supportive to the life. Secondly treatment by the three tire system (combined therapy with Allopathic, Homeopathy, Ayurvedic) may give better result. Thirdly use of more herbs and seeds in our food, which are full of nutrients and have medicinal quality also. Fourthly by repetition of Holy name because Holy name strengthen to our soul so by this four methods recovery is fast and better. Co- author Dr. (Mrs). Kundan Srivastava **P1**

349 Vital Life Consciousness Chandra Prakash Trivedi ‹atcptrivedi@gmail.com› (Education, Vedic Research Institute, Ratlam Former Principal MJS P.G.College, Bhind, Indore, M.P. India)

The life consciousness is phenomena of existence and phenomena experience, the brain is material object and instrument of DNA to execute the functions of life. The Eureka moment of life is light of life. It is stunning to touch pre-cosmic dawn with phonon- photon interaction. To know the vital power of vital energy is to know one's own self. Under space time fabric Life is gift of nature on Earth. The resonant vibration with dualistic Force of Echo beholds the Creation and Life, under Space Time Fabric. The Life consciousness is just like the bird flowing towards heaven. His pathways are pure and pleasant to travel upward without contamination beaming imperishable life for glory. The Life is the dynamic combination of sense organs and brain to execute thoughts in action from the atmosphere. The thought waves compress the men from all sides, and he speaks in assembly of life. The cellular body beholds the thought mentality adorned to body. The atmospheric ocean is the treasure house of imperishable thought words. It has laid down the silent invisible foundation of resonant thought words with dualistic force of resonance. The plasma membrane is transition zone between the cell body and atmosphere. It is just like obverse and adverse of a stamp seal as two faces of the same coin. The resonant waves of words strike the plasma membrane with press mark and rebound like touch and go reaction. The immortal thought words compress the living-beings from all sides. The audible word waves press the plasma membrane with reverse electron spin action and message immediately reached to brain for action. In the human-beings the audible words strike the ear drum and rebound and message reached to brain and sense organs execute the function. The cellular body beholds the thought mentality adorned to body as one unit along with the atmosphere at micro level. The higher frequency of resonant thought words compress the cell membrane with reverse spin of electrons, it alter the wavelength of DNA mental code chord confined to cell body as one unit with the universe. The cellular body is the seat of sacrifice, under space time fabric, where life appears in different forms with different bodies. The thought mentality never rest, it travel continuously and appear with life and disappear with death. **P1**

5.11 Virtual reality

350 Attended Breathing in Virtual Reality (vr) "Mindfulness" Research at the Institute of Neuroscience (University of Oregon) and Egi Lab; Aleman Lab, A Quantum and Nanoscale Physics Lab Hannes Bend, Ryan Jayne, Electrical Geodesics Inc; The Brain Electrophysiology Laboratory, Eugene, OR ‹hbend@uoregon.edu› (Institute of Neuroscience, University of Oregon, Eugene, OR)

Virtual reality, rapid technological development and an increase of mindfulness practice and research in the past years have contributed to a new understanding of conscious awareness of the world and wellbeing. The various perspectives from the fields of neuroscience, psychology, physics, arts and technology have been merged in a current joined project of the University of Oregon (UO) and Brain Electrophysiology Laboratory Electrical Geodesics, Inc. (EGI Lab). An EEG study on neuroaesthetics («Correlation between Visual Stimuli and Brain States,» 2014/2015) in the lab of Edward Vogel (then University of Oregon) examined 30,000+ images from the fields of science, arts and popular culture, and provided a novel setting and findings about screen-interactions through electrophysiological measurements. The analysis indicated which type of visual stimuli and aesthetics could consciously (self-reports) and unconsciously (EEG/brain frequencies) be correlated with a higher frontal theta power (Tang et al., 2010). Mindfulness research (Dahl et al., 2015) notes little is known about the neural mechanisms of the specific type of meditation being practiced. Beyond studying the neural mechanisms of meditation techniques, it is important to understand what describes a ‹meditative state'. Research suggests that the presence of increased theta waves is associated with meditative states, as well as activation of the anterior cingulate cortex (Holzel et al. 2011). We subsequently started (to the best of our knowledge) the first within-subjects study comparing different meditation techniques using fMRI with the IRB-approved fMRI study «Neural Mechanisms of multiple Meditation Techniques within Practitioners» in collaboration with psychologist Michael Posner at the UO. The mindfulness research, analysis of the studies and its findings on various meditation techniques, brain states and types of visual stimuli and screen-interactions inspired the development of a virtual reality program and research. Research on virtual reality experiences is still in its infancy despite its growing popular usage and accessibility. Recent findings on virtual reality interactions and pain threshold, body ownership (Martini et al., 2015) and trauma therapy (Bohil et al., 2011) have shown various health benefits. Our current approach is to utilize (electro-)physiological measurements in a comprehensive virtual reality and meditation study at the EGI Lab in conjunction with the Institute of Neuroscience (UO). The study also draws upon findings on interoception, contemplative practices and health (Frab et at., 2015). Somatic experiences (e.g. consciously attended breathing) have been used as core elements in trauma therapy concentrating on interoception and proprioception. Breathing tasks are an integral part of meditation practices, and part of a highly effective technique enabling participants to voluntarily activate the autonomic nervous system (Kox et al., 2014). Neurocognitive components such as internal attention to raise meditation practitioners body temperature (Kozhevnikov et al., 2013) have empirically shown innate, and formerly considered impossible, human cognitive and physical capacities as trainable. The potential training of meditative and somatic experiences in virtual reality to voluntary regulate internal body states (Khalsa, Davidson et al., 2015) is the focus of research and development of a virtual reality meditation program, and the latest data will be presented. **P2**

351 Contemplative Practice Versus Video Game Play Associations Between Attention, Dreams, Mindfulness And Self-presence Jayne Gackenbach, Craig Guthrie ‹gackenbachj@macewan.ca› (Psychology, MacEwan University, Edmonton, Alberta Canada)

It has been suggested that video game play may offer the sort of practice of focused attention that is most associated with meditative practice. Only once have these two practices been compared. Gackenbach, Swanston and Stark (2015) found that gamers outperformed those who practiced either meditation or meditative type prayer (contemplative group) on a change blindness task. However, the contemplative group in their study reported more benefits from their practice than the gaming group. In terms of dreams related to practices that encourage attention practice, the contemplative group reported more lucid dreams than the gaming group or the control group. However, for control dreams it was the gaming group that reported the most followed by the contemplative and control groups. The present study is an extension of the first study. Again three groups of students were selected based on their prescreened frequency of either contemplative practice or video game play. High on one and low on the other or being low on both contemplative practice and video game play, control group. These groups reported separately to a computer laboratory where they were run in varying size groups. Initially they performed three attention type tasks: change blindness, Stroop test, and multiple object tracking. Upon completion they continued in the laboratory and filled out five self-report inventories: Dream Intensity Scale, Spiritual Dream Scale, Self-Presence Scale, Kentucky Mindfulness Inventory, and Mindful Attention Awareness Scale. In preliminary analysis of 228 respondents correlation patterns between the scales and the attention tests differed as a function of group. No association between any of the individual difference scales and the attention tasks were found for the control group. A different pattern of associations was found for the contemplation and video game groups across sex. Specifically, the contemplation group's scores on the Kentucky Mindfulness Scale were significantly associated with poorer performance on the stroop task. A different pattern emerged for the gaming group. Self-presence was positively associated with correctly identifying objects in the eight trials of multiple object tracking and with fewer incorrect clicks for the total change blindness trials, thus better performance. The relationship between the various self-report measures was more substantive for all three groups. The highest correlation in the contemplative

group was between Dream Intensity and Spiritual Dream scales scores. Other significant associations for this group were between Dream Intensity, Self-Presence and mindfulness in an activity. The same significant associations were for the Spiritual Dream Scale. Self-Presence was associated with mindful awareness in an activity. Interestingly the broader measure of mindfulness, the Kentucky Mindfulness Scale, evidenced no association to any other individual difference measure. In contrast, the gaming group evidenced few significant associations between the various individual difference variables. The one exception was mindful awareness in an activity (gaming for this group while for the other two groups the scale was worded to reflect their activity). Gamers reported high spiritual dream scores and high self-presence scores associated with mindful awareness. **C13**

352 Immersive Media and the Evolution of Consciousness Ed Lantz <ed@vorteximmersion.com> (Vortex Immersion Media, Inc., Los Angeles, CA)

The emerging role of virtual reality, immersive environments and machine intelligence in the evolution of human consciousness are discussed. The unique psychological impacts of immersive and interactive environments are reviewed along with the wide variety of immersive media delivery systems. Concepts explored include the gamification of everyday reality, prototyping of alternate social realities, digital mindfulness practices, evoking awe and mystical states of consciousness, cosmic theater, immersive education and digital domes for individual and group transformational experiences. A future is envisioned where physical and cyber realities seamlessly merge into an expanded human consciousness, blurring the lines between human intelligence and artificial intelligence. **P2**

5.12 Miscellaneous

353 Towards Machine Consciousness: Leveraging Analytics and Industrial Internet for Improving Efficiency of Wind Farms Alakh Bhatnagar, Umang Bhatnagar, Asst. Manager, Deloitte; D. K. Banwet, Professor Emeritus, Indian Institute Of Technology (IIT) Delhi; Shalini Nigam, (DEI) <bhatnagar.alakh@gmail.com> (Analytics and Research, Genpact, Gurgaon, India)

A tangible step towards achieving Machine Consciousness is to record, analyze, and model the functioning of conscious entities and then applying these models to make machines more efficient at what they do. The last decade has witnessed the internet revolution which has been the biggest innovation since the industrial revolution. The exponential advancement in internet and digital technologies has fundamentally changed the way data is generated, collected, stored, analyzed and interpreted for insights. At the same time the number of machines getting connected to each other increased manyfold, created a new ecosystem of connected machines, and started harnessing large amount of performance data available for enhanced efficiency. The new age machines not only use data, but now have the ability to create models, predict outcomes, evaluate results and make a conscious decision to alter their own performance to optimal levels. As the new age wind turbines get connected to the digital infrastructure, the industry is looking forward to reaping benefits at industrial scale. These wind turbines have the capability to alter their performance to match the operating conditions and deliver optimal levels of performance. This paper aims to quantify benefits that a wind farm can reap by leveraging analytics and data networks. Data of wind farms was accessed from publicly available sources for multiple years and locations in USA and analyzed using artificial neural networks on the statistical computing software R. The results demonstrate that by leveraging analytics and data networks, wind farms can reduce down time, improve efficiency, and reduce cost of operation while increasing operational life of assets. This paper also aims to explore further applications of analytics while Internet-of-Things (IoT) goes on to connect several industries and pushes the machines from being smart to consciously efficient. **P1**

354 The Development of Wellbeing Rien Havens, Combs, Alan <rienhavens@gmail.com> (Really Helping, PBC, Boulder, CO)

This presentation reports the results of a qualitative study of the relationship between adult personality development as defined by Robert Kegan's (1982) constructive-developmental model, and how individuals speak about, and make meaning of wellbeing their lives. In particular it focuses on the ongoing sense of conscious wellbeing seen as a function of the developmental level of the participant's personalities. The subject-object interview (SOI; Lahey et al., 1988) was chosen because it is a powerful instrument for examining adult developmental complexity in the context of a flexible variety of topics, in our case especially how the participants discuss the various experiences of, and meaning making around, wellbeing. In constructive developmental theory, how people experience wellbeing changes as meaning-making structures move from concrete to more flexible and expansive developmental organizations. Here wellbeing was examined in an exploratory interview,

allowing participants to talk openly about their experiences, meaning making, and storyline, and the study was able to capture and begin to organize how experiences of wellbeing shift in the conscious mind-stream of the participants throughout developmental progress, outlined by Kegan (1982). The participants described a conscious link between experiences of wellbeing and their experiences of more complex developmental stages, and many of the participants in higher developmental levels described a link between altruistic thoughts and behaviors and very high levels of wellbeing, which opens the question: "What is the relationship between wellbeing, altruism (including love and compassion) and the complexity of one's conscious worldview?" We found in the interviews, that as participants ascended through the developmental stages, their wellbeing experiences became less self-centered, and more altruistic. This shift was evidenced in the themes and details of their qualitative interviews. Our participants, obtained through informal connections and snowball-sampling, the 20 participants, selected from an original population of 50, ranged widely in age and socio-economic class. **P2**

355 The Importance of Following a Vegetarian, Teetotaller Lifestyle in Eastern Meditation and its Reasons Nidhip Mehta, Neha Sinha Mehta <nidhipmehta@gmail.com> (Architecture, Pearl Instutute, Agra, Uttar Pradesh India)

Lifestyles effect our well being tremendously. Efforts Being Made to Examine the Need for a Vegetarian Diet for Practicing Mediation as Taught in the East. **P1**

356 Relationship Between Toxins, Health (Physical and Spiritual) and Meditation Neha Paliwal, Kumar VaibhavKundan Srivastava <neha.26.leo@gmail.com> (DEI, Austin, TX)

There is hidden correlation between toxins which we intake from our food, food which is contaminated with chemicals and are genetically modified and cooked with oils at high temperatures which kills almost all nutrition, in this paper we study its impact on human being?s complete health (physical and spiritual) and its impact of meditation. Also, we conclude that how improving our diets and eating habits would help to achieve target of complete super human being and live healthier and happier - physical and spiritual life. Common man will be shocked to see the spread of toxin in our daily life. Today?s market is loaded with preservatives, pesticides, polluted air, water, cosmetics, cleaning products. Here we will be focusing on toxins in our life. Few major toxins are MEAT Products, DAIRY Products, PROCESSED Foods like MSG, GMO, SUGARY foods like HFCS, RESTAURANT food, Another extensive source of toxins are HEAVY METALS like, Aluminium, Lead, Mercury. It is very hard at first to stop these products not only by heart but by mind too. They create an addiction in the brain very similar to cocaine. Once you flush out the excess and unnatural food from the blood the addiction to toxin will naturally go. Toxins which has been in our body for so long will not leave our body happily and tend to make it difficult for us, but don?t let these toxic and these false brain ideas make you weak, with the time and very soon they will align with what is right for you and your body. Let me throw more light on the function of food and mind. Our bodies are acidic because of toxins so when we are hungry our mind automatically reaches out for the acidic food. This is a natural process. After following toxin free diet for a week our body will become alkaline and mind will crave for vegetables and fruits. Acidic bodies are prone to various illnesses. And any kind of illness creates distraction towards concentration. Raw diet will help in giving us more energy and we will be able to concentrate better in meditation as Raw vegetables and Raw fruits are alkaline. Foods should be eaten fresh, dehydrated with low heat or fermented. Reason being heating not only diminishes its nutrients but also makes the food toxic and less digestible. It?s like ?Cooking is killing?. Raw foods are filled with vital life energies. Few changes in our life style can bring dramatic improvement in our Mood, increase in energy level, controlled sugar level, cholesterol, BP, thyroid, PCOD, and in some cases Cancer. **P1**

357 Swarm Consciousness - An Emergent Property of The Swarm of Self-organized Conscious Agents Sanjay Saini, Prem Sewak Sudhish <sanjay.s.saini@gmail.com> (Physics and Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

"The whole is greater than the sum of its parts." As Aristotle quoted it around 2000 years ago still seems consequential in reference to swarm consciousness. Swarm Consciousness (SC) can be defined as the collective consciousness of individual self-organized conscious agents which themselves are primitively conscious and decentralized. Swarm consciousness has been able to display evidence of emergent property. An emergent property is a property which a system made out of a collection of individual agents has, but the individual constituting agents do not have. It has been observed that many individual conscious agents working separately may not achieve their goal or may not make appropriate decisions or may not behave intelligently but a swarm of them may do, or at least, do them with comparative ease due to the swarm consciousness. Individual agents may have a very

primitive consciousness whereas a swarm of them, which makes a system of such agents, shows a remarkable and versatile organization improving the collective consciousness or swarm consciousness to a great extent. Swarms may be of various types. Particle swarms are swarms of natural entities such as birds, bees or fish living in groups. Birds and bees, for example, have simple brains but they carry out tasks such as initiation of the flight, flying in group, and making decisions for things like searching for food in their lifetime. Individually they may move independently on their own pace and determinism causing randomness and confusion but collectively when they consciously coordinate their movements, they achieve an amazing organization. The outcome of the collaborative behavior of these conscious natural agents emerges to be manifolds when each agent uses the knowledge of its fellow agent, knowledge of itself along with the knowledge of the environment for making their decisions. Ants in their swarm make use of a chemical known as pheromone found in them to search for food and the best path to reach that food source. Each ant leaves a pheromone trail behind them making various paths. Out of these, the best path is finally traversed by most ants which is highlighted by having maximum amount of pheromone deposited on it. There are many more similar examples of natural swarms. **P1**

358 Vortexhealing: A Novel Energy Healing Modality Elizabeth Stephens-Pande <elizabeth.pande@gmail.com> (Transpersonal Psychology, Sofia University, Los Altos, CA)

Energy healing is an alternative therapy intended for: balancing the energy pathways in our physical or subtle bodies, facilitating the bodys innate healing mechanisms, and dislodging negative emotional patterns and conditioning. Studies have been conducted on many energy healing techniques, including Reiki, BodyTalk, Healing Touch, and Qigong. I would like to introduce a novel energy healing modality called VortexHealing Divine Energy Healing. Because the frequency of energy being channeled is extremely high, VortexHealing students receive several hours of attunement/transmission per level of training, as compared to a few minutes of attunement per level of Reiki training. It has been in use since 1994, and while there are many anecdotal testimonials, to my knowledge no formal study of this modality has been performed. For my PhD dissertation research at Sofia University, I will conduct a study on VortexHealings efficacy. I will identify 50-100 volunteers willing to receive one VortexHealing treatment, employing its most advanced technique, which is purported to release emotional conditioning at the upper-dimensional Universal Assemblage Point. I will employ no fewer than five healers, and we will focus on removing one topic of emotional conditioning in particular: survival fear, or life in a human body is unsafe. I will measure the test subjects self-reported anxiety levels both before and after the energy healing session. Having personally experienced the profound effects of this modality, I am eager to run this larger study and to present my findings to the psychology and consciousness studies communities. **P2**

6.0 Culture and Humanities

6.01 Literature and hermeneutics

359 Quantum Leaps in Princeton's Place: How Synchronicity Helped Me Write a Novel Donna Clovis <clovid01@nyu.edu> (Visual Culture and Literature, Franklin University Switzerland, Princeton Junction, NJ)

The novel, Quantum Leaps in Princeton's Place, is framed by one of the four levels of inquiry into consciousness, Level 3: Depth-psychological Hermeneutics (Brian Lancaster). Specifically, Jung's postulate of the collective unconscious. Mental and physical events are interrelated. Physical events can be intrinsically meaningful as in his concept of synchronicity. Depth psychology constructs and religion apply so that the concealed realm reveals itself through a series of meaningful events. Jung argues that this unseen unconscious contains archetypes that function to transmit knowledge to the conscious realm. This transcendent function brings about information to the conscious lower mind. William James also argues the psychological dynamics of mystical states represent the conditions necessary to a higher source of information, If there be higher spiritual agencies that can directly touch us, the psychological condition of their doing might be our possession of a subconscious region.The story begins with unrelated interviews of the oldest people living in Princeton. A series of coincidences places the author at a location where more information is revealed. The novel depicts a century of change in the one-time home of Albert Einstein in Princeton, New Jersey. This tree-lined town, dominated by its famous university, contains many magnificent homes including the Rosedale House (Kirkus Reviews). In Quantum Leaps, stories from 1900 to the 1960s follow four women of

different backgrounds who meet in time in Princeton's history, united in their search for equality. The voices of the Rosedale House tell their stories, representing a microcosm of America still relevant in these modern times. This cast of characters in Princeton's history depicts more than an intriguing drama, but a perspective of the haunting past relevant to our present and future.*Books can be purchased on amazon.com prior to the conference for book signing at the end of the session. **P2**

360 Ignatius' Brain: Food and Sex in John Kennedy Toole's A Confederacy of Dunces Olga Colbert <olvalero@smu.edu> (World Languages and Literature, Southern Methodist University, Plano, TX)

This work is part of a larger research project on the interplay between science and literature. I will examine A Confederacy of Dunces' discourse regarding food and sex, particularly the cognitive function of the protagonist's digestive system. Many critics have noted the less flattering traits of Ignatius Reilly's body (sloppiness, flatulence, excess weight), ever present in Toole's novel. I will focus on the most salient aspect of Ignatius' body: his digestive system, particularly his (pyloric) valve. This valve (mentioned 39 times in the novel) seems to have a regulatory function, regulating not only digestion, but also action. Ignatius seems to think with his gut, and therefore, his pyloric valve functions as a form of brain in the text. Ignatius's discourse regarding his body is consistent with his persona as a Medievalist who despises modern society: it seems to fall within a Galenic paradigm or within the state of the science of anatomy during Medieval times at best. However, when Ignatius discusses other characters' consumption of food or their sexual behavior, his discourse moves clearly within the Freudian paradigm that was in vogue when the novel was written. Furthermore, the character's own behavior regarding food or sex, when closely examined, can be best understood within the parameters of the latest research in neuroscience, particularly that which falls within the umbrella of chemical and genetic approaches. I will delve on the state of scientific discourse in the three periods, discussing the work of Galen, Medieval and Renaissance anatomists such as Montana de Montserrate and Alessandro Benedetti, Freud's theory of the instincts and drives, as well as modern studies on chemical food addiction and neurological conditions that affect impulse control. Recent neurological studies regarding the enteric nervous system (a set of neurons running along the gastrointestinal tract) will also be incorporated into my analysis. I will contrast Freud's model with Oliver Sacks' work on the neurological bases of excessive, unregulated sexual or food cravings. The three paradigms overlap in the text and serve as a good case for examining the interplay between science and literature in order to determine which one is ahead of the other at a given time, in this case in the early 1960s, the time when the novel was written. **C24**

361 A Poet's Investment in Qualms: Investigation of Qualia / The relationship of language to being / lyric inquiry and consciousness Annie Guthrie <a.p.guthrie@usa.net> (Tupelo Press, Tucson, AZ)

Poetry is a unique, communicable language that can privilege a range of different valences in order to create meaning - poetry is often divided into camps of accessible and difficult, with easy poems giving more weight to progression, and hard poems communicating meaning through experimental methodologies; posing or enacting a hard problem, these difficult poems might arrive at meaning by virtue of a number of hybrid technologies. The making of the poem itself, too affects the transmission of meaning, and can include experimental devices such as invocation, incantation, divination, and conceptual constraint. In poetry, the language is not necessarily bound to narrative as a linear progression (which is, in essence, movement forward in time) and so qualities can be held in plural dimensions; poetry thereby perhaps contributes a very good effort toward revealing or even touching the nature of consciousness, which famously defies linguistic capture. In attempting to signify or corral the unnamed/unknown in language, a scientist approaches what is also known as poet's territory: attempted excavation of a place of the unknowable and inarticulable is a poetic act, and, in fact, the attempt to raise the unknowable into language, for some poets, is also an attempt to bring it into knowable existence. Poets are thinking about the relationships between language, behavior and action; in their performances, poets are thinking about engaging and altering the consciousness of the room. Letting the mind go dark, raising images and inquiry - listening to poetry - might be instructive or useful practices for those wishing to explore the intuitive side of the study of consciousness. Poets aren't in the business of providing proofs, but they are at some level exactly in the business of saying 'what something is like' language is the primary medium used to invoke, represent, enact, question and/or transform consciousness. The poet is handling qualia, is considering the perception and reportability of qualia, and the language is made in order to accommodate that desire to communicate an essence- it's how and why syntax and diction are chosen. That desire also

determines the construction, appearance and delivery (performance) of the poem. If the problem of explaining phenomenal qualities is just the problem of explaining consciousness, it is also the problem of making poems. **C24**

6.02 Art and aesthetics

362 Real-Time Processing Technologies and Communications Marios Athanasiou <mario.athanasiou@gmail.com> (London, United Kingdom)

Marios' work explores the effects of real-time processing technologies and communications on human perception of reality and the role these technologies play in the convergence of physical and virtual reality into a new, hybrid reality. In his work he uses software, sensors, projections and networked systems in conjunction with abstract sculptural forms to build immersive, physical or virtual audiovisual environments that aim to induce different states of consciousness and generate new modes of thinking and perceiving. Drawing inspiration from scientific concepts concerning quantum physics, the nature of consciousness and cybernetics, Marios creates physical, virtual or hybrid reality installations where energy flow is in a constant flux of transformation from one state to another. Recent exhibitions include _proto_ether_fields_v.1_ at the 2015 International Symposium on Mixed and Augmented Reality, purestate.space online at La Scatola Gallery, Superposition at Arebyte Gallery; Omega Point at MKII; Potential Entity at a Telstra International, a disused data storage and telecommunications center; Blue Omega at I Thought You Were The Real Thing group show at Romantzo in Athens. His work Omega Point was also shortlisted for the 2015 Lumen Prize. He is also the curator at www.channelnormal.com, an online exhibition space that predominantly focuses on presenting time-based and web-based works. www.mariosathanasiou.com **A1**

363 Stellar Consciousness Exhibition with Digital Collages and Paintings from Star Bright?, an artist/scientist book. C Bangs, Dr. Gregory Matloff <1cbangs@gmail.com> (Brooklyn, NY)

My work images our life in a conscious cosmos interconnected and intertwined with the macrocosm and the microcosm and is woven with elements produced by stars, in the plants and animals we eat, wear and surround ourselves with. The proposed exhibition will provide a framework for exploration of the dialogue on a self-organizing conscious cosmos between my work and that of my partner, astrophysicist, Dr. Greg Matloff. Contextualizing my images and Greg's writing, graphs and equations in a variety of mediums will visually express in an open framework what philosophers and physicists call the "hard problem" of consciousness. In our recent artist/scientist book, Star Bright - collected this July by the Museum of Modern Art and the scientist/artist book, Starlight, Starbright: Are Stars Conscious? (Curtis Press, UK, 2015), Greg and I explore the philosophical doctrine of panpsychism. Editor Note: The video link https://www.youtube.com/watch?v=5xFQVnlZvEk **A1**

364 The Dappled Grey: An Illusion Based Artwork that Questions the Nature of Looking Roger Bays <roger.bays@gmail.com> (Christchurch, Canterbury New Zealand)

This artwork, 'The Dappled Grey,' utilises an illusion to explore the nature of looking. The experience of looking at the work creates artefacts in the conscious experience that, on close inspection, seem to have no presence or existence at the source (the work). This leads the art viewer to experience a discrepancy between what is consciously perceived and what is offered by reality, or thought to be offered. It is hoped that this challenges the art viewer to consider their own conscious experience and speculate about the nature of reality and what they might know about it, if anything. It is also hoped that art viewers may engage in dialogue about what is happening in the work, and share stories brought to mind by the conundrum that the illusion presents. This artwork is influenced by my sympathies with a new mysterianism perspective. I know a great deal about conscious experiences, I have them all the time. Yet, I know nothing about non-conscious reality, which, as far as I can tell, is inaccessible to me; even if I look at a neuron through a microscope, or the stars through a telescope I only ever witness conscious experiences, the actual reality beyond, if it exists at all, eludes me. This line of thinking offers the possibility that, 'the hard problem,' does not lie with consciousness, but with reality. In which case we may find ourselves with, the easy problem of consciousness and the hard problem of reality. To create the work I started with a standard optical illusion that is often used in talks about consciousness and worked with the idea of transposing the grid like effect onto a familiar object. Working with one of the requirements, a dark background, the idea of a black horse materialised. I began working with a found photograph and started to overlay a grid onto the horse. I then pushed the photograph into a silhouette. This enhanced the mechanics and robustness of the illusion and allowed me to further experiment with the parameters of the grid. To improve, 'the look,' of the grid I changed angles and positions of lines, and added colour. This presented the risk of the illusion collapsing. But I found that it was possible to deviate from the strict symmetrical nature of the standard grid and still maintain a robust illusion. I found that animating the image gave life to the work, and encouraged the art viewer's gaze to move through the scene, which further enhanced the illusion of flickering grey dots. The title, 'The Dappled Grey,' gives a nod to the gray matter of our brain and offers contradiction, the horse is black, yet the illusion offers elements of dapple grey. Historically, art has included illusion, the concepts behind this work invite the art viewer to go further and consider philosophical notions. The viewer is being nudged, for a short time at least, to become a philosopher. **A1**

365 Hidden in Plain Sight: How Storytelling and the Arts Leave a Trail of Clues to the Deeper Nature of Consciousness Nick Day <nick@conscious-pictures.com> (Conscious Pictures, San Francisco, CA)

The emergence of language and the capacity for storytelling can be considered fundamental to our becoming human. Our brain seeks meaningful patterns - "the story" in everything we see, hear or sense. Storytelling favors survival by activating a powerful inner world of association and meaning, enabling us to more successfully navigate the external world, empathize with others, and develop abstract ideas. Millenia of oral storytelling around the campfire produced a truly fantastic realm of myths, legends, folk tales and fables, filled with symbols and metaphors. Then, between 2,000-5,000 years ago, the development of written language dramatically altered the nature of storytelling and made possible the establishment of a largely reliable historical record and what would become the classical schools of philosophy. Forms of storytelling continued to evolve, giving us theatre, novels and narrative art, eventually synthesizing into cinema and modern electronic media. Thinkers since the time of Aristotle have described traits common to these forms of expression as archetypes: characters, images and scenarios that recur over time, forms and structures that seem essential and, indeed, hardwired. Jung and Campbell are renowned for exploring this rich realm of the psyche, and Pauli even proposed that archetypes can be considered a bridge to a deeper objective reality, an intriguing approach that connects the creative arts to the ideas of quantum consciousness theorists such as Roger Penrose and Stuart Hameroff. This talk will explore these ideas as well as broader aspects of storytelling and art throughout human history. **C24**

366 Effects of Phenomenally 'real' and Cognitively 'unreal' Stimuli in Contemporary Art on Visual Consciousness Ivana Franke, Bilge Sayim, University of Leuven <studio@ivanafranke.net> (Studio Franke, Berlin, Germany)

In most everyday situations, vivid visual perception of an entity goes hand in hand with the experience of this entity as phenomenally and cognitively 'real', i.e, as having mind-independent properties, and an existence independent of one's mind. Perceptual vividness and phenomenal realness can each be independently compromised in visual perception. For example, a number of motion illusions with static stimuli are highly vivid but phenomenally unreal as they lack correspondence with an object in the external world. By contrast, objects, e.g., in peripheral vision, fog, or in the far distance, appear less vivid but not necessarily less real. Here, we show a new type of stimulus that appears at the same time perceptually vivid and phenomenally real while it lacks appropriate categories to externalise one's experience. The coincidence of these features is frequently experienced as inexplicable. In a range of 3-dimensional art installations, interwoven nylon strings in a dark room reflect specular highlights. The reflecting surfaces (the strings) are invisible to the observer, and the highlights are perceived as small self-luminous dots grouped into larger configurations. The dots themselves and the entire configurations cannot be clearly located in space. Observer motion induces the perception of counter-intuitive changes of size, shape, distance, and rotation of the configurations. These - at the same time vivid and seemingly inexplicable - perceptual phenomena regularly yield the experience of the configurations as cognitively puzzling and animate. Visitors are prompted to question and speculate on what they perceive, how their movement is related to the perceived changes, and the nature of visual consciousness. **C24**

367 Your Attention, Please! Ellen Levy <levy@nyc.rr.com> (IDSVA, New York, NY)

Issues of consciousness find a close companion in attention; without it, many believe there can be no conscious awareness. Levy brings both experience and sentience to bear upon the objects of her attention as seen in her artworks. These images can be looted antiquities unattended during wartime as in her collaborative art project, Stealing Attention, dating from 2009 or unidentified specimens in her recent works, Anomalies and Artifacts. In both projects the shifting role of attention is highlighted by juxtaposing a grouping of prints with a related animation. In Stealing Attention, an assigned task generally prevents viewers from focusing on the disappearance of depicted antiquities

while watching a con game, 3-Card Monte. In the animation Anomalies and Artifacts, she features the continual refocusing of a microscope lens to determine whether an unanticipated apparition is real or an artifact. The software program used to produce the animation simulates much of the anomalous behaviors and appearances under investigation. This creates uncertainty whether the technologically-assisted eye has seen beyond its own constraints. The animation is juxtaposed with prints that portray the various glitches and artifacts that different kinds of lenses can produce. Viewers can contemplate them with a circular 4 x 4 inch dichroic lens that will be made available. see www.complexityart.com **A1**

368 Empathic Basis of Aesthetic Appreciation and Proprioception Erika Levy <levyee@hendrix.edu> (Hendrix College, Prairie Village, KS)

In this paper I will argue that aesthetic appreciation is based in empathic responses, which run even deeper when associated with the proprioceptive processes involved in the aesthetic appreciation of dance. To this end, I will outline Barbara Montero's conception of the simulative processes involved in the observation of movement-based art forms, as written in "Affective Proprioception." This involves an exploration of the extent to which varying levels of intentionality and consciousness can be attributed to the complex system of neural mechanisms responsible for simulative processes. I begin with an outline of Gregory Currie's 'Empathy for Objects,' and identify limitations of his view of bodily simulation. I argue that, due to the limitations of focusing on visuomotor processes, a more integrated cognitive function; proprioception must be explored. Exploration of the extent to which proprioception enters into the aesthetic appreciation of dance reveals how varying levels of consciousness alter and shape our personal and interpersonal experiences of the world and its contents. Specifically, the levels of intentionality associated with movement can lead to a distinct empathic response. Varying levels of intentionality can be combined with varying levels of consciousness, leading to a complex system by which individuals have unique experiences of the world around them. This exploration expands our conception of the role intentionality and consciousness play in empathic responses to aesthetic objects as a whole. **P2**

369 Representational Painting, First-Person Reporting and Consciousness William Oberst <woberst@gmail.com> (North Adams, MA)

Many representational artists paint what they see, and try to "get it right." It's tempting to take their paintings as first-person reports of their visual, conscious experience–testimony about what they saw, and how they saw it. On what grounds should we take paintings as reports of consciousness? A justification based on color qualia would go something like this: painters attend to color qualia in order to capture, in paint, how colors "appear" in the subject; when viewers look at completed art, they base their knowledge about the artists' color consciousness on a match between the colors they see in the paintings, and color qualia in the artists' visual experience. While that explanation might seem reasonable (even self-evident), I argue that it's wrong: first, because an examination of actual paintings shows they don't really have colors that can be said to match color qualia; and second, because of a thought experiment demonstrating why there can't, in fact, be such a match. After dispensing with qualia (and the idea of matching that's associated with them), I next consider a better tie between paintings and consciousness, where viewers look at paintings while utilizing an inherited, perceptual skill heavily favored by evolution: "reading" certain features in the environment as the effects of agents, thereby learning about agent-related events that happened in the past. Concerning representational art, viewers look at paintings and grasp how artists saw, in their subject, locations calling for the application of the brush strokes that are now on display–information about the artists' seeing that viewers take as knowledge about artists' visual consciousness. Since brush strokes don't depict anything in themselves (although they contribute to depiction), whatever painters saw as warranting particular brush strokes weren't objects. The result is that viewers don't take the artists' seeing as grounded in objects, but in what artists saw as paintable, or in how objects appeared to artists, or in artists' consciousness of the subject. Interesting questions arise about how consciousness should be understood in those terms. Is it necessary–or even possible–to first "bracket" artists' communications (in this case, paintings) as heterophenomenology might dictate, in order to turn them into reports about beliefs that can be approached from a third-person point of view? **C24**

370 Geometric Extensions of Consciousness Jiyun Park <park@jiyun.com> (Studio Involution - Interdisciplinary Design, Iowa City, IA)

Geometric Extensions of Consciousness - Morphological Gardens and the Works of - Anne Griswold Tyng, Manuel Baez and Lynnclaire Dennis Myths are metaphors for matter and analogues of interconnected phenomenon. The mythical first architect Daedalus and his mythical Labyrinth, housing a demi-god Minotaur are survived using Ariadne's Thread of Knots. Through the Thread's unraveling, the consciousness of the divine proportion from the center of the labyrinth can be mapped. Anne Griswold Tyng, Manuel Baez and Lynnclaire Dennis have traversed from the center and brought forth mappings of consciousness through geometries abstracting nature's own processes or life force. In her 1965 Graham Foundation publication, Geometric Extensions of Consciousness, architect Anne Griswold Tyng, mapped cycles of consciousness as geometry transforming through phases of rotation and polarity, revealing metamorphosis. In architecture over thousands of years, from the pyramids of Giza to present, she uncovered cycles of patterns capable of predicting the next style or epoch. Her cycles mirror metamorphosis through applied bilateral rotation/polarity [butterfly]; rotational [egg]; helical polarity [caterpillar]; and spiral rotation [chrysalis]. These insights reveal nature's geometry - dimensional shape shifting of Platonic solids. Tyng further describes the five Platonic solids as fundamental particles or elements, which add up to hundreds of other elements based on Pauling's Closed Packed Spheron Theory and Buckminster Fuller's atomic close packing. Extending these relationships Lynnclaire Dennis uncovered Ether or dodecahedron added to the Empedocles four solids: tetrahedron [pyramid, fire]; cube [earth]; octohedron [air]; and icosohedron [water] revolve around each other through a toroidal tre-foil knot. Thus, she has merged the five Platonic Solids, as Kepler attempted to do. The morphing, breathing geometry of these five elements is a meta-pattern, known as Mereon. Mereon's 3, 4, and 5 reverse symmetries, create patterns in a CymaScope that resemble a heart pulse. Patterns from Mereon resonate Prime Frequencies where a new energy source could produce water. Architect Manuel Baez's morphological gardens reconstruct natural phenomenon through the morphing of the five Platonic solids. Examples include seeds becoming trees and cycling to flower/fruits/seeds. The evolving geometric forms dance along lines of force or energy to expand from point, line, plane and volumes through knotted fields of reciprocities. This revealed dynamic push, pull and rotation of potentialities from triangles into hexagons and squares into octagons expand beyond cardo-decumanis as growth of forms generating 10,000 possibilities. Unlike a Tower of Babel, cursed with many languages, thus unable to name themselves to god, a universal language of mathematical geometry as number itself has qualities of shape, color, and sound. The particles of sound behave along waves like light, sharing an in[visible] field, dancing in the ebb and flow of reciprocating forces/energies or vital life force like breath that traverses within and beyond. Organic building blocks, resembling cell behavior or DNA, geometric extensions of consciousness reveal nature's dynamic knotted architecture hidden within. **P1**

371 Beyond Duality: The Esoteric Realism of Beny Tchaicovsky Morning Star Trilogy - 3D Animation Melita Tchaicovsky, for Beny Tchaicovsky <melitta2012@gmail.com> (Artnetwork Productions, Oakland, CA)

Morning Star Trilogy (MST) is a symbolic journey in the imagination of the late artist Beny Tchaicovsky (1954-2009) who was an award-winning pioneer in 3D computer animation. A Surrealistic painter, musician and visionary. His art has been categorized as Surrealism or Fantastic Realism; he preferred to describe his art as 'Esoteric Realism,' in which creativity was used as a tool for consciousness exploration and as an agent of social change. Aside from a meaningful metaphysical and cosmic aspect, much of his work is a critique of society's preoccupation with consumerism and war. In the early 90s, Tchaicovsky began expanding his two-dimensional paintings into 3D animation and in the process became one of the pioneering artists who contributed to the history of 3D animation as an art form. He understood early on the relevance of the new technology and taught himself its software to use as a tool for his creative expression..His work has appeared worldwide since it was featured in the Gate to the Mind's Eye and Odyssey into the Mind's Eye. In the 'The Morning Star Trilogy' project, in a tour de force, Tchaicovsky created the 3D Animation solo, composing and performing the soundtrack as well. The trilogy includes 'The Call' followed by 'Caught Between Worlds' and 'Dimensional Connections.' In the Call, an enigmatic soundtrack fuses with breathtaking imagery to create a journey of insight and wonder. Fusing unusual sounds and music with state of the art computer animation technology, 'Caught Between Worlds' is a journey into worlds that can only be described through technology. 'Journey to Synesthesia' and 'Cyberscape' reflect Tchaicovsky's critical vision of contemporary society and mainstream cultural values; the outcry against war, and the opposition to a mechanized life as a result of a soulless technological progress. http://www.artnetwork.com/BOOK_BENY **A1**

372 Abstract Drawing as a Platform, Which Permits Unknown Impressions to Grow and Become Visible Frederikke Jul Vedelsby <frederikkejul@hotmail.com> (Copenhagen, Denmark)

Is it possible to pass on impressions, which cannot be verbalized, through drawing? As an artist, I

feel that drawing can act as a non-verbal language, a communication allowing perceived but undefinable impressions to be brought up to the surface. By allowing lines to move freely through the hand and to be assembled on paper, a visualization and a story of the perception is created. Here drawing works as a collection of structures that shows us perception in another, abstract form. I am experimenting with drawing as a platform where impressions that cannot be defined can be visualized to discover whether it is possible to view, distribute and communicate them. **A1**

6.03 Music

373 Impact of Yoga-Meditation on Musical Perception Pritam Pyari, Pritam Pyari; Saran Pyari Roy; Sant Saran; Sukhdev Roy <sukhdevroy@iitdalumni.com> (Music, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Yoga, the ancient Indian art of meditation transforms an individual by regulating the spirit, mind and body. There are different forms of Yoga, however, Nada yoga and the Surat-Shabda-Yoga that involve meditation on spiritual sound currents have a profound effect on an individual. Meditation leads to progressive quietening of the mind and its impulses that in turn result in elevation to higher levels of consciousness. Indian Classical Music is inspired from its spiritual traditions that describe Shabda (internal sound currents) and Anhad Nada (unstruck music) as the very nature of the spirit and consciousness. Renowned Indian musicians and yoga practitioners have identified different Ragas that have an impact on different Chakras or energy centres as each Chakra is associated with a seed syllable, color and number of petals or currents emanating from them. A detailed time-theory of North Indian Classical Ragas has been established through experiential and empirical research, when each raga has its maximum impact. The healing effect of Ragas has also been well established. In Indian classical music, every raga has distinct combinations of swaras (musical notes) having distinct frequencies and each note represents a particular colour. When a raga is sung or played on a specific instrument (string, wind or percussion) corresponding to a chakra it generates its own unique colour. In this paper, we extend our previous study reported in TSC-2015 by studying the effect of Yoga- Meditation on Musical and Color perception. 50 Male and female yoga practitioners were made to listen to four 5-minute instrumental flute compositions of Alap form of Ragas, namely, Ahir Bhairav, Jaijaiwanti, Bhupali and Darbari that affect the Anahata (heart), Vishuddha (throat), Agnya (third eye) and Sahasrara chakras respectively, after meditation. The order of the Ragas was not in the progressive order of the chakras. The responses were recorded through a questionnaire by noting their order of preference and the qualitative effect in terms of feelings, imagination, color etc. The procedure was repeated after each month of meditational practice. The subjective experience pertaining to the preference of ragas, perception of feelings and colors in majority of the individuals showed progressive improvement to higher states of consciousness that corresponded to that attributed to the different Chakras. The study highlights the impact of Yoga on Musical and Color preference. It demonstrates a means of assessing the consciousness of an individual and the usefulness of designing a musical consciousness test to ascertain consciousness levels. It can be invaluable for illiterates and better suited to obtain direct honest responses than through purely written psychometric questionnaires. It would not only help in measurement but also to tune consciousness to higher levels. The results were also correlated with other psychometric tests. The results of a correlational study with frequencies generated during the musical test using a SQUID based Magnetoencephelogram (MEG) will also be presented. **P1**

374 Brain Dance Timbre Wolf <timbrewolf1@gmail.com> (Tulsa, OK)

Music is refereed to as the universal language. Pythagoras suggested that astral bodies have a frequency that cannot be heard but at least, perhaps, felt. This notion, along with Hindu spiritualism, led the composer, Gustav Holst, to conceive and write The Planets beginning in 1913. Dr. Anirban Bandyopadhyay has added that, Each one of you are coupled to what is happening in the solar system. Elephants, dolphins, whales, birds, bats and frogs communicate through what seems to be music (though some is inaudible to the human ear). Even wolves manage to sing. Dr. Bandyopadhyay has shown that frequency sweeps, through microtubules, produce a series of pitches and rhythms that are, possibly, the very constituents of consciousness itself. These are the sounds that the brain is singing. Dr. Bandyopadhyay's audio clip is entitled "Triplet of Triplet of Resonance Band" (TTRB). The pulsations of TTRB have been determined to have multiple meters (at least 3). The pulse, at the fastest level, is 179.4 bpm (beats per minute). The mid-speed section is 58 bpm while the slowest pulse is a very slow 2.5 bpm. It should be noted that these 3 meters do not seem to line up, periodically, as true musical triplets would. Nor do they appear to conform to the reductionist musical style of minimalism (a technique that Holst used over a century ago and which Steve Reich and Phillip Glass popularized in the 1960s and 1970s). Rhythmically, perhaps, the brain produces music that is more like an infinite set, of the sonic equivalent, of Penrose tiles. Brain Dance is the result of the melding of Bandyopadhyay's microtubule frequency sweep and an instrumental piece based on African Congolese Soukous music. (Soukous is derived from Cuban Rumba, tribal rhythms, and popular African music). In the first section of Brain Dance the African Soukous pulse is aligned with the fastest pulse of TTRB. In the middle section the slowest pulse of TTRB is utilized underneath the driving pulse of Brain Dance. This part of TTRB was transposed from C down to A to better accommodate the tonality of the piece. While Brain Dance is designed to bring the largest audience to an appreciation of the music of the mind subsequent work will focus more on the intermingling of the three fundamental time signatures. A detailed frequency analysis of TTRB showed: Tones in 3rd set (F4 maybe) D6 (Against C#7) G#7 F8 B8 D#9 G9 A9 C10 D10 (An amusing footnote is that the D to the G#, when adjusted for the octave, is a tri-tone. As is the F to the B in the 8th octave. This was referred to, as early as the 18th century, as the Devil's triad. It was to be avoided, at all costs, and rumored to have led to excommunication for using it). Dr. Anirban Bandyopadhyay says, we will create a music that no one ever heard. It will create a class of music that is unprecedented in the musical world. And THAT is the goal. http://soundclick.com/share.cfm?id=13283433 **C14**

6.04 Religion and spirituality

375 Pharmacological Cause of Consciousness Phenomena Seema Bhat, Dr. Laxminarayan Bhat <seemaranibhat@gmail.com> (Chemistry, Reviva Pharmaceuticals, Cupertino, CA)

The scientific evaluation of consciousness phenomena has become one of the thrust areas of biomedical research due to its important role in the spiritual, physical, mental and social wellbeing of mankind. Different spiritual practices have been followed across the world to achieve higher levels of consciousness but widely adopted methods are prayer, meditation and yoga. Although the ultimate goal is to achieve higher levels of consciousness, no two methods of spiritual practices can lead to the same level of consciousness as they differ in many aspects. Some spiritual practices focus on the particular Chakras in the body/brain and others on sound, colors and particular form of physical activities such as dance. Therefore, the qualitative and/or quantitative outcome of each spiritual practice can vary to a great extent and this is one of the biggest challenges in the scientific evaluation of consciousness phenomena. Regardless of the methods of spiritual practice, the outcome of a spiritual activity leaves signature trails of neurological and physiological changes in the body due to pharmacodynamic effects. Thus, the study of pharmacological cause of consciousness phenomena can be very useful in the scientific evaluation of qualitative and quantitative outcome of different spiritual activities. We present the key biogenic monoamine receptors possibly involved in the consciousness phenomena, their expressions in the human body/brain, and the scientific rationale of receptor level interactions between cosmic waves and human body. We also discuss in this paper the pharmacological cause and evidence to explain the correlates of consciousness and scientific rationale for differential qualitative and quantitative outcome derived from different spiritual practices. **P1**

376 The "Purusarthic Principle": Consciousness as Means, Consciousness as Goal Alfred Collins <nasadasin@gmail.com> (Psychology, Pacifica Graduate Institute, Anchorage, AK)

The "anthropic principle," which comes in various "strong" and "weak" forms, was the insight of quantum physicists who noticed that the universe is finely tuned to make possible awareness of itself via the phenomenon of human consciousness. In the Copenhagen interpretation, consciousness is the observer or experiencer of quantum reduction, the one who in some way "chooses" that Schroedinger's cat lives or dies. This is a strong form of the anthropic principle: without experiencers there could be no universe, or at least none in which anything happens. However, philosophers like Nick Bostrom have pointed out that our "choice" of world is not free, though we are given the illusion that it is by "observation selection effects," i.e, our natural tendency to claim particular significance for our chance placement in the world we actually see. In fact, we just happen to live in a world where quantum reductions–and specifically the ones we see–take place. This is the "weak anthropic principle," which simply recognizes that a particular sort of observer necessarily goes with a particular sort of world. If we did not live in such a world we could not see it.The Indian philosophical schools of Samkhya and Yoga agree with the weak anthropic principle in viewing the nature of experiencers/observers as necessarily consistent with the world they inhabit. But they add another level of consciousness, one "for the sake of which" (artha) experience takes place. This higher consciousness, called purusa in these systems (atman elsewhere) implies a new form of strong anthropic principle

that I call the "purusarthic" principle. Everything that occurs in the world, on this view, is action motivated by the aim of giving enjoyment or experience to consciousness but also and essentially to bring about enlightenment or release from the suffering of finding ourselves, over and over, locked into the facticity of a world that has to be as it is. This release occurs when we recognize that experience is not for the sake of our everyday self, the one locked into the world of suffering but for the sake of revealing what Roger Penrose calls a "Platonic" world of mathematical and ethical/esthetic truth. The universe, then, does not labor to bring forth the mouse that is mankind but rather through humans (and doubtless other species on other planets and possibly via AI in a posthuman world) to realize its deep source and aim in consciousness. In the purusarthic principle, what the world "just is" (the weak anthropic principle) points toward what it "truly is" (the strong principle). In this way the weak and strong forms of the anthropic principle are brought together. **P2**

377 Network of Creational Currents-Understanding Consciousness Shanti Gupta, Radhika Singh; Amolak Prasad <shan_gupta2@yahoo.co.in> (Panchkula, Haryana India)

I have attended conferences on consciousness and heard the speakers from various streams. I must admit that much of their discourse is beyond me. They take you onto the journey through labyrinths of neurons, synapses, axons, dendrites and the neurotransmitters in search of consciousness. What they are, however, unable to explain is, what is the source of consciousness, where does the consciousness come from, how does it manifest, why does it give rise to phenomenal activity and where does it go after death? All arrangements in this creation are being carried out through currents, whether they be visible or, not. Just as external creation is maintained by currents like in a magnetic field; in the same manner the entire economy of this physical body is maintained by currents, known collectively as the nervous system. These currents are subtle in subtle regions and gross in the regions of gross matter. These currents and networks spread out in all directions in individual system and subsystems like in a magnetic field. Chief current of consciousness is the one which has created the physical world, this body and made the ganglia in the physical body. The entire economy of creation in the physical worlds is regulated through this current. To understand consciousness, the scientists ought to study and accept the role of creational currents that brought forth the creation into existence, and interact with spiritual scientists to understand and experience the correlation between macrocosmic and microcosmic consciousness in an integrated wholesomeness. Science is best at answering mechanistic "How" rather than "Why" questions. Koch tries to suggest the abstraction of transcendental soul as a possible answer to the enigma of consciousness. David Chalmers concludes that conscious experience does not follow from the physical laws that rule the universe.... nevertheless, the physical and the phenomenal worlds are closely linked in. The source or the reservoir of consciousness does not belong to the physical world and is not subject to the physical laws. It does not reside in the neurons or synapses of the brain. The current of consciousness is highly subtle, comes from above and enters the human body and imparts consciousness to its various parts. When it leaves the body, consciousness ceases, this world ceases as well. Consciousness is not the field for scientists, or for the philosophers or even for the scholars. This is the subject of experiential knowledge of those exalted spirits who have access to the subtle and the subtlest regions, the currents issuing forth from there and operating in regions of purest spirit and universal mind besides the physical worlds; those who understand the forces that unify the physical forces with the subtle and the subtlest forces including the force of consciousness which rule the regions of Universal Mind and the Region of Pure Spirit; those who are acquainted with and have access to the reservoir of consciousness. This paper seeks to explain consciousness in terms of integrated wholesomeness of macrocosmic and micros-cosmic consciousness as revealed in the Religion of Saints. **P1**

378 Global Consciousness Project (Cognitivism to Connectivism) and Better Worldliness - Data Study of Spiritual Consciousness Measurement Leading to a Scientific Extension of Collective Consciousness Swati Idnani, Suresh Idnani; Sneha Idnani <swati.idnani@gmail.com> (Cognizant, Vernon, CT)

Our individual minds, though distinct and uniquely ours, may also join with others in a kind of mental symphony that now and then becomes audible against a prevailing background of static. That's a conclusion suggested by the Global Consciousness Project (GCP). After many years of monitoring multiple world events, researchers report strong evidence of some kind of transpersonal mentality that seems to emerge when many people share a common concern or experience. At such times, a global network of devices employing quantum tunneling has found weak but definite signs of coherence arising out of background "noise" or randomness. As propounded time and again by Prof. P.S. Satsangi Sahab ? the 8th spiritual leader of Radhasoami faith, ?In human frame, the spirit force resides in the innermost core and is thus covered by subtle mind and gross matter. Accordingly, there is spiritual emanation in the form of spiritual wave, particularly from the eyes and forehead of a human being?. He has also gone on to state ? ?As implied by the fundamental axiom of spiritual consciousness, the spirit force possesses prime energy which evolves into various mental or physical forces by its association with media of different kinds?. This, therefore can be measured ? as suggested by various experiments conducted as part of Global consciousness project as well as a preliminary systemic study of spiritual consciousness of Dayalbagh community, during congregational meditation-cum-prayer meetings in the community Hall and measured via random number generators. Through our topic, we aim to focus on conducting a data science specific study of - a. GCP / systemic experiments that allude to the view that there is no disparity between physical science and spiritual science b. Extend the conclusions to whether Better worldliness can be achieved by raising collective spiritual consciousness **P1**

379 Revealing the Real Science of Consciousness Through a Novel Divine Sacred Geometrical Structure of Conscious Quanta Santosh Harinarayan Kaware, Dr. Moninder Singh Modgil; Mr. D. D. Patil; Mr. H. B. Bhoir <san_kaware@yahoo.co.in> (Researcher, Alchemy of God, Mumbai, Maharashtra India)

This paper mainly focuses on a novel divine sacred geometrical structure of Consciousness Quantum Spiritual Energy (CQSE i.e. conscious quanta or observer), the operating system of mind, intellect and impressions and the process of interaction of CQSE quanta with brain. As CQSE quanta subtle Planck geometry is very small and less than 1.616 exp -35 meter hence it cannot be measured with the present scientific measuring instruments. Due to this reason scientists are unable to find out an existence of CQSE quanta hence they are considering it as just an imagination. On one side spiritualists are practicing different meditation techniques and on the other side scientists are studying different branches of science to reveal the real science of consciousness but both are unable to find out ultimate reality about consciousness.Hence scientists are not accepting an existence of consciousness and considering the brain is driving a body which is not at all true. In reality CQSE quanta is very subtle spiritual quantum gravity whose basic vibrational frequency acts on brain by creating vibrations through Aether (quantum vacuum energy) medium, which creates electromagnetic bio-photons and these acts on neurons microtubules of brain through unified sacred geometric field produced from 16 Aether energy points of quanta and drives body through brains relay command center along with 7 main and 6 minor chakras of subtle light body. This proposed geometry of CQSE quanta is nothing but Quantum Platonic World of Wisdom and Light which is represented by Pentagonal Star with angles of 18, 36, 72, 108 degrees and 16 Aether energy points in which 3 points act as operating system and 13 points includes natures 5 elements, values and powers of CQSE quanta which are connected to 13 chakras of subtle light body. Human consciousness produced from operating system of mind, intellect and impressions of the CQSE quanta in which intellect is at the center and it acts as a signal receiver and transmitter. Mind generates thought signals which will be given to intellect for final decision and accordingly intellect produces a basic vibrational frequency which will be decoded by the particular group of neurons present in the hypothalamus. This will further trigger the neurons microtubules of pituitary gland and specific neurons of thalamic relay station through which neurons of a particular region of brain will be activated to carry out particular act by physical body organs. In this way control signal is initiated to carry out a particular act by the body and power for movement of body parts will be provided by a particular chakra of subtle light body which is continuously created by CQSE quanta. Mind creates feelings after completion of a particular act, after sometimes repetition it became the habit and get stored in impression point. In this way,CQSE quanta drive physical body on energy, frequency and vibration level. This paper is a starting step in revealing the real science of human consciousness and to bring awareness among scientists about CQSE quanta and its interaction mechanism with physical body. **P1**

380 Theories of The Universe and the Concepts of Space and Time : Similarities Between Modern Science and the Ancient Indian Scriptures Shabd Sahni, Surat Sahni, Prakash Sahni <poojaswamisahni@gmail.com> (Apeejay School, NOIDA, UTTAR PRADESH India)

In the 20th century, scientists first stated the following facts: a. That the universe had a beginning and would have an end. b. That time and space are neither absolute nor infinite. These were first proposed by Einstein in his Theory of Relativity and later other scientists which include Hawkings and Penrose who refined the facts to include the results from Quantum Theory. Their conclusions were based on observational data and mathematical equations. The Ancient Indian Scriptures which were composed thousands of years ago contain similar statements. Although they are written in an

ancient language and in poetic form, they essentially say the same thing. To quote Swami Vivekananda from the 19th century while expounding the Vedanta philosophy. "In the Absolute, there is neither time, space, nor causation. The idea of time cannot be there, seeing that there is no mind, no thought. The idea of space cannot be there, seeing that there is no external change. What you call motion and causation cannot exist where there is only One." In this poster we go through the findings of the two radically different methods, the scientific method which builds upon first principles and postulates; and the spiritual which is experiential. **P1**

381 A Perspective of Consciousness and Consciousness Studies Dharampal Satsangi, P.Sriramamurti; C.Tulsi Das ‹psriramamurti.db@gmail.com› (Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Consciousness is awareness of self and surroundings enabling activity of the conscious being exercising the sense organs as well as motor organs. It comprehends ordinary awareness of living beings at physical level, clinical consciousness, extra-sensory perceptions, induced states and the states of transcendental nature attainable by contemplative methods employed in spiritual traditions of the world corresponding to Turiya, Turiyatita, Satt Pad and Radhasoami Dham. It is studied in metaphysics, parapsychology, biology of mind and neurology. These studies confirm to the principles of investigation of science namely, reduction, refutation and repeatability. The inner science formulated by Price and Barrel by observation, descriptive reporting and understanding by analysis, also comes in its purview. The measurements of these states have been in vogue. In the spiritual traditions, phenomenological measurements were made for assessing the gradual spiritual development of the practitioner for taking up higher course of action until the final goal is reached. However, these attainments, show up on the face of the practitioner, which are reflections of the different changes in the brain and its structural alignments. Brain is the repository of the subjective effects of states of consciousness in all the grades. Modern studies of nervous system and brain are revealing several of the electro-chemical changes that occur with the subjective experiences of consciousness, comprehending physical, psychological and spiritual levels of consciousness. To comprehend the great gamut of studies the scientists have to be open minded to consider all levels of consciousness and their effects on the nervous system and the brain. The interdisciplinary studies that are emerging with interaction between science and spirituality, augurs well for the progress of science of consciousness. The Dayalbagh Educational Institute, Agra in India, is playing a leading role in promoting the studies under the guidance of Prof. P.S.Satsangi, Chairman, Advisory Committee on Education, Dayalbagh Educational Institutions and with the active participation of various faculties of the Institute. Facilities for measurements of electromagnetic effects of levels of consciousness attained by practitioners of Surat Shabda Yoga are made use of such as fMRI, SQUID, EMI etc. Cognitive Tests are also being performed on the practitioners, like Myers-Briggs Type Indicator (MBTI), Consciousness Quotient Inventory, Freiburg Mindfulness Inventory. **P1**

382 Gravity Is Eternal Consciousness Which Pervades Entire Cosmos Anirudh Kumar Satsangi, Ankita Satsangi, Achraj Satsangi, Akshay Mathur, Achal Srivastava ‹anirudh.jenna@gmail.com› (Director Office, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Carl Sagan has rightly said, "The nitrogen in our DNA, the calcium in our teeth, the iron in blood, the carbon in our apple pies were made in the interiors of collapsing stars. We are made of star stuff". The observable universe is made largely of hydrogen atoms whereas human body consists largely of oxygen and carbon atoms. Life in its present form as we know it on Earth Planet was created only after the synthesis of protein molecules consisting of carbon, hydrogen, nitrogen and oxygen atoms. Life is specified by genomes. Every organism including humans has a genome that contains all of the biological information needed to build and maintain a living example of that organism. The biological information contained in a genome is encoded in its DNA and is divided into discrete units called genes. Genes not only transmit hereditary traits but also mastermind the entire process of life. Genes are chemical molecules - Adenine, Cytosine, Guanine and Thymine. Their constituent elements are C, H, N, and O. Thus our life process is governed by recycled star stuff. Carbon, Nitrogen, Oxygen, Iron, Calcium and all other heavy elements are created in dying stars.. Gravitation Force is the Ultimate Creator (A.K.Satsangi, 2006). Gravity is the Prime Fundamental Force. Other three Fundamental Forces viz., Electromagnetic, Weak and Strong Interactions were created from this Prime Energy . Other forms of energy, mass, particles, atoms, elements were created from these forces after the big-bang. Due to Gravity stars and planets were also created. Gravity is sustaining the entire galactic system and solar system. Under the influence of strong gravity stars and planets die. And finally gravity acts as an ultimate annihilator of the entire Cosmos. Thus Gravity is the eternal consciousness and pervades in entire cosmic evolution and dissolution. Genes should be the study matter for Science of Consciousness. **P1**

383 Living Every Moment With The Almighty Sumiran Satsangi, Shipra Satsangi ‹sumiran.satsangi@gmail.com› (Delhi, India)

Introspection of our 'Daily Karmas' and surrounding environment around us at the end of the day reveals the condition of our mind which is filled with infinite thoughts at any point of time. It tells us that condition of mind which changes every moment and it also reveals our vulnerability in this world at large. Constant struggle with life problems and changing circumstances and condition of our mind (full of numerous thoughts) takes away our power to take right decisions which we all are required to take, again multiple in number each day of our life. It is said that each person is born with a purpose and each person has his trajectory or path defined by the Supreme Being. It would be desirous and beneficial that we try and follow this path and not even for a moment divert from it. But we experience its not possible every moment, i.e. we get disconnected with the path often. We than wonder that we were taking the right decisions till this time, but suddenly at some hour or some day, our mind changes its track and taking us to the path, which is different to what our inner conscious wants us to follow. The present paper explains the importance of our constant connect with the Supreme Being, our creator at all times. Whether we are sleeping, walking, talking or doing any work. Why the same is important and how can we sustain it at every moment of time is what the paper would explore through questionnaire and personal interviews. **P1**

384 The Nature of Consciousness According to Kashmir Shaivism Dharampal Satsangi ‹dharampalsatsangi@gmail.com› (DEI University, Agra, U.P India)

Kashmir Shaivism says that if we could pare away that superficial layer and know ourselves as we truly are, we would discover ourselves as divine beings, Shiva Himself. It holds that pure Awareness, and not matter, is the basic stuff of the Universe. It can also be called God, the Infinite Absolute beyond any form. Awareness is divine, it is 'Shiva', the Lord of the Universe. The Absolute is an eternal all-pervasive principle, the highest reality, the nature of all entities eternally and blissfully at rest within its own nature. The Absolute is the nature of the Self (and thus of us all). It is full of conscious activity through which it generates the universe, and reabsorbs it into itself at the end of each cycle of creation. Consciousness is finite. It is the manifest form of Awareness bounded by the three qualities of Nature, the three Gunas. Consciousness is Being, it is 'Shakti'. In Kaishmiri Shaivism one withdraws from Consciousness (the finite), to Awareness (the infinite), but one also goes on an outward journey from the infinite to the finite, because both the finite and the infinite have an intimate connection. The finite (Consciousness) is not seen as unreal, but as a symbol of the infinite (Awareness). There is no real distinction between them. These two movements constitutes Spanda, a key concept in Kaishmiri Shaivism. Spanda is the pulsation of the Absolute in different phases of being. Spanda, the eternal pulsation of the Absolute, oscillates between a passion to create and dispassion from the created. Through it the Absolute transforms itself into all things and then returns back into the emptiness of its undifferentiated nature. In this paper the author explains the concepts of Awareness, Consciousness and the Spanda. **P1**

385 Inner Universe: A Community of Mind, Soul and the 'Third Eye' Dolly Satsangi, Gagandeep Nigam; Sunita Satsangi ‹dollysatsangidei@gmail.com› (Paramedics, Dayalbagh Educational Institute, Agra, UP)

Reality can be understood in two ways as science and spirituality. Modern day scientists believe that consciousness is ubiquitous. The outline of everything people construct is formed in the mind and then filled in with the matter to assume and accurate shape. If quantum theory describes the processes for the outer cosmos, consciousness does so for the inner cosmos. Spirituality is something which can be experienced. In case of quantum computing we have considerable difficulties in establishing experimentally much of the theory which has been propounded till now. If the mind, by concentrating itself on matter, can work such wonders and attain such miraculous physical powers as we have, what can it not attain if it concentrates on itself? The soul is conscient energy, aware of its own existence. The soul does not grow or diminish but only experience changes in its happiness or unhappiness, peace or peacelessness. Any person who looks for true happiness in this materialistic world, he has to learn the practices from that holy person who has attain salvation or freedom in their life time from life and death and history from desires of every kind. Key words: Quantum theory, cosmos, conscient energy **P1**

6.05 Mythology

6.06 Sociology

386 Consciousness Studies and Social Problems: The Case of Islamist Extremism Seymen Atasoy <seymen.atasoy@emu.edu.tr> (Business Administration, Eastern Mediterranean University, Gazimagusa, North Cyprus)

'Consciousness studies' contain concepts, hypotheses, and theories that can significantly improve social science research. Eminent political scientist Alexander Wendt developed a theoretical foundation for such applications. However, present-day social scientists do not make much use of these resources. As a case in point, the policy-oriented political science and international relations literature on Islamist extremism generally overlooks the subjective inner experiences of the involved individuals and their communities, namely their nested individual and collective consciousness. In philosophical parlance, Jihadists, as well as their supporters and opponents are all treated as 'zombies.' This paper proposes an analogical holarchic model of consciousness fields by synthesizing 'quantum consciousness,' 'morphic fields,' 'integral theory,' 'collective unconscious,' and other ideas from consciousness studies. Some of these concepts are controversial, but reassessing Islamist extremism with this model renders added benefits: an alternative framework to organize available data and a new perspective to evaluate them lead to increased explanatory power and heuristic fruitfulness. The emerging picture shows that Jihadism is parasitic upon Islam, and how the infection goes much deeper than the visible material plane causing permanent damage to the collective consciousness of Muslims and rest of the humanity. Next, the study recommends some policy measures regarding fundamental education reform in Muslim majority countries, new theological interpretations of Islam, and the inevitability of the evolution of Islamic culture. The paper ends with an invitation to students of consciousness to join the interdisciplinary dialogue. **C11**

387 Facilitating Collective Knowledge and Social Learning Through Cloud-based Curation of Research Data and Software: A Case Study in the Disciplinary Culture of Astronomy Gretchen Stahlman, P. Bryan Heidorn <gstahlman@email.arizona.edu> (University of Arizona, School of Information, Tucson, AZ)

Curators of scientific research data currently face the unique challenge of extracting knowledge from heterogeneous and complex datasets, an endeavor that requires both interdisciplinary and domain expertise to accomplish true curation, with an overall goal of facilitating reproducible science through discoverability and persistence. From a Cognitive Science perspective, curation through cloud computing ideally functions as distributed intelligence, enabling scientific discovery and integrity of research by minimizing (or even eliminating) physical, geographic, institutional, political and infrastructural barriers to collaboration. However, in building upon disciplinary knowledge utilizing existing communication structures, coherent data products are culturally contextualized through epistemic frameworks and intellectual and technological affordances. The role of a data archive as a collective memory practice in science facilitates both cultural learning as a discipline and individual learning through the research process, forming a semantic network of concepts and information that can be explored as a new frontier and discovery-driven research paradigm, and reflecting a broad shift in scientific thinking towards ecological knowledge systems and a changing research environment. The case study presented here focuses on a new institutional collaboration that is leveraging existing cyberinfrastructure resources while actively developing innovative data analysis applications and data linking tools for scholarly communication. The Arizona Astronomical Data Hub (AADH) was initially conceptualized when a group of researchers and professional staff at the University of Arizona held several meetings during the spring of 2015 about astronomy data and the role of the university in curation of that data. The group decided that it was critical to obtain a broader consensus on the needs of the community. With assistance from a Start for Success grant provided by the University of Arizona Office of Research and Discovery (ORD) and funding from the American Astronomical Society (AAS), a workshop was held in early July 2015, with 28 participants plus 4 organizers in attendance. Representing University researchers as well as astronomical facilities and a scholarly society, the group verified that indeed there is a problem with the long-term curation of some astronomical data not associated with major facilities, and that a repository or 'data hub' with the correct functionality could facilitate research and the preservation and use of astronomy data, overall enabling repurposing of data, supporting the semantic goals of the publishing community, and working towards fully reproducible science. The Arizona Astronomical Data Hub pilot project has been funded for one year through an ORD Accelerate for Success grant and is now

being developed in an agile, incremental manner that will allow consistent community growth from the early stages of the project, building on existing CyVerse (formally iPlant) infrastructure (www.cyverse.org) initially developed for the biology community and with robust cloud-based resources for managing, linking and sharing diverse research data among and across current disciplinary boundaries to encourage discovery and development of collective knowledge. Through this infrastructure, metarepresentational and inferential behavior and metacommunication between scientists are made transparent with standardized and thorough metadata, a community-established taxonomy, and fully-documented software and data products, overall participating in an evolution of scientific communication. **P2**

6.07 Anthropology

6.08 Information technology

388 The Value System Characteristics of Chinese Online Game Players Wang Chaoguang, Gino Yu <whikgd@gmail.com> (School of Design, The Hong Kong Polytechnic University, Hong Kong, Hong Kong)

Understanding the worldview of players is an essential part of game design. This paper reports the results of our study to identify the value systems of Chinese online game players based upon the Emergent Cyclical Levels of Existence Theory (ECLET) by Clare W. Graves, which is also known as Level of Consciousness as adapted by Ken Wilber. We conducted a survey of 5,427 participants within the online game Ghost II that measured their worldview based upon the ECLET. Our study showed that Chinese online game players are mainly operating at Blue value system, a core value that is to sacrifice self now in order to receive reward later. The data was also compared with instrument averages resulted from global measurement main based on western subjects. The differences across the demographic variables such as gender, age and occupations were also examined. The study is significant in its research methodology (using commercial game data in the study) as well as its findings regarding players' core values. Our findings establish a baseline for the future study of value systems and provide valuable information for game designers to understand and meet the need of target users. **C12**

389 Artificial Neural Models for Machine Perception Christian Szegedy <szegedy@google.com> (AI, Google, Mountain View, CA)

The domain of machine perception focuses on the computerized processing of sensory inputs like audio-visual signals. Applications of machine perception include very practical tasks including image analysis and speech to text transcription. Today, several widely used internet services rely heavily on second generation deep and recurrent artificial neural networks. These are used for a wide variety of immediately useful tasks ranging from voice recognition in phones to powering web search. However, deep artificial networks have been shown to produce stunning results in previously unanticipated directions: for generating neural arts and transferring style and content between images. It is especially remarkable that several current methods for neural art generation were not engineered with the explicit purpose of producing art in mind, but have emerged naturally from research efforts to understand the feature representation learned by artificial networks designed for other, unrelated, tasks. For example, the DeepDream approach was developed as a visualization tool to study the features learned by the models trained for various image processing purposes. It is remarkable that despite the extremely scant resemblance between artificial and biological neural systems, the internal features that emerged spontaneously in both of them show strong, sometimes even quantifiable, similarities. This might suggest the speculative hypothesis that both complex biological systems and relatively simplistic deep learning approaches might be manifestations of a few shared, fundamental, information theoretical processes. **PL6**

6.09 Ethics and legal studies

390 Ethical Consciousness in Auditing Aashiq Bommireddipalli, Prem Sewak Sudhish <aashiqb2291@gmail.com> (Dayalbagh Educational Institute, Agra, India)

As an upshot of the numerous auditing scandals at the turn of the millennium in the global business environment, the focus today is largely being shifted towards auditing standards, code of conduct and ethical training. In the wake of these scandals, there is a necessity to restore public trust. Integrity, objectivity, professional competence, confidentiality and professional behavior are the fundamental principles crucial for an auditor to carry out his work in an ethical way. An auditor is faced with a large responsibility and could therefore face pressure that tests the auditor's moral values.

An auditor's responsibility is not bounded to his client or the employer, but he or she has a sacred responsibility towards the whole society. To be able to execute this duty, the auditor needs to have competence and capability to perform an audit, exercising professional skepticism and judgment, as well as abiding with relevant ethical requirements. This paper makes an attempt to suggest how an auditor of elevated and superior consciousness aids the organization and government achieve accountability, improve operations and instill confidence in the citizenry whose public trust government and private institutions hold compared to an auditor of inferior or evolving consciousness. **P1**

391 Denying Minds: Animal Consciousness and Cognitive Dissonance in Neuroscience Research Ann Lam, Elan Liss Ohayon <alam@pcrm.org> (Research and Policy, Physicians Committee for Responsible Medicine, Washington, DC)

Neuroscientists, biomedical and consciousness researchers using non-human animal subjects face serious practical and ethical quandaries: On the one hand, if other animals are different from humans then the research and conclusions may be misleading and harmful. On the other hand, if other animals are like us and can consciously experience the world, then the research is unethical. Although most neuroscientists would insist that they aim to minimize animal suffering, very few face these quandaries head-on. Instead, these questions are transposed to whether animals are conscious and, if so, to what degree and form. This sort of questioning is, at face value, no more or less helpful for understanding consciousness than asking whether other people are conscious. Indeed, it suggests the question: "are neuroscientists conscious?" Beyond mere sophistry, solipsistic or definitional concerns, questioning the terrain of a neuroscientist's consciousness in this way alerts us to the presence of the deep cognitive discord in the field and its impact on consciousness research. Here we describe some manifestations of cognitive dissonance in neuroscience research. Specifically, we examine some reasons that neuroscientists continue to wrestle with speciest quasi-solipsistic questions. We study how this bias distorts our view of the mind while also enabling the practice of non-human animal research despite the knowledge that it causes suffering to conscious beings. We first draw on theoretical and empirical studies of cognitive dissonance in the realm of addiction and human omnivore dietary practice. We demonstrate some of the largely illogical, complex, cognitive strategies taken to minimize the dissonance and associated anxieties which include an array of both conscious and unconscious strategies. We show that the denial of consciousness in other animals can entail a transposition of knowledge items to the unconscious, reducing awareness in both the subject of study and the self within the researcher. We then extend the examination to neuroscience and survey the reasons why cognitive dissonance may be even more dramatic and harmful in research, including: (1) problematic legacies from various schools of philosophy and psychology (Cartesian dualism, classical and operant conditioning, functionalism, eliminative materialism, etc.), (2) strong reductionist trends, (3) the high stakes of neuroscience applications (e.g., human health, understanding dementia), (4) high payoff (solving the "most complex systems in the universe"), (5) concentration of intellectual abilities facilitating self-denial and rationalization, (6) academic and funding biases (7) social milieu. We explain how these factors exert enormous pressures that can result in the denial of minds and undermine consciousness research. However, beyond mere critique, we also describe how a range of emerging human-based approaches can allow us to engage the deepest neuroscience questions in ways that are not only more ethical but actually more informative (e.g., iPSCs, imaging, and computational studies). We describe our own experience in establishing the first "Green Neuroscience" laboratory and exploring "vegetarian neuroscience" and "vegan neuroscience". Finally we show how these new approaches may help remove barriers in neuroscience that have traditionally obstructed us from seeing the true nature of consciousness in other minds as well as our own. **P1**

6.10 Education

392 Techno-Psycho-Axiological Approach to Consciousness Abdul Sameer Khan, Neha Shivhare <a.sameer.k88@gmail.com> (Pedagogical Sciences, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Every human being on the planet evolves and grows in consciousness in seven well-defined stages; these are service, making a difference, internal cohesion, transformation, self-esteem, relationships, survival (Barrett, 2010). Human grows gradually from survival stage to service stage in his lifetime as his consciousness develops deeper and deeper, although every individual is not able to reach at the higher level of consciousness only few can achieve the highest stage. It depends on the experiences we have during our journey of life, needs, aspirations, values we have in life as the guiding principles. This paper highlights the importance and positive impact of education based on techno-psycho-axiological approach to teaching-learning system for ensuring the quality and values in the teaching-learning system. This approach will be beneficial in developing the higher consciousness among the learners. Utilization of recent trends and technology and psychological principles can result in real and sustainable improvements in teaching and the learners, only when these are founded on the strong grounds of axiology (the philosophical study of values). The axiological perspective widens our perspective enabling us to understand how all the objects, events, living beings are inter-connected in a form of esoteric system, and also makes us realize the need for striving for ideals and perfection for a better world order. Without consideration for axiological perspective, even the most advanced use of technology and psychology can never lead to true success of teaching. Therefore, by utilizing techno-psycho-axiological approach, quality and values can be integrated into the teaching-learning system which may be helpful in developing the consciousness among the learners. The present paper suggests some measures for incorporating techno-psycho-axiological approach in education for evolving consciousness of the students and learners. **P1**

393 Development of Activity Based Learning Programme (ABLP) of Spiritual Education and Studying its Effectiveness on Spiritual Consciousness and Happiness of Secondary school children Ranjeet Kaur Satsangi, Dayali Dei Saini <ranjeetkaurdei@gmail.com> (Pedagogical Sciences, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In today's world despite comforts and amenities,people generally lack inner happiness and harmony. Even children are living in stress.They are overburdened with studies or are ignorant of the real source of happiness. The major cause of this state of affairs seems to be the lack of proper education. In the words of Sir Sahabji Maharaj the fifth revered leader of Radhsoami Faith "Education, more education, education made perfect is the only panacea for all our country's ills and evils." Man is said to be a complex triune of Body, Mind and Soul or Spirit. Spirit is the highest truth that has ever been discovered. Spirit is all knowing, ultimate truth, consciousness and bliss. It is our real self. It can be awakened through right education or spiritual education. Through spiritual education spiritual education could be enhanced. An spiritually conscious person seeks happiness not from material pursuits but from within. The researcher being teacher and teacher educator herself developed an "Activity Based Programme"(ABLP) of spiritual Education for secondry school children and studies its effectiveness on spiritual consciousness and level of happiness of children. The seven days programme of Spiritual education incorporated seven activity based lessons on spiritual education of one hour duration. Each lesson was designed incorporating a small prayer, silence, two or three scientific experiments, question answers and discussion and summing up with a short conclusion. Self prepared "Happiness Scale" and spiritual consciousness scales were administered on 22 students.(15 male and 7 females) of class X of the age group of 14 to 16.Single group pre-test and post- test experimental design of research was employed. Statistically significant difference(.05) was found between the means of pre- test and post-test spiritually consciousness scores of the samples where- though the means of the post test happiness scores was found to be higher than the means of the pre test but the difference was not found to be statistically significant, leading to the conclusion that through Activity Based learning Programme of Spiritual education level of spiritual consciousness and happiness can be enhanced. Spiritual education should be an integrated part of education at all levels. **P1**

394 Harnessing the Environmental Consciousness to Global Consciousness for Sustainable World Preeti Srivastava, Savita Srivastava <2301preetisrivastava@gmail.com> (Pedagogical Sciences, Dayalbagh Educational Institute, University, Agra, UP India)

Once Einstein said, "A human being is part of the whole, called by us "Universe," a part limited in time and space." He experiences himself, his thoughts and feelings as something separate from the rest - a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest to us. Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty. Consciousness is the state of being conscious; awareness of one's own existence, sensations, thoughts, surroundings, etc. Like every other aspect of nature, Consciousness, also, is an infinite, invisible field- an "ocean" of awareness or intelligence everywhere available- with waves that radiate throughout society. The elaboration of a roadmap on global consciousness is an urgent need. It is imperative to think about and succeed not only in adopting a broader world view, but also in aiding the young women and men in adopting such a view that enables children and youth to "think about the world" and to find and shape their place in it. To overcome national fixations, ethnic narrow narratives and instrumental ways of perceiving the world, and to redefine our relationship with nature, is the goal of the development of a global consciousness, recognizing

the multiplicity of world views and cultural identities and most crucially environmental consciousness. Numerous environmental issues are presently faced by humankind are caused by misusing of environment and unconsciousness of the society. Although the environmental consciousness results from the interaction between the society and family, formal education given in this process is also important in increasing the environmental consciousness of the society. Environmental consciousness includes pro-environmental behaviour: cognitive, affective and psychomotor domains; environmental ethics; environmental altruism; programme of action and environmental education, which goes beyond providing students with simple information about environmental issues. As defined in the National Project for Excellence in Environmental Education; "environmental education is a process that aims to develop an environmentally literate citizenry that can compete in our global economy, has the skills, knowledge, and inclinations to make well-informed choices, and exercises the rights and responsibilities of members of a community." (NAAEE, 2001). Today educators are convinced that research in pupils' understanding of many aspects of environmental issues will be valuable to teachers so as to teach pupils more effectively. It may therefore necessitate an in-depth evaluation of the course curricula of any environmental education program keeping in mind "Man is both creator and moulders of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth." Consequently, there has to be a revolution but it has to a revolution of Global Consciousness for Sustainable World. **P1**

395 Peace Education For Universal Consciousness Savita Srivastava, Amarved Srivastava; Prem Prasad Srivastava <2708deisavitasrivastava@gmail.com> (Foundations of Education, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Education for total consciousness is not moment vault, consequence orient, but an ingenious, inspired, self- enlightening, process for human development and divine recognition. The consciousness of man is as old as humanity. The quest for understanding the nature of Universal Consciousness is inherent in the senses as butter in milk. When the sensory consciousness becomes more and finer, it opens a high way to Universal Consciousness. The whole creation is within the parameters of awareness. All sense knowledge is about cause and effect. Universal Consciousness is concerned with the inner self of man beyond time, space and causation. The cosmic consciousness is so mysterious in its nature and proportions that no man conceives it in terms of his intelligence. Human Consciousness involves three levels of awareness, the sense mind, the logical, the logical intelligence and the spiritual bliss. Intuitive knowledge is the knowledge of the self where an intimate fusion takes place between individual consciousness and universal consciousness. The cognitive, aesthetic and ethical aspects of consciousness are interdependent and complementary. The knowledge of the inner self is a unique experience which cannot be described in words. This does not contradict reason, but only transcends it. In the words of Radhakrishnan, 'the presence of the Divine is one thing, the consciousness of the presence of the Divine is quite another'. The Vedas also reveal that underlying all physical universes there is one abstract entity with the quality of consciousness. Having created the universe, consciousness remains fully present in it and controls everything in its own way. In this world of flux and change, the only one thing unchangeable is Universal Consciousness or cosmic intelligence. Though consciousness is present every where as Jiva or life-force, it is manifested only in human beings. A man with child like transparency and strong moral foundation alone can inspire for this type of knowledge. The Katha Upanishad makes it very clear that Reality, the Absolute Consciousness is smaller than the smallest and greater than the greatest (2-20). In fact consciousness is the sum of total of mental processes that actively participate in man's understanding of Reality and of his own personal being. Man and the universe are separate entities and the distinction between individual self (Jivatma) and universal self (parmatama) is unreal. Maharishis Mahesh Yogi's view is, 'the field of relativity is fleeting, always changing, but the Absolute never changes.' Thus, the concept of this paper includes the Concept of Education and Peace and Peace Education, Potentialities of Consciousness, Power of the Human Mind, the Vision of Vedanta and Science, the Light of yoga, Concentration and Meditation Learning through Self Discovery and ultimately infusion of Peace and Universe Consciousness for Harmonious Cosmos. **P1**

6.11 Entertainment

396 The Science of Consciousness in Karel Capek's "R.U.R." James Kerwin, Kipleigh Brown <kerwin@mac.com> (Helicon Arts Cooperative, Glendale, CA)

Far from just writing "a play about robots," Czech author Karel Capek started the modern conversation about consciousness, civil rights, and humanity with his seminal masterpiece "R.U.R." Written in 1919 and first performed in 1921, "R.U.R." explores a future society (set in 1969 – the "then-future") in which "robots" – the Czech word for "indentured servants" – are birthed in laboratories and endowed with no civil rights. Arguably the first piece of modern literature to pose fundamental questions about the nature of human self-awareness, qualia, and spirituality – and to explore the sociopolitical ramifications of such queries – "R.U.R." inspired countless science fiction books, films, and TV series throughout the following century, from "Blade Runner" to "Dollhouse." In this session, director James Kerwin ("Yesterday Was a Lie") and actress Kipleigh Brown ("Star Trek: Enterprise") present a present-day cinematic take on the play, and discuss the manner in which current models of quantum consciousness (including Orch-OR) impact modern adaptations of "R.U.R." – as well as other science fiction programs such as "Star Trek." **C12**

397 Science Fiction and Consciousness Robert J. Sawyer <sawyer@sfwriter.com> (Mississauga, ON Canada)

Robert J. Sawyer's bestselling science-fiction novels have long explored issues of consciousness. In this talk, Sawyer will discuss the models of and theories about consciousness he's variously employed in novels such as FlashForward (and the ABC TV series based on it, for which he is consultant and a scriptwriter), in which the consciousness of all human beings is displaced forward in time for a period of two minutes; Mindscan and Red Planet Blues, in which consciousness is digitized and uploaded; Hominids, in which true self-aware consciousness arises in Neanderthals; The Terminal Experiment, in which a biomedical engineer records the final cessation of consciousness at death; Factoring Humanity, in which a technology is developed that allows surfing of the collective unconscious; the "WWW" trilogy of Wake, Watch, and Wonder, about the spontaneous emergence of consciousness in the World Wide Web; and the just-published Quantum Night, which combines the Hameroff-Penrose Orch OR theory with a riff on David Chalmers's philosopher's zombie thought experiment. **C6**

6.12 Miscellaneous

398 Risk Control Strategies Practised by Early to Modern Humans Gur Dayal Narang <infgmrs@gmail.com> (Sydney, NSW Australia)

To survive and enhance our wellbeing has been the integral part of the human existence. Has the definition of wellbeing changed from early to modern humans? Were these strategies practised by early humans different from the modern humans? Were these strategies also linked to the change in our consciousness? Has consciousness played any role in the evolution process? Modern humans possess lots of tools for enhancing their wellbeing? Can today's tools increase our overall wellbeing? The poster will systematically list the risks and the corresponding strategies from early to modern humans and will also attempt to answer the above questions. The poster will also state the possible future optimal strategy for the ultimate wellbeing of our human existence. **P1**

399 Trees and Plants Provide Support System to Help Human Consciousness to Rise Ranjeni Singh, Neha Sinha Mehta <ranjenisingh@gmail.com> (The Speaking Tree/Times of India, Bennett, Coleman and Company, New Delhi, DELHI India)

Forests, with their flora and fauna, provide a solid support system to human beings to live and raise their consciousness. Trees are full of prana or pure energy. Forests are supporting systems that sustain human life on this planet; thereby helping them reach higher spiritual realms. Trees and plants are considered to be inanimate objects, but they too have consciousness. Some researchers say they have awareness too. Like humans, they have auric energy fields. Perhaps, that is why our ancient sages always went to the forest to meditate, reflect and gain enlightenment. Buddha attained nirvana under the Bodhi tree. Jesus Christ often preached sitting under trees. We breathe freely when we are surrounded by other life forms. We feel an integral part of the web of life. The pure energy of the forest helps our consciousness to expand. When did you last look at a flower and feel happy? You don't remember! That's because we have delinked ourselves from communion with life. Our energy fields are blocked by our karmic deeds and negative thoughts. Many ashrams and spiritual retreats are set in sylvan surroundings: with trees, shrubs and herbs supporting small eco-sub systems within, besides providing food, fodder and medicine for humans. Both humans and nature benefit from each other. It appears that trees act as antennas for Universal Thought. Plants interact intelligently with their environment. The forest cover provides balm to our eyes, is the green lungs of our planet and inspiration for our soul. The well-being of forests is an important part of our existence. Forget of rising our consciousness, without trees, we don't exist. Every culture has in its core, a Cosmic Tree or Tree of Life that explains our earthly existence. Trees are our closest relatives. We breathe in what they exhale and they inhale what we breathe out. We are intimately connected. The tree of life is a

metaphor used to describe the relationships between organisms, both living and non-living. People living in forests, the tribals and indigenous people from around the world - be they the Aborigins of Australis, the adivasis of India or the Indians of Americas - have a special relationship with forests. They depend on each other for sustenance. Traditional teachings and folklore encourage communication with trees and plants. They are also means to be respected. Our consciousness may differ from that of plants and other organisms but we are all connected with the same energy or force that gives life. As our consciousness expands, hopefully, our attitudes toward nature will change and we will start to live in balance with the plants and animals with whom we share this earth. Yes, forest covers need to grow; trees are channels that help us connect with the Divine. **P1**

Additional: Quantum Biology – Nature of Life

400 Ultraviolet Photo-Induction of Self-Organization in Living Systems? Craddock, Travis, Also by Philip Kurian Publishing <tcraddock@nova.edu> (Nova Southeastern University, Fort Lauderdale, Florida)

Precursors for the key building blocks of life - nucleotides, aromatic amino acids, and lipids - can be derived from simple materials found in the primordial Earth environment upon exposure to ultraviolet light. While these hydrophobic precursors would tend to aggregate following classical statistics, current paradigms of biochemistry remain unable to explain how such inanimate precursors combine to give rise to animate life. The specter of non-trivial quantum effects in biological systems has been raised since the time of Schrodinger, and now it appears that this may be a reality. Recent experimental results and theoretical analyses have shown that thermal energy may assist, rather than disrupt, quantum coherent energy transfer in chromophoric antennae complexes, especially in the 'dry' hydrophobic interiors of biomolecules. Interestingly, when in water solution, nucleotides and aromatic amino acids are very strong absorbers and extremely rapid emitters of ultraviolet light within the 230-300 nm wavelength region, which is a part of the Sun's spectrum that could have penetrated the prebiotic atmosphere. Here we discuss how these precursors may act as acceptor molecules to antenna pigment donor molecules by providing an ultrafast channel for transfer of ultraviolet photoexcitations, and how such structures may lead to self-organizing living systems. We perform a computational and theoretical investigation of ultraviolet energy transfer between chromophoric molecules in protein and nucleic acid structures and present the spatial structure and energetic properties of such systems. Plausibility arguments for the conditions favoring quantum mechanisms of self-organization are provided. Overall we find that such transfer of ultraviolet photon energy is a biologically feasible mechanism for driving self-organization. We discuss these findings in the context of the origin of life, cellular division and neuron morphology.

NOTES

TSC 2016 East-West Forum Abstracts

TSC 2016 East-West Forum Vision & Plenary Talk Abstracts

EW1 Consciousness System Modelling Theory (for closed system of the Grand Macrocosm to open system of the Human Microcosm) Prof. Prem Saran Satsangi, Leader of Radhasoami Faith, Dayalbagh and Chairman, Advisory Committee on Education, Dayalbagh Educational Institutions

Consciousness System Modelling Theory utilizes framework similar to Physical System Theory with fundamental axiom, postulates and system model equations, and as long as this model makes predictions which are verified by the observed results, not just in the outer world, but also in the inner world of experience, the theory holds. Considering the Grand-cosmos as a whole as a closed system (unlike human microcosm (with body-mind duality) as an open sub-system), it is conjectured that there is an immutable abstract unified force-field of consciousness which is present in each element of space-time of the grand macrocosm, whether at the primary abstract-level of the universe of pure consciousness, or the secondary-level of the semi-abstract universe of mind, or the tertiary real physical level of the universe of matter. This system modelling view is from scientific perspective rather than any religious or spiritual perspective and should apply to both individual consciousness at microscopic levels as well as the Universal Consciousness at the macrocosmic level.

However, one needs to go beyond the outer experience of the physical universe (to two universes on top of it) and integrate efforts of physical scientists with inner experience based on ultra-transcendental meditation to consider the Grand Cosmos as a closed system. Integration of inner experiences with those of the outer world will yield full closure of the system through abstractions and bring physicists within reach of their elusive and cherished dream of a universal theory of everything.

EW2 Did consciousness cause the origin of life and drive evolution? Stuart Hameroff Professor, Anesthesiology and Psychology, Director, Center for Consciousness Studies, The University of Arizona, Tucson, Arizona, USA

Conscious behavior serves to optimize feelings, e.g. Epicurean delight, 'dopaminergic reward', Freud's 'pleasure principle', spiritual bliss, and altruism (it *feels* better to give than to receive). However Darwinian evolution is viewed as genetic survival, perhaps because scientific approaches to brain function can't account for feelings or consciousness ('qualia', the 'hard problem'). Sir Roger Penrose proposed mental properties including qualia accompany self-collapse of the quantum wavefunction by 'objective reduction' ('OR'), a threshold in the structure of spacetime geometry. Such OR qualia would be occurring ubiquitously in random environments throughout the universe, but be non-cognitive and merely 'proto-conscious'. The Penrose-Hameroff 'Orch OR' theory suggests OR events in pi resonance 'quantum channels' in cytoskeletal microtubules within brain neurons are organized, or 'orchestrated' by inputs, memory and vibrational resonances, and terminate by 'orchestrated OR' to give meaningful conscious moments, and that such moments are influenced by 'Platonic values' embedded in the structure of reality. On a grand scale, Orch OR implies life originated, and the brain evolved to orchestrate and optimize pleasurable OR qualia already present in the universe. Billions of years ago in the 'Primordial soup', pi resonance clouds of 'dopamine-like' molecules apparently coalesced within micelle-like precursors of biomolecules and cells. In these regions, quantum events were shielded from random, polar interactions, enabling more intense and pleasurable OR qualia. 'Pi stack' geometry in micelles and biomolecules optimized OR qualia and precipitated life. Microtubules, and eventually the brain evolved to orchestrate OR-mediated resonance, optimizing pleasure, life and its behavioral pursuits.

EW3 Objective Observation – A Fundamental Tool for a Science of Consciousness James J. Barrell, Department of Psychology, University of West Georgia, USA

Objective observation is of great value in science. In the West we put an emphasis on statistics to tell us what level of confidence we can have in our subjective observations. We can become preoccupied with how to rule out the variance hidden in our biases etc. That is, if we are unable to be truly objective, how can we at least create conditions that can in part circumvent this lack of objectivity? Instead of "throwing up our arms" and surrendering to this belief that objective observation of the subjective (e.g. consciousness) is impossible, I am here to tell you that not only is it possible but there is an approach and method to learn how to do it. (Inner Experience and Neuroscience; MIT Press – Price and Barrell).

What does it mean to be objective about our subject matter? Mostly, it means being non-judgmental and impartial. In science, we often allow our theories, beliefs and reflections to bias our observations. This is particularly problematic when the subject matter refers to our own subjective conscious experiences. The challenge is to learn how to be objective about the subjective rather than subjective about the objective. Often, the term objective is used to refer to a reality that lies outside our subjectivity without realizing that our subjectivity is also entangled in and a part of that reality and must be observed objectively. Objectivity is now a form of observation rather than a place for observation.

Objective observation is not possible in waking sleep, absorption or even attention. For example, attention can easily be guided by judgements. Unlike attention, there is form of awareness that can occur free of reflection and without judgments. In the West this form of awareness can be reflected in the popular movement toward meditation and mindfulness. Some supporters of this form of observation have been Jon Kabat-Zinn, Eckhart Tolle, The Fourth Way of Gurdjieff and Ouspensky as well as Fritz Perls and his Gestalt Therapy. Much of this information, particularly related to meditation, has its origins in the East.

One of the best ways to describe this form of awareness is "noticing". Noticing is not the same thing as paying attention. Paying attention is effortful and noticing is not. Often, the instructions are "just open up and notice what is happening in this moment". To do this, it is imperative to have the ability to enter the moment, the present. Most of our waking lives we are either in the future, the past or in some form of absorption. (Wake Up - Barrell) From this perspective of present-oriented noticing, it is possible to notice our own thoughts which cannot be noticed when using attention (e.g. classic introspectionism). Overall, this form of awareness, learning to notice, is essential for a fuller understanding of our conscious subjective lives and makes a science of consciousness possible.

EW4 Conscious Mental States, The Infinite Regress Problem, and Episodic Memory Rocco J. Gennaro, Professor and Chair, Philosophy Department, University of Southern Indiana, USA

Some contemporary theories of consciousness, such as the higher-order thought (HOT) theory (Rosenthal, Gennaro), hold that there is an essential "self-awareness" that accompanies each conscious mental state. For example, according to HOT theory, a mental state M becomes conscious when there is a HOT directed at M. Other major western figures, such as Brentano and Sartre, have also embraced a somewhat related position. This view, or something very close to it, is interestingly also found in Indian and Buddhist philosophy where consciousness is taken to be "inherently reflexive" (such as in Dignāga, ca. 480-540 CE). One problem is how to avoid the infinite regress problem such that the self-awareness in question requires yet another instance of self-awareness *ad infinitum*. In this talk I will explore various ways that these theories attempt to handle the infinite regress problem and explain why I opt for HOT theory. In addition, I critically examine Dignāga's so-called "memory argument" for such self-awareness in the first place which then leads to a further problem, namely, does this self-awareness imply the existence of an enduring *self*?

EW5 Tesla and Vivekananda and the Akashic Field Subhash Kak, Regents Professor, Oklahoma State University, Stillwater, USA

Tesla, the great inventor, believed that an akashic field was at the basis of reality and from it one could harness energy. In this he was guided by Vivekananda, who brought the movement for self-knowledge to America and influenced some of the greatest minds of the twentieth century. The idea of an akashic field that is the medium of consciousnsess was proposed by Ervin László in his book the Akashic Field: An Integral Theory of Everything. This paper untangles the concept of akasha by going back to its roots in Vedic theory and sees what connections it might have with corresponding quantum approaches to consciousness.

EW6 Triplet of triplet resonance band is fundamental to the universe Anirban Bandyopadhyay, National Institute for Materials Science, Tsukuba, Japan

We started from the theory of number system and generated a space time metric, the metric looked like triplet triplet resonance band. We found this triplet of triplet in the microtubule, protein, DNA neurons, in the EEG data, we have started collecting frequencies from astrological phenomena, we are able to see such a frequency pattern everywhere. We argue with systemic analysis that triplet of triplet observed in the nested cycle and ordered factor metric is fundamental to this universe.

We have thoroughly investigated why everything in the appears triplet of triplet in the frequency spectrum, then, we realized that 2 and 3 makes 66% of all integer space, hence, mostly we see triplet of triplet (3 is made of pairs, i.e. 2). We have found that 2-5, 2-7.....2-37, only 12 primes make 99% of the entire integer space or all possible symmetries.

We found that triplet of triplet or triplet of pentet groups are units of a machine that could generate nested time cycles or rhythms. Hence we have developed a protocol to design machine engineering, that could mirror its own information replica outside the machine. Such a duality is our objective.

EW7 The critical importance of understanding basic awareness Chris Fields, Sonoma, USA

Much of the discussion at TSC and in the "consciousness community" in general focusses on unusual, enhanced, "higher" or otherwise extraordinary states of consciousness. I suggest that it is a lack of interest in, understanding of, and consensus about more basic, "lower" forms of awareness that most impedes our understanding of consciousness. Typical, intact human beings exhibit an awareness of many aspects of their environments and their own actions that they do not remember and cannot report but is nonetheless evident from their behavior. This everyday "unconscious" or "subconscious" awareness provides an entryway for characterizing the bodily awareness exhibited by the autonomic nervous system and, more generally, the environmental and physiological awareness exhibited by other organisms, including those lacking differentiated nervous systems. Achieving a scientific consensus that such "lower" organisms, including even prokaryotes, are aware of their environments and their bodily states and act on the basis of thier awareness is, I suggest, a prerequisite for significant progress in the science of consciousness. A thorough understanding of both what such systems are aware of and how they achieve and act on their awareness will provide, moreover, a basis from which to characterize fundamental aspects of human awareness, such as the sense of space and time, that are often simply taken for granted.

EW8 Behind the Myths, Tibet's Buddhist Culture Thubten Samphel, Director, The Tibet Policy Institute, Central Tibetan Administration, Dharamshala, India

The world, particularly the West, has long viewed Tibet as remote and isolated. This view has led to the growth of many myths of Tibet. These myths include the Shangri-La, the place of eternal youth, the Third Eye and lamas flying from one mountain peak to another.

Behind these myths is the reality of one of the greatest transfer of knowledge from one culture to another. From the 7th to 12th century, for a period of 500 years, the Tibetans made a conscious and sustained effort to imbibe the wisdom of ancient India. This mighty cultural and spiritual enterprise included a continuous stream of Tibetan scholars visiting India to study at the feet of great Indian Buddhist masters. This effort involved mastering Pali and Sanskrit and understanding the whole body of Buddhist wisdom which was comprehensively translated into the Tibetan language.

In this way the Tibetans were able to retain the teachings of Buddha and his art of inner transformation for the benefit of humanity.

EW9 Is Mindfulness based Stress Reduction really Mindfulness; an exploration into the richness and potential for advancing the understanding and application of mindfulness Lobsang Rapgay, Centre for Buddhist Studies & Mindful Awareness Research Center, University of California at Los Angeles

We are witnessing an unprecedented interest in and acceptance of mindfulness into every aspect of modern culture, science and academics. However, in recent years questions are being raised by researchers and scholars about how mindfulness is being appropriated to the point that the deeper and richer meaning of mindfulness is potentially being lost.

This presentation will begin with a brief review of the major positive findings of MBSR followed by some of the new research that is raising some serious concerns. A major factor that may be responsible for this state of affairs is the exclusion of the rich conceptual framework underlying classical mindfulness in conceptualizing and formulating MBSR. Classical mindfulness which accords more with findings from cognitive science may enhance the effectiveness of MBSR and let us hear the echo of mindfulness as taught by the Buddha.

EW10 Mind and Matter in David Bohm's Monism Paavo Pylkkanen, University of Helsinki and University of Skovde

The physicist-philosopher Davd Bohm gave considerable effort to develop a general world-view on the basis of quantum and relativity physics. He proposed that these theories urge us to give up the idea that the world is fundamentally made of some basic elements in mechanical interaction. Instead, what is fundamental is "undivided wholeness in flowing movement". Parts then form and dissolve in this flow. How can mind and conscious experience be understood in the context of this new world-view? Bohm proposed that mind and matter are not separate substances but rather different aspects of the one unbroken movement. These aspects are analogous to each other in various

interesting ways. For example, it can be argued that an Aristotelian-like "formative cause" is a key factor in physical, biological and mental phenomena. In this talk I will present Bohm's view and compare and contrast with Schaffer's (2010) recent defense of monism, as well as Ladyman & Ross's ontic structural realism.

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EW11 Constructing Neuroaesthetic- Literary -Triple Hierarchical Paradigm of Consciousness: A Novel Approach Bani Dayal Dhir, V. Prem Lata, Department of English Studies, Dayalbagh Educational Institute, Agra, India, Arsh Dhir, Chief General Manager, Dayal Motors, Dayalbagh, Agra, India

"Literary systems are perceived intuitive systems which largely belong to the typology of human activity systems rather than other types such as natural systems, designed physical systems or designed abstract systems." - Rev. Prof. P.S. Satsangi

Sublime literature embodies 'intuitive consciousness' and elicits an experience which transcends the consciousness of everyday life. Imbued with luminosity, signified by mystery, a work of art is vital to realize the Central Being. Longinus theorized 'sublimity' in literature as the echo of the great soul, a lofty mind, grandeur of thought, nobility in diction which corresponds well to the Indian notion of 'Satyam, Shivam, Sundaram'.

When Shakespeare wrote, 'I have a device to make everybody well, write me a prologue…' everyone was intrigued as it had far greater implications than socio-cultural contexts. Since the time of Aristotle scholars have encountered a myriad of psychological puzzles related to the notion of beauty in literature, how literature transports us to a trance –like state, a state of self- absorption, how our brain enables us to create and recreate literature etc. Although researchers have long inferred that the "classical" language regions, like Broca's area and Wernicke's area, are involved when the brain interprets written words, recent researches have revealed that artistic narratives activate many other parts of the brain as well. 'The language of literature, particularly poetic language, draws more on our right brain systems for processing language than normal, everyday languages does' (Holland 2009). Neural studies are demystifying the fundamental brain processes at play in the literary experience as Holland states, 'our brain plays tricks as we read literature'.

Defining neuroaesthetics, Semir Zeki states, 'it does not ask the question of what is beauty, but only the brain mechanism that engages with the experience of beauty.' In recent years research has been carried out on the neuroscience of aesthetic experience (Starr, 2013), aesthetic responses and evolved human behaviour (Davies, 2012), what love and art reveal about the brain (Zeki, 2009), where art comes from and why (Dutton, 2009), the neuroaesthetics of art history (Onians, 2007), etc. However the thrust of all these research explorations has been on neuroaesthetics of visual and auditory arts- painting, dance and music. Even in the most recent publication on neuroaesthetics (Huston et al., 2015), literature plays no significant role. There has been some associative neuroaesthetic work done on prose fiction (Miall, 2009), but there is paucity of neuroaesthetic studies in literary sphere. Literature employs a different kind of visualization from that of music, dance and painting. A literary text contains culturally determined semiotic signs, hence the words and their meanings within the immediate and subsequent contexts acquire greater significance than the external form.

The present study draws the basic conceptual framework from the research being carried out at DEI on 'Frequency and Energy as Neuro-correlates of Beauty in Maths, Science and Art' (Dayal Pyari Srivastava, Vishal Sahni, Prem Saran Satsangi) and places literary experience at the focal point.The objective here is not to present a mere neurological profile of literature, but to build a broader paradigm by linking neuroaesthetics of literature to science of consciousness as literary experience is an 'exemplary experience which enables an exceptional type of identity called the Spiritual- Self '(Bjarne Sode Funch 2013).

Through experimental findings the study would answer basic questions– what is aesthetic experience? What is beauty in literature? Why is literary experience fuzzy and mystical? What happens when we read a literary work? What is the neurological basis of literary experience? The endeavour is to foreground the underlying hierarchy in literary experience, through the formulation of a triple

hierarchical literary model, positioning 'literature of senses' at the lowest level, 'literature of knowledge' at the middle and 'literature of spirit' or spiritual literature at the highest level.

To test the hypothesis, the experiment participants would be made to read a variety of literary texts and as they read the magnetic fields generated by neuronal activity of their brains will be measured through Magnetoencephalography (MEG). The results will be examined with reference to the model of triple hierarchies of consciousness propounded by Rev. Prof. P.S. Satsangi to establish how literature of senses corresponds to the lowest level of consciousness i.e. material consciousness, literature of knowledge to the middle order of cognitive consciousness and literature of the spirit to the highest level of consciousness i.e. spiritual consciousness which is the domain of Ultimate Reality and Absolute Truth. Texts from both east and west have been selected for the purpose. Poetic extracts from oriental spiritual literature have also been selected for the experiments to test and prove why centuries ago Plato in his seminal work Republic had pronounced that he would permit only spiritual poetry to be read in his ideal state and had banished rest of the poets from his Republic.

Key words- Neuroaesthetics, literature, hierarchies in literary experience, brain and literature, triple hierarchies of consciousness.

TSC 2016 East-West Forum Oral Presentations

2. Quantum Mechanism of Light Transmission by Biological Cytoskeletal Filaments Michail Inyushin, Igor Khmelinskii, Lidia Zueva, Vladimir Makarov

We propose and elaborate the detailed theory of the quantum mechanism (QM) explaining the light transmission by protein filaments in live cells in general, and applied it to explain the light transmission by the bundles of specialized intermediate filaments in the Müller cells located in the eye's retina. The problem of transparency and light transmission by the biological cells with narrow processes is created by the very small effective distances of light transmission by optical channels with their diameter smaller than the wavelength of the transmitted photons, resulting from the classical models. Leaving aside the peculiarities of the biochemical structure of the intermediate filaments, we describe them as hollow electrically conductive tubes 10 - 20 nm in diameter. We analyze the quantum confinement of electrons in such tubes, creating discrete electronic states that may absorb photons at one end of the filament, generating an excited electronic state. Next, such an excited electronic state may emit photons at the other end of the filament, or transfer the energy directly to the chromophore molecules of the retinal light receptor cells, and thereby transmit the luminous energy from one end of the filament to the other. The overall calculated efficiency of the energy transmission through an individual filament, as described by the QM, may be 60 - 70 %.

5. From 'Physical' to 'Metaphysical': Heinrich Harrer's Seven Years in Tibet within the Paradigm of States of Consciousness Supriya Baijal

Seven Years in Tibet (1952) by Tibetologist Heinrich Harrer (1912-2006) which simply begins as a mere 'journey' to explore the Forbidden City, Lhasa towards the end becomes much more than a journey. Harrer's literary work is a gripping delineation of his scepticism, perplexity with frequent questioning of various aspects of Tibetan Buddhism. His journey becomes remarkable as it brings to light aspects related to re-incarnation and other religious beliefs of Tibetan Buddhists. The real journey of the writer to metaphysical consciousness begins when he comes in association with Dalai Lama. The paper attempts to explore and analyze Harrer's voyage as a philosophical and spiritual voyage and locate it within the paradigm of altered states of consciousness. 'Altered States of Consciousness' are states in which the quality of experiences is significantly different from ordinary states of consciousness. It would situate Harrer's vacillations during his journey within the framework of different material and higher transcendental states of consciousness. This paper would re-interpret this physical journey as something which results in the discovery of his Self to a great extent. An attempt will also be made to draw together some concepts of Hinduism and Tibetan Buddhism to throw more light on the concept of transcendental consciousness.

11. How Thoughts are Generated: An Eastern Philosophy Hypothesis Vijai Kumar, Anjoo Bhatnagar

There are about 1 million billion synapses in human brain with possibly hyper – astronomical neural circuits. "Somehow…..that's producing thoughts" says Charles Jennings, Director of Neurotechnology, at the MIT McGorven Institute for Brain Research. In this view thoughts may be regarded as "sparks" of neuronal activity. However well conceived be the ideas (Taylor and Le Fann 2004) they

still fail to recognise the "explanatory gap" between current understanding of brain structure and "what it does, how we think, feel and emote." We attempt to present a hypothesis of how and where the thoughts are generated on the basis of the concepts of Eastern Philosophy (Radhasoami Faith) and reach the level of consciousness, and its synergy with the scientific understanding of brain structure and function. Relationship of the Eastern concept of the constitution of the macrocosm and microcosm and generation of thoughts will be discussed.

13. Development of Activity Based Learning Programme (ABLP) of spiritual education and studying its effectiveness on Spiritual consciousness and Happiness of Secondary school children Ranjeet Satsangi, Dayal Saini

In today's world despite comforts and amenities, people generally lack inner happiness and harmony. Even children are living in stress. They are overburdened with studies or are ignorant of the real source of happiness. The major cause of this state of affairs seems to be the lack of proper education. In the words of Sir Sahabji Maharaj, the fifth Revered Leader of Radhasoami Faith "Education, more education, education made perfect is the only panacea for all our country's ills and evils." Man is said to be a complex triune of Body, Mind and Soul or Spirit. Spirit is the highest truth that has ever been discovered. Spirit is all knowing, ultimate truth, consciousness and bliss. It is our real self. It can be awakened through right education or spiritual education. Through spiritual education spirituality could be enhanced. A spiritually conscious person seeks happiness not from material pursuits but from within. The researchers, being teachers themselves developed an "Activity Based Learning Programme"(ABLP) of spiritual Education for secondary school children and studied its effectiveness on spiritual consciousness and level of happiness of children. The seven days programme of Spiritual education incorporated seven activity based lessons on spiritual education of one hour duration. Each lesson was designed incorporating a small prayer, silence, two or three scientific experiments, questions, answers and discussion and summing up with a short conclusion.

16. Tanmatras, the spiritual quantum basis of perception and emotions Mani Sundaram, Prem Sundaram

The present paper is an attempt to understand the process of perception and especially of qualia, by introducing the concept of Tanmatras. We propose that the basis of our perceptions,senses/ qualia are Tanmatras, the inner senses which display the power of prime consciousness or the spanda principle. Tanmatras are basic principles, potentials or essence, vibrations, the subtlest particles of spiritual quantum field or dark matter, associated with each external sense. Impressions from physical sense organs have to interact with the spirit force in order to be sensed. In reality spirit/real self is the perceiver.

21. A comparative analysis of well - being of yoga practitioners (general yoga asanas and pranayam) and practitioners of ultra-transcendental meditation (surat - shabd yoga) P Sriramamurti, Purnima Bhatnagar, Shalini Nigam

The objective of this study is to compare the well - being of people who practice yoga (general asanas and pranayam) with those who practice ultra - transcendental meditation. In a quest for a better life, happiness as well as peace of mind, people have adopted different means. Yoga in its myriad forms is one of the methods. For the purpose of the study, well - being is defined as 'good mental states, including all of the various evaluations, positive and negative, that people make of their lives and the affective reaction of the people to their experiences'. The study will encompass primary data collected through a survey with respondents belonging to yoga practitioners (general asanas and pranayam, etc) and ultra - transcendental meditation (surat - shabd yoga).

24. Mystical Experiences: Dualistic vs. Non-dualistic Sona Ahuja

Advanced meditators experience dualistic and intuitive mystical state sequentially. There is quantum leap from dualistic to intuitive experiences. The non-dualistic state with the absence of subject-object duality is critically debated. The mystic experiences the emptiness or absence of any content which is in contradiction to having an experience itself. The question arises if there is non-duality in experience that is the experiencer unites with the experience itself then how does the subject report it? The nothingness can be the beginning that is the absence of sensory experiences or the union of observer and the observed. But it cannot be tested. There are five different schools of Vedanta philosophy describing the relation between the two. (i) Dvaita (dualism) clearly differentiates the observer and the observed. (ii) Vishista Advaita (qualified monism), espouses that both exist but they are not separate entities. (iii) Bheda Abheda (difference – non-difference/ dualistic monism), the experience is emphasized more than the experiencer. (iv) Kevala Adavita (monism), recommends that

only one entity exists. (v) Shudh Advaita (pure monism), the observer and the observed are believed to be inseparable. The description of this association is more like different stages on the philosophical path.

In the oriental philosophy of Saints (Radhasoami Faith), at higher level of consciousness, the mystics report to be in dualistic state or intuitive state at free will. The observer can be witnessing awareness or the awareness itself. This solves the mystery of the experiences. Since, the mystic can be in both the states at free will once the state is reached progressively, he can report the experience. This model allows us to generate testable hypothesis. It can be scientifically examined through inner science approach which is both repeatable and verifiable. The valid instrument to test this hypothesis can be none other than the mystic himself. Thus, the experimenter along with co-investigators can himself be the subject and can experience the state by practice of mediation for verification of the claim. To sum up, this paper discusses the debate of dualism vs. non-dualism in the light of objective verification of mystical experience. The analogy of five schools of Vedanta philosophy, eastern and western perspectives and verifiable model of oriental philosophy of Saints is analyzed to reach the conclusion.

25. Overcoming The Observer Paradox Through Harmonic Resonance Nagma Markan, Bhakti Kapur, Priti Gupta, CM Markan

The Observer has been an integral as well as an intriguing aspect of Quantum Theory. While western science defines an observer as a 'conscious' entity that facilitates the measurement of a quantum system, an alternate yet interesting definition of observer is discussed in eastern literature (Spandh Shastra) and is reiterated through the Sampling Theorem in signal processing. According to this definition any system operating at a higher frequency (subtler) can observe a system working at a lower frequency (coarser), however, the inverse is not possible i.e. the coarser cannot observe the subtler. By applying this ideology to the brain we can have a hierarchy of observers in the order of increasing frequency e.g. whole-brain, network, neuronal, microtubular, protein-level, molecular, atomic, subatomic, EM waves down to the Planck's frequency level where the higher frequency systems essentially control the lower systems in a top-down fashion. During meditational practices the practitioner takes his/her attention inside towards subtler (higher frequency) realms of creation where he/she is able to observe or experience a greater sense of reality, manifesting at that level of subtlety. This method of taking attention inwards amounts to a lower frequency brain observing higher frequency regions in a bottom-up manner thus contradicting the definition of observer and creating a paradoxical situation that we term as the Observer Paradox (i.e. how during meditation the coarse brain is able to observe and experience the subtle levels when the sampling theorem only allows the subtler to observe the coarser). To understand how the brain could accomplish this, there is a need to understand how the brain builds an inverse hierarchical pathway/bridge between lower and increasingly higher frequency levels using attention wherein certain higher order experiences guide this internal journey. Recently it has been shown that wave function collapse can be observed on a lab instrument by Homodyne Interferometry which down-shifts the wave function vector information (high frequency) to the detector's range (low frequency apparatus). Therefore, a hierarchical process in the brain that is similar to interferometry might be the key to overcome the Observer Paradox. In this paper we discuss how focused attention could create Quantum Coherent Feedback between lower and higher frequency levels establishing a state of Harmonic Resonance between them. In this state, by the principle of interferometry, the information at the lower region is a dimensionally reduced version of the higher frequency information that is consciously experienced in the form of mystical lights and sounds.

28. Yoga and Meditation alters Visuo-spatial Retention and Processing Sona Ahuja

The mystics report to have extra-ordinary experiences in the form of complex images which are not similar to the ordinary sensory perceptions. The psychological view on imagery suggest that maintaining an image for long time is not possible because of limited working memory resources. In such a case the retrospective report of mystics regarding their experiences is debated for credibility. The present study examined the effects of yoga and meditation on capacity for storing visual form and colour information, visuo-spatial processing skills, and perceptual task demanding concentration on complex images. The participants included advanced meditators (trained for sound practice along with the practice of contemplation of form), intermediate meditators (trained for the practice of contemplation of form), beginners and non-meditators. The automated tasks were administered on participants before and after meditation to assess their visuo-spatial processing, focusing attention on complex images, verbal and visuo-spatial retention. Their performance was compared

with that of control groups. The results indicate that all the groups performed at the same baseline level, after the practice of yoga and meditation (based on oriental philosophy of Saints - Radhasoami Faith) for a period of 20 weeks, the experimental group demonstrated an increase in performance on visuo-spatial working memory and processing skills compared with the other groups. The results suggest that yoga and meditation specifically train one's capacity to access heightened visuo-spatial processing resources. Further, the difference in the gain of each strata is discussed in the light of alteration in verbal and visuo-spatial working memory. The dopaminergic and other external methods of improving working memory are well-known. But these are supplemented by side-effects. The non-pharmacological and self-sufficient methods like yoga and meditation can be more beneficial and practical for improving the visuo-spatial retention and processing skills. The results can advance the study of mystical experiences where mystics report the extra-ordinary experiences in the form of complex visual image.

30. Spiritually-Inspired Quantum Holographic Theory of Intuition Sant Saran, Sukhdev Roy

Considering the teachings of eastern spiritual traditions that include the vibrational theory of consciousness, the Spanda Shastra, Nada Yoga and Surat-Shabda Yoga in Kashmir Shaivism, Vedanta, Sant Mat and the Radhasoami Faith, respectively, it is proposed that focused attention on an object, for instance in meditation, attunes the individual's psychophysiological system to the quantum level of the object, through energetic resonance, which contains implicit, holographically encoded information about the object's future potential. The body's perception of such implicit information about the object's future is experienced as intuition. A socially coherent group amplifies nonlocal interaction and intuitive and telepathic effects by resonant feedback loop between the collective bio-emotional field of the group and an individual member or in yoga-meditation, the spiritual teacher. It is shown that the quantum holographic theory appears to effectively conform to the descriptions of perception and intuition in eastern spiritual traditions.

31. Effect of Yoga-Meditation on Music and Color Perception Pritam Pyari, Saran Pyari Roy, Sant Saran, Sukhdev Roy

In this paper, we extend our previous study reported in TSC-2015 by studying the effect of Yoga Meditation on Music and Color perception. 50 Male and female yoga practitioners were made to listen to four 5-minute instrumental flute compositions of Alap form of Ragas, namely, Ahir Bhairav, Jaijaiwanti, Bhupali and Darbari that affect the Anahata (heart), Vishuddha (throat), Agnya (third eye) and Sahasrara chakras respectively, after meditation. The order of the Ragas was not in the progressive order of the chakras. The responses were recorded through a questionnaire by noting their order of preference and the qualitative effect in terms of feelings, imagination, color etc. The procedure was repeated after each month of meditational practice. The subjective experience pertaining to the preference of ragas, perception of feelings and colors in majority of the individuals showed progressive improvement to higher states of consciousness that corresponded to that attributed to the different Chakras, according to eastern spiritual traditions. The study highlights the impact of Yoga on Music and Color preference. It also demonstrates a means of assessing the consciousness of an individual and the usefulness of designing musical consciousness tests to ascertain consciousness levels. Such a test can be invaluable for illiterate individuals and better suited to obtain direct honest responses than through purely written psychometric questionnaires. It would not only help in measurement but also to tune consciousness to higher levels. The results were also correlated with other psychometric tests. The results of a correlational study with frequencies generated during the musical test using a SQUID based Magnetoencephelogram (MEG) will also be presented.

33. Understanding Cognitive-Emotive Phenomena using Experiential Science: Case Study of Intuitive Experiences Nandita Satsangee, Prasun Sharma, Shabd Roop Satsangi, Soami P. Satsangee

The science of inner experience or Experiential Science is being increasingly accepted as an approach to exploring human consciousness. This approach has the potential not only to scientifically analyze and influence complex human emotions and experiences of individuals, but also to extend the benefit to collective human emotions as well. James Barrell and Donald Price have initiated pioneering work in this area. They have attempted the exploration of negative emotions, among other things, with the aim of resolving 'human problems' arising from these negative emotional states. Based on a similar research paradigm their study may be extended to understand positive cognitive-emotional experiences also. Whereas the understanding of negative emotions may help to mitigate human conflict and crises, such attempts may be fortified by studying the positive human emotions and experiences not only to provide an additional lever in uprooting deeply engrained negative emotions but also to propagate desirable cultural ethos. Based on the methodology and insights

from Barrell, the present study attempts to explore the complex phenomenon of intuitive experiences which have not only cognitive and affective dimensions but psycho-physical and transcendental-spiritual as well. In a world replete with logical knowledge, often ineffectual in solving human problems, there is an increasing need for intuitive knowledge – a parallel mode of knowing capable of handling highly complex and incompletely known contexts.

The present research undertook an experiential study of intuitive experiences initially based on case studies of four individuals. The study is being presently extended to include a larger sample of about thirty adults of varying age groups and backgrounds to identify the 'necessary and sufficient conditions' that characterize intuitive experiences. A clearer insight into the nature of intuition resulting from the investigation, it is hoped, will help in nurturing them and applying their benefits to personal, professional and larger social contexts.

34. Hearing is Seeing: Spectral Geometry and Spirituality Shiroman Prakash, V Gurucharan

A beautiful mathematical question which defines the field of spectral geometry is: "Can you hear the shape of a drum?" The question was asked in an article written in 1966 by Kac, but goes back to mathematical physicist Hermann Weyl. When you strike a metal vase you hear a sound that is the superposition of several discrete frequencies, (typically not integral multiples of a fundamental frequency unless the vibrating object is a string). Can you infer the shape of the vase from the sound alone? This question has recently been invoked by Achim Kempf of Waterloo to provide a new way to think about quantum gravity – the allowed "vibrational frequencies" of a space-time may be more fundamental (gauge-invariant) degrees of freedom than the geometric description of the shape of space-time (given by the metric). Within string theory, the answer to the question is "not always uniquely" – apparently different shapes of extra dimensions can give rise to the same spectrum of string states (a phenomenon known as Mirror Symmetry in Calabi Yau Manifolds, or more generally, T-duality). Studying the equivalence classes of manifolds that give rise to the same vibrational states of a string is the start of a subject called stringy or quantum geometry.

In the classical limit of quantum geometry, one can, in practice, hear the shape of a drum without much difficulty. However, in general, vibrational frequencies (at least within string theory) seem to define a slightly more abstract mathematical structure which is perhaps more fundamental than the classical notion of shape. The central ideas of spectral geometry and quantum geometry provide an analogy (and perhaps also a logical basis) for the duality between form and formlessness invoked in the Radhasoami tradition. In the meditational practice taught by the Radhasoami faith, practitioners see beautiful lights as well as hear a characteristic sound in a hierarchically ordered series of stages of meditation (e.g., a bell sound at one of the early stages). However, for ascending to higher states of meditation, practitioners are instructed to focus attention on sound rather than lights, and hearing is considered to be a more "fundamental" sense than sight. The sound is accompanied by beatific form, which, in light of spectral geometry could perhaps be thought of as reconstructed by the observer from the vibrational frequencies heard. However, sound is ultimately more fundamental than the form as in the final, highest stages of meditation one hears a sound and the accompanying form disappears.

39. A data science study of Subliminal imaging, brain functions and creating Unconscious Cognitive decision making models Swati Idnani, Suresh Idnani, Sneha Idnani

This abstract proposes to study the effects of subliminal communication propagated via imaging on human brain functions (conscious and unconscious). Conclusion from this study intends to be reviewed to determine feasibility of creating an externally guided decision making model with supporting data scenarios to establish if a similar internal unconscious cognitive brain state (promoting spiritual quest, value-based physical, emotional, moral conduct) can be reached if certain subliminal stimuli are provided to the brain.

41. Mindfulness Based Cognitive Therapy – "Mind Full or Mindful?" A study of Biochemical, Genomic & Neural structure changes governed by the Brain Teena Idnani, Swati Idnani, Suresh Idnani, Sneha Idnani

The secular practice of meditation is associated with a range of physiological and cognitive effects, including lower blood pressure, lower cortisol, cortical thickening, and activation of areas of the brain associated with attention and emotion regulation. Studies to date have included both behavioral and physiological data focusing on key cognitive aspects of mindfulness practice, such as attention, memory and have included secular and spiritual forms of mindfulness/meditation. The term Mindfulness is common to Buddhist traditions, where it forms part of the eightfold noble path to

awakening, and was adapted by Kabat-Zinn in his therapeutic program to mean "...paying attention in a particular way, on purpose, in the present moment, and non-judgementally". It focuses on becoming aware of all incoming thoughts and feelings and accepting them, but not attaching or reacting to them. Given the increased interest in investigating the benefits (health/spiritual) and processes involved, our aim is to review and reflect on how measurement of brain activity can be achieved within an empirical framework while studying the effects of MBCT in the brain. This study therefore intends to link brain activity and effects from MBCT to different states of consciousness in order to deduce the degree of impact in achieving the latter, and therefore promote the concept of a disciplined and structured method that is required to baseline spiritual practices and their importance, which can essentially fuel young minds at an early stage to connect with their core of existence.

42. Manifestation of Consciousness Vineeta Mathur

A study taken up in DEI, Agra, India, on people of different age groups showed that spiritual Consciousness not only manifests more with age but also in people who have the required qualifications of a seeker of spirituality. Such people generate Consciousness in others so that it can be regenerated in the form of Universal Consciousness. The study included around 60 individuals of different age groups and following different faiths. Their spiritual consciousness was compared to their age and the kind of spirituality they were seeking. It was found that some of the most spiritual elders were followers of Radhasoami faith. Further analysis is underway.

43. Intuitive Consciousness and Creativity Vineeta Mathur

It is believed that intuitive consciousness arises from perceptions that are not mediated through the ordinary senses, and brings creativity and speed to the process of enquiry, thus opening the way for intellectual freedom. The creativity which arises may be in the form of art, invention or emotion. This paper endeavours to investigate how intuitive consciousness is linked to creativity and projects hidden perceptions in creative forms.

49. Impact of Dayalbagh (Eastern) Culture and Eco-System on Students and Western Visitors Mukti Sahni

The impact of Dayalbagh (eastern) culture and eco-system on students from Kindergarten to Ph.D. (K to Ph.D. levels) is clearly discernible to any observer inside as well as outside the system. The Dayalbagh values system is imbibed by participating in activities like community prayers (Satsang), community service (Seva), Yoga, spiritual exercises (Abhyas), working in the agricultural fields, cleaning the campus by picking plastic and polythene litter and waste management from a very early age. We follow the adage 'Cleanliness is next to Godliness' and are economical in use of resources that strain the earth through use of modern technology (like electric rickshaws and solar vans), since the century old existence of Dayalbagh, while the world is waking up to remedy this crisis only in the present times. We have a Children's Science Centre to update us of the scientific advancements in the world and a Children's Recreation Centre where games to enhance our mathematical and linguistic abilities are made available to children of all strata of society. There are special lectures on state-of-the-art studies on brain, consciousness, discoveries in the solar system among others. We have a School of Art and Culture, School of Languages and a Children's Library which organizes Children's Book Fair to inculcate the reading habit at a very young age. We are taught to appreciate the unity of Ultimate Truth, Ultimate Knowledge, Ultimate Beauty (Satyam-Shivam-Sundaram) which helps in the physical, emotional, cultural and spiritual development of school going children into supermen of tomorrow.

Dayalbagh has been a liberal advocate of adopting modern scientific techniques to study of the teachings of the sages of the East, over a century and this has been appreciated by several visitors from the West over the ages. We adopt all the rigour of science to study spiritual phenomena. Max Mueller, the great German Indologist, in his book "Ramakrishna : His Life and Work" appreciated Rai Bahadur Saligram Sahab (Huzur Maharaj), the second Revered Leader of Radhasoami Faith. Sir Sahabji Maharaj, the Founder of Dayalbagh appreciated the Einstein-Tagore meeting in Berlin in 1930. Major Yeats Brown in his book 'Lancer at Large' (1936) called Dayalbagh 'a colony of work-a-day mystics' and an "Indian Utopia". Paul Brunton in "A Search in Secret India" (1935) described Sir Sahabji Maharaj as "Master of over one hundred thousand people, who practise a mysterious form of yoga; prime organizer of the multifarious and materialistic activities which seethe around me in Dayalbagh; taken all in all, I write Him down as a brilliant and breath-taking man. Nowhere in India, nowhere in the entire world, may I expect to meet His like again." Dr. Volker Moeller, a German visited Dayalbagh in 1950s and obtained Ph.D. from University of Tübingen, Germany on Radhasoami Faith in 1956. In the

present times, numerous western scientists like Sir Roger Penrose, Prof. Stuart Hameroff, Prof. Vlatko Vedral, Prof. James Barrell, Prof. Rocco Gennaro, Dr. Chris Fields, Prof. Jack Tuszysnki, Prof. Elizabeth Behrman and Prof. William R. Klemm among others have appreciated the synthesis of western liberal thinking with the simple eastern lifestyle of Dayalbagh.

50. Experimental Study of the Effect of Peak Frequencies of Instrumental Melodies on Cortical Activity of the Brain of Meditators Measured by SQUID Based MEG Device Dayal Pyari Srivastava, Vishal Sahni

Ancient religious literature of the east, particularly that on the Radhasoami Philosophy, is replete with descriptions of the Saints about different levels of spirituality. Apart from perceiving manifestation of the presiding deities of different spiritual planes of spirituality in terms of specific "shabda" (sound form), the accomplished meditators experience the hearing of melodious musical instruments or their approximations or characteristic tones specific to these planes. (Soamiji Maharaj, Sar Bachan)

In the quest towards a science of consciousness, research at the Center for Consciousness Studies, DEI, Agra, India has revealed that characteristic peak wave frequencies associated with diferent levels of spiritual planes are detected by MEG device from the brains of subject meditators, depending on their spiritual attainments or the regions of spiritual planes where their spirit current is focussed at the time of MEG measurements. (Satsangi and Sahni, 2007).

In the present study, a sophisticated SQUID device has been used to unobtrusively record the brain wave patterns when the subjects meditate. The results are compared with the brain wave records obtained from an experimental condition when melodies or musical tones with peak frequencies identified for different spiritual planes are played through a headphone in the ears of the meditators. This study is an attempt to study the effect of induced experience in the form of spiritual musical frequencies on the inner spiritual phenomenology of consciousness through well-established scientific epistemology, including three important stages of observation (awareness), report (description) and analysis (understanding). (Price and Barrel, 2012).

51. Correlational Study of Nature and Eastern Mind: The Philosophy and the Science Pooja Sahni, Jyoti Kumar

The open air, natural habitats and forest trees have a special fascination for the Eastern mind as symbols of spiritual freedom. The Eastern approach to nature requires that we first understand how the world of nature is viewed, which is very different than that of the predominant western religions. The Vedic vision of unity is the basis for an ecological approach in which we need not protect nature as we would an inferior creature. We honor nature as our own greater life and expression. In Radhasoami faith, there are several texts available that vouch for the pertinent connection of nature and human consciousness. According to Buddhist teachings there is a very close interdependence or inter-relationship between the environment and the inhabitants. Inspite of its historic and religious importance, in the past few decades the worth of nature and the contact with the natural world has diminished and this has caused many a problem for urbanized dwellers.

Recently the significance of natural environment for holistic health – physical, mental, spiritual well-being and functioning is being scientifically studied. It is seen that interaction with natural environment inevitably yields corresponding states of conscious experiences through positively affecting our brain/cognition. (Selhub, Eva M and Logan, Alan C.2012). Further EEG studies have also provided evidence of enhanced structural plasticity, brain synchrony and oscillations- the electrophysiological correlates of attention and cognitive functions while in natural environments (such as wilderness). In this paper, we study the consciousness level and the inclination towards natural surroundings, environmental issues through standardised test. High correlation between Consciousness Quotient and the pro-Environmental behavior was demonstrated. Further analysis also deduced that the spiritual consciousness- a sub-factor of Consciousness quotient is very high among subjects demonstrating high pro- environment behaviour. This research further delves into deeper issues of what drives the human consciousness, behavior and actions vis-a-vis environment. Once this strong link is understood and established interaction with natural environments could potentially help in therapeutic and optimal cognitive functioning.

52. Correlational Study of Triguna Test with Strength Deployment Inventory (SDI) on Yoga Practitioners: Comparison of East-West Approaches to Consciousness Shobha Bhasin, Gurdev Roy, Shagun Dayal, Sukhdev Roy, Timothy Scudder

In our previous study presented at TSC-13, the correlation between MBTI and Vedic approaches had been identified on consciousness states of 100 Yoga practitioners in America and India. We considered the Vedic Personality Inventory developed by Wolf that had Cronbach $\alpha > 0.90$. In a subsequent study presented at TSC-14, we identified the correlation between these two approaches for a larger set of 280 University students in India. In both cases, we found evidence of construct validity from the correlation data. We found lower Sattva component in students as compared to Yoga practitioners, revealing the efficacy of yoga meditation on personality development. In the present study, we have taken the widely used Strength Deployment Inventory (SDI) as another approach to determine the consciousness level of meditationers and students in America and India. SDI helps in assessing a subject's motives and strengths in relating to others when everything is going well and when faced with conflict. The correlation analysis between Triguna and SDI tests suggest that Satogun has a relatively high correlation with SDI Blue (Altruist-Nurturing personality) and inverse correlation with SDI Green (Analytic-Autonomizing personality). Rajogun, Tamogun have a high correlation with SDI Green and an inverse correlation with SDI Blue. The results of this study will be presented along with inferences. Since most concepts and phenomena in spiritual and transpersonal psychologies are complex, unidimensional instruments that assess these constructs do not suffice for most research purposes. The present study highlights the importance of multidimensional tests and/or multiple measures for consciousness studies.

55. Religiosity And Consciousness In University Students Kavita Kumar, Kanti Singh Pawar

Religion first appears, or is learned or embraced, through the operation of ordinary, automatic, cognitive processing. Religious ideas, like all kind of ideas, owe their existence to a raft of specialized tools used in the brain's mental workshop to interpret and organize the world. However, the consciousness can be defined as a state of awareness, wakefulness, the ability to experience or to feel, having a sense of selfhood, and the executive control system of the mind. It has been widely understood by cognitive scientists that religious ideas and behaviours sustain on human cognitive and psychological processes. In the present paper, the investigators have aimed to study the Religiosity and Consciousness of university students. Hundred students from Dayalbagh Educational Institute, Dayalbagh, Agra, India, have been selected and administered Religiosity and Spirituality Scale for Youth by Hernandez (2011) and Consciousness Quotient inventory by Brazdau (2013). The data has been analysed on the basis of multiple regression. Hence, the present study is valuable for the individual's overall enhancement of mental, social, emotional and spiritual growth. It will also be beneficial to get a better insight into the various components of consciousness and its predictors.

59. Machine Morality: Need of Ethics in AI and a study of Artificially Intelligent Agents from a Moral Perspective Achint Satsangi

In the present era of advanced technology, there is extensive research going on in the field of Artificial Intelligence. Artificial Intelligence refers to human-like intelligence exhibited by machine or software. Presently, the research is primarily focussed on neural networks, machine learning and making the artificial agents smarter and faster in terms of functionality. However, the issue of Machine Morality has also emerged as a challenging subject of debate and research. The emergence of autonomous killing machines, self-driving cars etc. has raised issues regarding machine morality. This paper will discuss issues pertaining to Machine morality, technological advancements and research in the field of artificial intelligence, propose modifications in laws of robotics, and highlight the need of ethics in artificial intelligence, concepts of machine learning, emotion and cognition in machines, advantages and risks of A.I. (artificial intelligence) technologies. From observing the state of crime and violence in various parts of the world, the paramount importance of human values and ethics is clearly evident. The usage of drones and development of autonomous killing robots by some countries is being debated on ethical grounds. Also, there are speculations that the artificially intelligent agents may pose a threat to humanity in future. Hence, there is an important need for integration of ethics into the machines. The paper would also discuss the development of emotional artificial intelligence technologies and applications like the pain detectors, emotion detectors through conversation, typing patterns, and facial expressions etc. self-learning robots and artificial brains like Robo-Brain which learns from the internet resources, mind-reading fashion Neurotiq,(-Google's) self-driving cars etc. The limitations and risks associated with "unethical" artificial intelligence would also be discussed. Also, the interesting idea of how can we, as humans, benefit from the

process of incorporation of ethical values in machines will be introduced, and thereby use similar methods for training human beings for inculcating humane moral values and emotions in present scenario will also be discussed. The concept of roboethics would also be discussed- that how humans should interact with the robots. Also, more issues will be discussed like- the responsibility of making the life-death decisions should be taken by humans, not robots; the robot should give priority to the lives of humans above its own safety etc.

60. Impact of Yogic Practices on Spiritual Consciousness Prem Pyari, Anoop Srivastava

Many studies have proved positive influence of yoga in enhancing overall consciousness. Yoga being understood as a set of certain physical exercises, surat shabda yoga refers to well established spiritual exercises practiced in India for spiritual advancement. Therefore, positive impact of yoga on surat shabda yoga and in turn of the two on spiritual consciousness is highly likely. But absence of a properly validated and reliable questionnaire to assess spiritual consciousness has remained a hinderance in the assessment of Spiritual consciousness so far.

Though a component of Spiritual consciousness is included along with components of Physical, Emotional, Mental and Social consciousness, and of the consciousness of the Self in a composite measure of consciousness given by psychometrically reliable and valid Consciousness Quotient Inventory (CQI) (Brazdau, 2009), an assessment of Spiritual consciousness alone can also be made through the relevant portion of CQI. Accordingly, this paper attempts to highlight the impact of yogic practices on Spiritual consciousness.

TSC 2016 East-West Forum Poster Presentations

3. The Subjective And Objective Evolution Of The Consciousness Soam Prakash

This world is an illusion which appears to be real. It is just like the miseries we suffer in a dream which is imaginary. Actually, the consciousness is not a product of this world; this world is a product of consciousness. This world is a reflection of spiritual world. In the land of devotion, everyone is a serving unit. All of the acquired happiness is a part of the absolute consciousness which can only be found there. In Bhagwat Gita, Krishna tells Arjuna "I am everywhere and nowhere, everything is in me and yet nothing is in me". In my un-manifested form, the entire universe is pervaded. Behold my mystic opulence, my simultaneous oneness and difference. Although I am the maintainer of all the living entities and although I am everywhere, I am not inflicted by any of this, for I am the very source of creation. These are actually the Quantum properties of the creator in the universe. The material has not created material world but the consciousness or spiritual world has created the material world. The evolution of single cell structures or bacteria do have a consciousness of their own, similarly in the other invertebrates it re-aligns and the continuous flow is in the creation of higher invertebrates and vertebrates. The evolution is thus measurable by the source of bio- field or their electromagnetic characteristics. The integration of eastern philosophical school with western thinker and philosophers would be a fruitful culmination and the purpose of creation would be well served.

4. Consciousness and Smoke of Clouding Waves of Desires Kanta Arora

Indian scriptures of religious philosophy declare that desire was the earliest seed and thought was the product. The sages who searched in their hearts with wisdom, found the bond of being in the non being. First desire sprouted forth earliest which produced thought. The Divine Will to grow or expand is the force behind all creation (Nasadiya Sukta of Rig Veda). I consider human form to be a disintegrated spark of that Divine desire. The clouding waves of desires surround living beings always and push them forward to a Will and determination. Will is greater than mind. For when a desire arises, man wills, then he thinks in mind / utters speech and acts and reaches as far as his will goes. I find reasons to believe that to be conscious is to be desirous. Self consciousness is desire itself. The tendency (desire) to grow and expand is the force behind every activity of world. Consciousness confined in the city of human body is a pack of desires. Seed of desire sprouts forth, expands to live its life and reverts back to its source. On the other hand eastern spiritual traditions also consider desire to be the root cause of all pain in life and a trap for falling into pangs of birth and death again and again. Some scriptures clearly distinguish between the crazy desires of mind leading one to stray for pleasant things which are of transitory nature and advice to distinguish between the good and pleasant with an aim to seek permanent bliss by going deep within. The only remedy for all deeper ills of life is the knowledge of the divinity of the human Self. The paper expresses a logical view as to how the smoke of clouding desires projects the tendency of spirit to mix with mind and matter and

how one wanders in wilderness of this universe through developing a separate entity (I-ness). How a burning desire pulls up from within the Self itself to revert back for the experience of reunion with the ultimate reality, based on the philosophy of Upanishads and revelations by Indian saints.

6. Unfolding the Strings of the Cosmos : The Consciousness exists in empty space (vacuum) also Ansh Agarwal, Siddharth Agarwal

If a region of space contains nothing, or it's a vacuum, even then "Casimir force" acts as shown experimentally by Marcus Sparnay and Steve Lamoreaux. This quantum activity, though subtle, is due to quantum uncertainty. It happens due to reduction in field jitters/fluctuations (of electromagnetic, weak and strong nuclear forces).A field value cannot remain zero uniformly has been proven by calculations using mathematical framework (for explaining the value of Cosmological constant) and the recent data from Inflation and Supernova. The concept of existence of Consciousness in empty space as per Quantum Theory is best explained by "quantum non locality" or "quantum coherence". The "collapse problem" or the "binding problem" of quantum consciousness can be explained by the principle that things or space are in a wave like state until they are observed by a conscious observer and that consciousness causes collapse of wave function.

7. Harnessing Peace & Science with Qur'an in Present Era Savita Srivastava, Amarved Srivastava

The peoples of every religion are peace seeking, promoters of Global Harmony along with Global Peace. Moreover Science is active to harness the sciences as well as social sciences using observations and experiments. We must be active to harness the sciences and social sciences in the 21st century to promote Peace for the World-Citizens irrespective of faith, colour and creed. And a crucial fact is that the Qur'an, while inviting us to cultivate science, itself contains many observations on natural phenomena and includes exemplary details which are seen to be in total Judeo-Christian Revelation. These scientific considerations, which are specific to the Qur'an, surprised us at first. Until then we had not thought it possible for one to find so many statements in a text compiled more than thirteen centuries ago referring to extremely diverse subjects and all of them totally in keeping with modern scientific knowledge.

8. Consciousnesses of Vedanta in Hindu philosophy and Science Preeti Srivastava, Savita Srivastava

Vedānta or Uttara Mīmāṃsā is one of the six orthodox schools of Hindu philosophy. The term Veda means "knowledge" and anta means "end", and originally referred to the Upanishads, a collection of foundational texts in Hinduism. The wisdom of Vedanta enlightens that man's real nature is consciousness. But we do not properly grasp the idea because of 'Maya' or ignorance. One of the main factors that block the right type of perception is the ego in every man. The 'Search for Truth' compels us to watch the operation of the ego in our own consciousness. Unity in Diversity is the plan of nature and the 'Mahavakyas' or great words of Indian thought like 'Aham Brahmasmi', 'Tatvamasi', 'Ayamatma Brahma' and 'Prajnanam Brahma' speak volumes of the real nature of total consciousness. In Vedanta there is no distinction between subjective and objectives knowledge.

9. Bhagavad-Gita and Consciousness: a Universal Phenomenon Preeti Srivastava, Savita Srivastava

The very first step in self-realization is realizing one's identity as separate from the body. "I am not this body but am spirit soul" is an essential realization for anyone who wants to transcend death and enter into the spiritual world beyond. Although we are not these bodies but are pure consciousness, somehow or the other, we have become encased within the bodily dress. Living in the bodily conception, our idea of happiness is like that of a man in delirium. Some philosophers claim that this delirious condition of bodily identification should be cured by abstaining from all action. Because these material activities have been a source of distress for us, they claim that we should actually stop these activities. Bhagavad-gītā indicates that this material body is not all in all. Beyond this combination of material elements, there is spirit, and the symptom of that spirit is consciousness.

10. Consciousness and Spiritual Intelligence Savita Srivastava, Prem Prasad Srivastava

The history of the development of our knowledge about intelligence is fascinating. Although leading thinkers had been searching for a long time for any clues as to 'what makes us tick?' and 'What makes us smart?' amazingly, the concept of the Intelligence Quotient has been around for less then 100 years – the first experiments in intelligence testing by 'scientific means' started only at the beginning of the 20th century. Spiritual Quotient is the soul's intelligence. It is the intelligence with which we heal ourselves and with which we make ourselves whole. SQ is the intelligence that rests in that deep part of the self that is connected to wisdom from beyond the ego, or conscious mind. It is

not culture-dependent or value-dependent. It is our deep, intuitive sense of meaning and value, it is our guide at the edge, our conscience.

12. How Can We Construct A Macrocosmic Phenomenon From Science Of Consciousness? Sathiraju Anusha, SNL Sirisha

This abstract gives an alternative approach to macrocosmic phenomena i.e., spiritual inner experiences will be explained with a hydraulic elevator principle. The approach leads to a four-fold pattern, where in first stage; one can notify a specific experience (inner). The second stage will acknowledge from the initial perspective obtained from previous level. While in the third phase, the observer will understand these experiences through learning common factors and their inter-relations (example: factors that include mental aspects such as anxiety, pain etc...) and finally applying quantitative psychometric methods to test in general the functional relationships between these common factors (i.e. propose certain hypothesis and subject them to the test of scientific methodology). This approach follows a quantum-theoretic model, which indicates two methodologies to quantum theory as far as consciousness is concerned. One is due to von Neumann-Stapp formulation and consists of three processes of choice, causation and chance, while the other is the celebrated Penrose-Hameroff Orchestrated Objective Reduction theory which has three parts, the Gödel Part, the Gravity Part and the Microtubule Part.

14. Spin network based diagrammatical study of quantum theory of space-time Sonali Bhatnagar, Satsangi Jyoti

To combine the two successful theories of general relativity and quantum mechanics into the theory of quantum gravity, there are various approaches. The road that we chose to study is the application of Roger Penrose's model to Quantum Gravity using the Loop Quantum Gravity. This theory is defined for the continuum nature of space-time that breaks down at the fundamental Planck level, giving way to an intrinsically discrete structure. To understand the nature of space time whether it is discrete or continuous, we use R. Penrose's spin network model where the discretisation is used as a practical tool and perform the diagrammatical study in that model for actually understanding the structure of the universe at a fundamental scale.

15. Meditation (Dhyān) to Super-Consciousness (Samādhi) with reference to the mystic poetry of Swāmi Vivekānanda Namita Bhatia, Soami Das Bhatia

According to Swāmi Vivekānanda, there are three states of consciousness-Conscious, Unconscious, and Super-conscious which belong to one and the same mind. The Conscious is on the middle plane. The unconscious is beneath consciousness and there is no feeling of 'I' here. When the mind goes beyond this line of self-consciousness, it is called Super-consciousness or Samādhi. This is the highest level of consciousness and is unaccompanied by the feeling of egoism. To attain this state the mind has to be trained to remain fixed on a certain internal or external point. When it is able to concentrate in this manner, an unbroken current flows towards that point. This state is called Meditation or Dhyān. With the intensified power of Meditation (Dhyān) one is able to reject the external part of perception and remain meditating only on the internal part. This state is called Super-consciousness or Samādhi. In this state everything comes under the control of the mind. This meditative state is the highest state of existence. The meditation must begin with gross objects and slowly rise to finer ones, until it becomes objectless. When the mind becomes strong and controlled, and has the power of finer perception, it should be employed in meditation.

17. Living every moment with the Almighty Sumiran Satsangi, Shipra Satsangi

Introspection of our 'Daily Karmas' and surrounding environment around us at the end of the day reveals the condition of our mind which is filled with infinite thoughts at any point of time. It tells us that condition of mind changes every moment and it also reveals our vulnerability in this world at large. Constant struggle with life problems and changing circumstances and condition of our mind (full of numerous thoughts) takes away our power to take right decisions which we all are required to take, again multiple in number each day of our life. It is said that each person is born with a purpose and each person has his trajectory or path defined by the Supreme Being. It would be desirous and beneficial that we try and follow this path and not even for a moment divert from it. But we experience its not possible every moment, i.e. we get disconnected with the path often. We than wonder that we were taking the right decisions till this time, but suddenly at some hour or some day, our mind changes its track and taking us to the path, which is different to what our inner conscious wants us to follow. The present paper explains the importance of our constant connect with the Supreme Being, our creator at all times. Whether we are sleeping, walking, talking or doing any work.

Why the same is important and how can we sustain it at every moment of time is what the paper would explore through questionnaire and personal interviews.

18. Effect of pre sleep meditation (Surat Shabd Yog) on quality of sleep, dreams and snoring
Anjoo Bhatnagar, Phool Chand Bhatnagar

Surat Shabd Yog is the sound practice of listening internally to the ever reverberating spiritual sounds via meditation, as prescribed in religion of Saints(Radhasoami Faith).In this practice the attention is directed inwards, to the seat of the spirit at 6th nerve center(ajna chakra) and the downward flow of the spirit current is checked. As the spiritual practice of Sumiran (repetition of Holy Name) and Dhyan (Contemplation of Holy Form) are continued for five to seven minutes, sufficient concentration of attention is obtained and the breathing becomes light. With still further concentration the flow of spirit current is gradually reversed i.e. instead of going down towards the navel, 3rd nerve center (nabhi chakra), it begins to go upwards to the brain. Mostly the dreams people see are due to downward flow of spirit current to the navel and these dreams are bad and dirty and this condition is accompanied by snoring. It's like animal consciousness. If the flow of spirit current is reversed, towards throat or 5th nerve center (kantha chakra) then the dreams are good. Mostly such dreams are true and these may have some premonition also. There is a close link of thoughts and breath. If spiritual practice is performed properly then the breath becomes light and only one hour of sleep may be enough.

19. Quantum Mechanics and Spiritual Consciousness Usha K, Aashiq B, Bhupinder Singh, Ashish B

There is a different kind of quantum theory which holds at Spiritual level. There is duality but not the corresponding uncertainty. Duality at will, not duality probabilistically is the key to spiritual upliftment. The above can be explained in terms of the relationship that exists between the individuals consciousness, the deity and the devotee. When the particle so desires, it stands aloof from the wave and observes the glory of the wave, call it the spiritual reservoir versus the particle as the individual spirit force, call it the deity (spiritual source) and the devotee (spirit force). So that is why Ultimate Reality does not have uncertainty. Ultimate Reality is characterized by certainty but with duality. In the physical world, in the mental world also, this duality and uncertainty go together, but in the primary sphere, which is the reservoir of spirituality, this is not so. So it is omni quantum force field which applies there. Since it (spirit force) is not a particle kind of entity, it is called a source-wave to part-wave duality. In this world, the spirit (conscious) force which is the prime source of energy has evolved into various mental and physical forces when it blends with the different kinds of mental and physical media. So in this physical universe, it takes the form of one of the four fundamental physical forces of nature and the one which is easiest to sense is electromagnetic energy. If the spirit is made to ascend to higher regions without having been purified, the result would be that the impure matter with which the spirit ascends to higher regions, would manifest itself with great force and strength and just as Rishis and Munis of old era fell down from their high spiritual status with great force, we shall also have a similar fate. Therefore at first, purification is a necessary process.

20. Peak Human Conscious Experience- A Spiritual Experience P Sriramamurti, B Saravanan

According to Eastern wisdom, Consciousness – Chaitanya, is the primeval cause of creation. It had a polarized state even before. The gracious object of spiritualizing the portion deplete with consciousness resulted in creation. The spirit entities inhabiting this part of creation on earth are endowed with physical bodies made of layers of ether, fire, air, water and solid matter and mind. All the spirit entities in their different grades of spirituality have experiences of different kinds. The human body is a microcosm endowed with the gateways to contact and reach different levels of creation – material, mental and spiritual. Potentially it can experience all the states at all the levels. The highly evolved souls – Sants and Param Sants, embodied in human form are capable of having the highest experiences of spiritual awakening. Generally human experiences are confined to objects on the physical and mental planes. With the advent of Param Sants the secrets of gateways to all the higher regions are made known. Consequently, man is today capable of having the highest spiritual experiences. It is evident that the peak conscious experiences attainable by man are the spiritual experiences. They are superior to all physical, mental and aesthetic experiences.

22. Is Entrepreneurship Decision of University Students a Conscious Choice? A Study of students of an Indian University using Triangulation Approach K.Santi Swarup, Mukti Sr-Narain, Karan Narain

As countries face weaker economic climate, more and more traditional business failures are becoming common. With increasing company failures and diminishing job opportunities, many graduates and students in universities have started exploring entrepreneurship choice. Universities

are also providing the eco system for nurturing these initiatives. But the question that remains to be addressed is, are these students conscious of their entrepreneurship choice? A conscious choice requires understanding of various options available to them and based on a goal, selecting the best alternative using a value system which enables them in meeting the goal. The purpose of this study was to study the level of consciousness in entrepreneurship choice of students of an Indian university.

Many studies focused on the entire graduate population for evaluating the level of preparedness of students. We are applying mixed scaling method where only those students willing to spend extra hours in exploring this opportunity were considered. We have used the dimensions of knowledge, attitude, skills, experience, opportunity and networks. Also the demographic variables like gender, age, stage of graduation, funding source, family background etc. were considered in identifying the variation among the students. We have collected both quantitative and qualitative data and triangulated with the existing secondary data evidence. The results of this study have implications for the entrepreneurship initiatives.

23. Intuitive Consciousness Guides and Prompts an Individual's Decision Making Arti B, Aashiq B, Ashish B, Geetha K

Consciousness is our most prized possession. It sets us apart from the opulent variety of earth – life and puts upon us an onus of responsibility. It takes us on incredible journeys and has given us the gifts of insight and transcendence. The same kind of process that gives the earth abundant life allows us to have a sense of self, to contemplate the world, to forecast the future and make ethical choices. Each of us has under our control a miniature world, continuously evolving, making constructs unique to our own minds. In the same way that life itself unfolded, our mental life is progressively enriched, enabling each one of us to create our own world. Intuitive Consciousness, as perceived by a common man, is the power of Thinking without Thinking as told by Malcolm Gladwell. An art expert sees a ten- million-dollar sculpture and instantly spots it's a fake. A marriage analyst knows within minutes whether a couple will stay together. A fire-fighter suddenly senses he has to get out of a blazing building. A Speed dater clicks with the right person ...Those moments when we 'know' something without knowing why. How a snap judgment can be far more effective than a cautious decision by trusting our instinct. The present paper attempts to emphasize the significance of Intuitive Consciousness when developed in evolving man helping him ascend from Apara vidya to Paravidya, guiding his consciousness in decision making and leading a fruitful life.

26. Embodied Spirit as a Bound State in an Open Multiple Quantum-Well System Sukhdev Roy

In this paper, we examine the human form as an embodied spirit in a bound state and analyse its functions based on the theory of open quantum systems, in which the interaction with the environment is also taken into account. We extend the framework of the spiritual-psycho-physical quantum vibrational theory presented in TSC-2015 to incorporate open quantum systems. It is shown that the spirit entity as described in Taittiriya Upanishad, to exist in five different koshas, can be considered to be in multiple metaphysical quantum-wells of the mind and body. The conscious state is a superposition of these vibrational energy states and variation in attention within can lead to resonant tunnelling between the quantum-wells. Meditation on the primordial spiritual sound currents can enable the spirit to resonate to higher energy states enabling transitions into the continuum and into the unbound state. The proposed theory provides plausible explanation not only for various states of consciousness, but also a wide range of parapsychological phenomena that includes intuition and healing.

29. Stepping Towards Conscious Marketing: A Case Based Approach Ishika Agarwal, Shalini Nigam, Sanjeev Swami

In management functions, marketers have changed the business largely into "Business of Advertising." This existing over-polluted marketing atmosphere has victimised the customers. Marketing in the 21st century reflects a more self-centric mind-set and as such there is a need for shift from traditional marketing to conscious marketing. This paper tries to awaken organizations towards marketing which is more harmonic and humanistic in nature (i.e., conscious marketing). In the words of Carolyn Tate, Head, Carolyn Tate & Co. "The business of business is no longer business. The business of business is to make the world a better place" (Carolyn, 2015). For the healthy functioning of the economy, Conscious Capitalism, Inc. a non-profit organization has provided 4 pillars of conscious business viz. higher purpose, stakeholders orientation, conscious leadership and conscious culture (www.conscioucapitalism.org). Further, companies like Ben & Jerry's, Google, IBM and Starbuck's are practicing conscious marketing. These big names have inspired many other ventures to practice

conscious marketing. This "inside out" approach is not easy to follow but some businesses are so authentic, harmonious, and right away tap into the heart of their people (clients/customer) to create their own unique marketing message. Through case based approach this study will examine such kind of businesses and their story of creating unique marketing and socially powerful business. The slow and gradual successes of these ventures are inspiration to all for delivering what is true and indeed needed by society. Finally, a framework is prepared in which a blueprint is proposed so that other companies or businesses can follow a path that leads to conscious marketing. Thus, this paper will propose a path (series of steps) by which an organization can slowly and gradually move towards conscious marketing, so that marketers can create their ideal clients and build their business which is consciously active for society at large.

32. Pharmacological cause of Consciousness Phenomena Seema Bhat, Laxminarayan Bhat

The scientific evaluation of consciousness phenomena has become one of the thrust areas of biomedical research due to its important role in the spiritual, physical, mental and social wellbeing of mankind. Different spiritual practices have been followed across the world to achieve higher levels of consciousness but widely adopted methods are prayer, meditation and yoga. Although the ultimate goal is to achieve higher levels of consciousness, no two methods of spiritual practices can lead to the same level of consciousness as they differ in many aspects. Some spiritual practices focus on the particular Chakras in the body/brain and others on sound, colors and particular form of physical activities such as dance. Therefore, the qualitative and / or quantitative outcome of each spiritual practice can vary to a great extent and this is one of the biggest challenges in the scientific evaluation of consciousness phenomena. Regardless of the method of spiritual practice, the outcome of a spiritual activity leaves signature trails of neurological and physiological changes in the body due to pharmacodynamic effects. Thus, the study of pharmacological cause of consciousness phenomena can be very useful in the scientific evaluation of qualitative and quantitative outcome of different spiritual activities. We present the key biogenic monoamine receptors possibly involved in the consciousness phenomena, their expressions in the human body/brain, and the scientific rationale of receptor level interactions between cosmic waves and human body. We also discuss in this paper the pharmacological cause and evidence to explain the correlates of consciousness and scientific rationale for differential qualitative and quantitative outcome derived from different spiritual practices.

35. Fourier Analysis of the Cosmology and Phenomena of the Religion of Saints Prakash Sahni, Pooja Sahni

In the past versions of TSC, we have done frequency domain or Fourier analysis of the lights and sounds of the religion of saints. The sounds of the religion of saints have been characterized using harmonics associated with the musical instruments which produce the sounds. The lights of the religion of saints have been characterized using color temperatures associated with the sources of illumination which produce the light. In mathematics, representation theory is a technique for analyzing abstract groups in terms of groups of linear transformations. The Fourier transform techniques can be applied to cyclic groups and by extension to finitely generated abelian groups. The cosmology of the religion of saints describes three grand divisions of creation. There are six sub-divisions of each grand division of creation. In the current work we use the Fourier analysis to analyze the cosmology of the religion of saints.

36. (A) Augmenting (A) Action for (D) Disaster Management through (I) Indigenous Knowledge (Gyan): A.A.D.I. GYAN - CONSCIOUSNESS: A Digital Library Initiative Sanjay Bhushan, Sanjeev Swami, Shiv Kumar Sharma, Anand Mohan

Environmental conservation and disaster management are vital to the sustenance of the livelihoods of Indigenous people and their communities who often live in hazard-prone areas. These communities have built up, through thousands of years of experience and intimate contact with the environment, a vast body of knowledge on hazards and the environment events. This knowledge is a precious resource that continues to contribute to environmental conservation and disaster management in these regions. Indigenous knowledge, in fact, should be considered as a complement to scientific knowledge in the development of community based disaster mitigation and risk management plans and programs. However, with the disruption of traditional lifestyles and changing settlement patterns, it is a challenge to maintain the continuity of traditional knowledge through transmission from generation to generation.

To address these issues, this project endeavors to highlight the utility of promoting a global scale and commonly shared digital platform for dissemination and enrichment of Indigenous knowledge

and practices across eco-communities of India and abroad based on a fully developed and functional web-portal branded - A.A.D.I.GYAN.- Augmenting Action For Disaster Management through Indigenous Knowledge (www.aadigyanproject.in). This portal is a part of digital library initiatives for documenting, preserving and promoting the role of Indigenous knowledge in mitigating natural and man-made disasters, particularly among Eco-communities.

37. A spiritual quantum theory of perception and qualia Prem Sundaram, Mani Sundaram

The problem of qualia is at the heart of consciousness research. Researchers are still far from any solution. This is mainly because their approaches are mostly materialistic, analytic and objective. A physicalist approach alone cannot solve this problem because the perceiver is spirit, not the brain or mind. However, the finding of information processing at higher frequency at quantum level in subtler microtubules, is a very significant discovery and supports our theory that knowledge involves processing at deeper level of reality. But, the deeper physical reality can show all the characteristics of consciousness, but is not real consciousness. It only mimics or reflect the latter. Hence, in order to know real consciousness itself, we need a holistic view of reality and include intuition as our method, to reach ultimate reality, the region of pure consciousness .

38. Comparative study of Role of Consciousness in Creational Cosmology as per Rigveda and Modern Science Abhitosh Tripathi

This paper looks at creational cosmology of Rigveda as described in Nasadiya, Hiranyagarbha and Purush Sukta and attempts to show that Rigveda explores many concepts which are akin to Modern Cosmological theories such as Big-Bang, Steady State and Oscillatory Theories. In the process it also compares Rigvedic view related to underlying principles of Physics such as Quantum Mechanics, Quantum Field Theory and standard Model and Consciousness Studies. Rigveda hypothesises and draws conclusions on the conditions prior to creation which Science considers to be point of singularity beyond Laws of Physics.

Rigveda's view envisages one conscious reality behind the entire manifest and un-manifested world. This paper looks at variations in pre-creational conditions described in Rigveda where entire matter of universe was either non-existent or confined to a minuscule space. Science is still attempting to come to terms with this where some favour a Big – Bang and some favour the concept of universe being created out of empty space or nothingness. Rigveda's manifest universe has both visible and invisible components and recent theories of Modern Science about Dark Matter and Dark Energy correspond to this. Conclusions of Science in terms of ratios of manifest matter, dark matter and dark energy, in percentage terms are remarkably similar to those of the Rigveda's views. Rigveda holds that evolution started with heat and desire (a conscious element) thus permitting entry of a conscious element. Science meets this partially allowing only for a gigantic explosion or Big Bang as cause of primal creation. Rigveda's view does not have a problem of entropy with which Science is still grappling. As per Science, entropy of the universe will continue to expand whereas Rigveda's view defines universe as cyclic. This paper also looks at Ten Dimensional world view of Rigveda which goes beyond four dimensions of (three dimensional) space and time and finds favour in Modern science where some believe in 10 and some in more than 10 dimensions.

40. Spiritual Consciousness: Realization of the Unity of Self with Universal Self Sahab Pyari Sinha, Surat Pyari Sinha

Higher consciousness, super consciousness, or spiritual consciousness are expressions used in various spiritual traditions to denote the consciousness of a human being who has reached higher level of evolutionary development and who has come to know reality more accurately. It also includes the development or knowledge of an "Ultimate reality". Spiritual consciousness is a deep experience, it makes us conscious of the deeper dimensions of life. It is an abiding inner awareness of the interconnectedness of one's own spirit (Jeevatman) with the supreme spirit (Parmatman), of one's individual self with the universal self (God). The human spirit is beyond the limitations of time and space. This awareness of the immortality of the human spirit opens our hearts and minds to a transcendent reality. This awareness that there is a 'higher self' working within us and guiding our lives is the first stage in our quest for developing spiritual consciousness. Once our 'inner eye' is opened to the transcendent reality, we gradually become more and more aware of the interconnectedness of the human spirit and the supreme spirit. Our spiritual consciousness deepens and we develop a devotional approach to the supreme spirit, God. We become devotees and bhaktas of this personal Lord, Ishta Deva . This can be seen as the second stage in developing spiritual consciousness. The spiritual consciousness blossoms to its full potential when the jivataman and the paramataman, the human

spirit and the supreme spirit, the individual self and the universal self, enter into deep communion of love. This is the stage when we become truly 'liberated souls', jivanmuktas. This is also a stage of the mystic. We become one with the whole. This stage can be seen as the ultimate destiny.

44. Spiritual Consciousness- A Democracy of Love Prem Kali Sharma, Payal Sharma

Love is the basic teaching of all the religions. All the religious leaders are endowed with a peculiar kind of love. This love is unchanging and experienced by the seekers of respective faiths and those in misery. It is astonishing and esoteric. It is the wonder of wonders and it is democratic. This democracy is due to the consciousness. As the spiritual consciousness prevails, love sets in, but this love is different from the love in the common notion. It is far more rational and uniform in nature and democratic in exercise, doesn't discriminate between two people. It is the love that helps one meet the goal of human life. The democracy of love achieves consummation with progress of spiritual consciousness. We study the correlation of Love Democracy and Spiritual Consciousness in this paper. Throughout this paper, by the term Love we do not mean the love for worldly things or relationships but the love that is free of all such associations. It sure is abstract but is easily understood by those who have had even one brush with it.

45. Consciously Directed Thinking Rahul Mathur, Vineeta Mathur

In Eastern Philosophy the history behind thoughts are called samskaras. A group of mutually reinforcing individuals with an orchestrated thought process through a belief system can be called satsanga. Association with such a group (satsangatya) provides a facilitating environment to obtain a directed change overriding the genetic program in an individual. If the goal is not self-perpetuation, it is possible that one can neutralize the genetic program of self-perpetuation written in the genes. Epigenetics is trying to throw light on the rationale of the ancient teachings which say that consciously directed thinking can bring about a change in our personality. Consciously directed thinking enables one to overcome the babble in one's mind, and free oneself from its compulsion, but this requires training. You can then change thoughts when you choose. There are no short cuts to inner peace which eventually leads to external peace. By creating peace in your inner world, in your mind, you bring it into your external world, and into other people's lives. You see the world from the heart because you are an emotional, mental, spiritual and physical being. Everything is defined according to a type of consciousness. What Mind consciousness does is more important than what it is. The 'platonic values' spoken of by leading scientists are explained in the Eastern Philosophy as the concept of the Universal mind. Teachings of Oriental Saints advocate that to be liberated, we need to go beyond Material consciousness, mind consciousness and understand the Transcendental Consciousness beyond and become enlightened.

46. Extension of Psychological Human memory model to include Chidakasha Gaurav Mathur, Reena Mathur

Human mind is the most complex part of the human body which the scientists and psychologists are still struggling to decode. The Atkinson–Shiffrin model of human memory is considered a pioneer approach of decoding the human memory though much refinements have been done on that too. However if we now analyze the concept of Chidakasha, the concept of Karma theory as given in Sant Mat and Hinduism, we find scientists only focusing on the "sthool" sharira and neglecting the "sukhsma" and the "karana" sharira which carry on to live even after our physical death and which are plausible explanations of memory surviving in people of their earlier births. This paper attempts to extend the The Atkinson–Shiffrin model to include the effects which are said to be permanently stored in the Chidakasha and which is the source of guidance of karmas in our present lives as per the beliefs of Hinduism and Sant Mat.

47. Six Sigma Spirituality – An Eastern Methodology Gazal Mathur, Sohang Mathur, Bhakti Mathur, Mrityunjay Mathur

The recent Hollywood blockbuster 'Interstellar' addresses a concept which we are still grappling with – reality beyond our physically perceived dimensions. Where the third dimension offers a sense of comfort – the fourth dimension comes with greater perceptual challenges. The dimensions beyond that of course seem far beyond our conceptual ability. Yet we now believe them to be the realm of reality. It however stands to reason that if it is real, then it must be perceivable. A physicist may be able to offer a logical rationalization of the existence of innumerable dimensions but an enlightened sage may be able to give you an experiential account of them. Thus the amalgamation of science and spirituality seems to be not only a probable but beneficial eventuality. If we similarly divide our persona into two factors – the internal and external, we may begin to see a vast divide between the two.

We are well acquainted with our external self but the internal still eludes us. Spirituality deals with our internal identity. This paper addresses the need to engage with the internal without defacing the external. It offers a methodology by which one can come full circle - realize higher dimensions, and as seen from the Eastern philosophical perspective, attain higher spiritual levels of consciousness as well as becoming a contributive member of society. Six Sigma is a concept that may prove significant in our endeavor. It has proven useful in the business arena as it seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability.

48. A Critical Analysis of Pain and Pleasure and its Consequence at Different Levels of Consciousness Sohang Mathur, Gazal Mathur, Bhakti Mathur, Mrityunjay Mathur

This paper aims to establish that true pleasure lies at the seat of the spirit entity and nowhere else. The body and mind are covers which dim or obscure our true essence or spirit force. Pain is a result of the diffusion of this spirit energy. On the other hand, when there is a concentration of spiritual energy at any sense organ, we derive pleasure. One may consequently assume that if we rid ourselves of the body and mind, we are left with only the spirit (the true source of pleasure) but contrary to this belief, the body is the instrument given to us to commune with higher levels of perception. It is equipped with nodal centres in the body as well as ganglia in the brain which help us to connect to elevated planes of consciousness. These higher planes move towards spirit intensive regions where the existence of pleasure is on a constant upward trajectory. Thus the body, mind and soul are a package deal awarded to human beings in order to attain the much alluded awareness of pure bliss.

53. Lower-Consciousness to Cosmic-Consciousness With reference to Huzur Maharaj's Pilgrim's Path and Dante Alighieri's The Divine Comedy Namita Bhatia, Soami Das Bhatia

The mystics believe that man has the hidden potential for awakening higher levels of consciousness. But it is beyond sense perception and manifests inwardly. It is associated with the bliss of extraordinary intensity culminating in the ecstasy of an experience of union with God –the Supreme source of consciousness and spirituality. During the past five to seven hundred years, beginning with the advent of Sant Kabir there has been a succession of great Saints whose teachings are uniform in nature and may collectively be called as the Religion of Saints. Kabir Sahab, Guru Nanak, Paltu Sahab, Jagivan Sahab, Tulsi Sahab, and Soamiji Maharaj are the Saints in this tradition. These Saints have spoken of higher regions of creation beyond Parabrahmapada of the Vedic religious tradition. They have all stressed on the importance of Bhakti of a True Guru, concentrating on and listening to the ever reverberating internal spiritual sounds via meditational practices, living an ethical and moral life, stressing the brotherhood of man and attaining oneness with the Lord. The Pilgrim's Path is one of the significant holy books of the Radhasoami Faith. It consists of letters written by Param Guru Huzur Maharaj to various satsangis. Though the letters are of a private nature and refer to particular cases but the subject matter dealt with in them concerns all pilgrims travelling on the path of spiritual development.

57. Towards Machine Consciousness: Leveraging Neural Networks And Analytics For Improving Business Processes Alakh Bhatnagar, Umang Bhatnagar, Shalini Nigam, D.K. Banwet

A tangible step towards achieving Machine Consciousness is to record, analyze, and model the functioning of conscious entities and then applying these models to make machines more efficient at what they do. The last decade witnessed the internet revolution which has been the biggest innovation since the industrial revolution. The exponential advancement in internet and digital technologies has fundamentally changed the way data is generated, collected, stored, and analyzed for insights. At the same time the number of machines getting connected to each other increased manyfold, created a new ecosystem of connected machines, and started harnessing large amount of performance data available for enhanced efficiency. The new age machines not only use data, but now have the ability to create models, predict outcomes, evaluate results and make a conscious decision to alter their own performance to optimal levels. As the new age business processes get connected to digital infrastructure, the industry is looking forward to reaping benefits at industrial scale by leveraging analytics and networks. Neural network analysis is one such example which takes inspiration from the functioning of human brain. Neural Network Analysis gives business processes the capability to alter their performance and deliver optimal levels of performance. This paper aims to quantify benefits that a business process can reap by leveraging neural networks and analytics. Representative data set of business process (transactions) was accessed from publicly available sources and analyzed using artificial neural networks and other analytical techniques on the statistical computing software R. The results demonstrate that by leveraging neural networks and

additional analytical techniques, business processes can decrease process down time and improve both efficiency and accuracy. This paper also aims to explore further applications of neural networks and analytics while Internet-of-Things (IoT) goes on to connect several industries and pushes the machines from being smart to consciously efficient.

58. The Matrix of Consciousness: Guru Influences Disciples through Spiritual Force Field at His Will Surat Kumar, Kavita Kumar, Bhakti Kumar, Reeti Kumar

It was proposed earlier that every individual with inherent spiritual force field, is in communion with Guru. Guru through his spiritual force field can influence the disciple in the process of spiritualization. Spiritualization, does not depend on the distance. Guru affects spiritualization from a distance, through spiritual domain of spiritual force field. This process of spiritualization can manifest through its various coordinates. The spiritual force field is the prime force field of the region of pure spirituality. It can influence the forces of physical world. Spiritual force field cannot be detected by physical means. Some effects like appearance of γ-waves in the proximity of the Guru creates resonance with the spirit currents of the disciples in the proximity of an adept. Such resonance can still be generated by the Guru, even when the discipwles are situated at far-off places. These effects are manifested when the disciples establish perfect communion with the Guru. This process of spiritualization induces the consciousness of the Guru in the disciples. But this spiritualization is quantized in step-by-step manner through levels/grades. This process can be further identified as the spirituality further advances.

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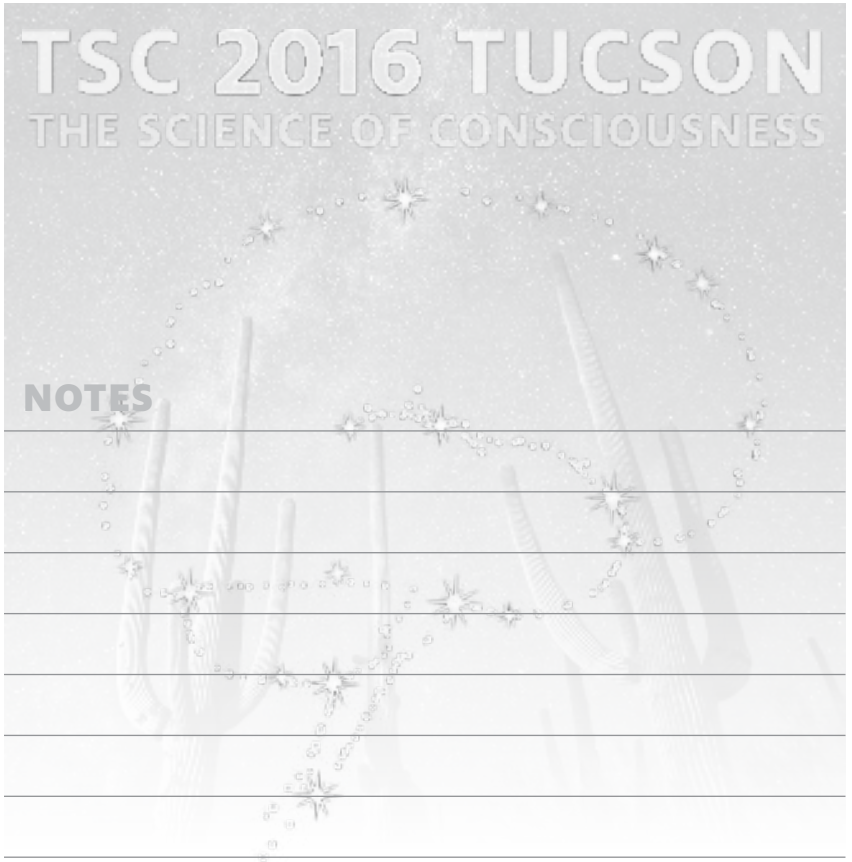
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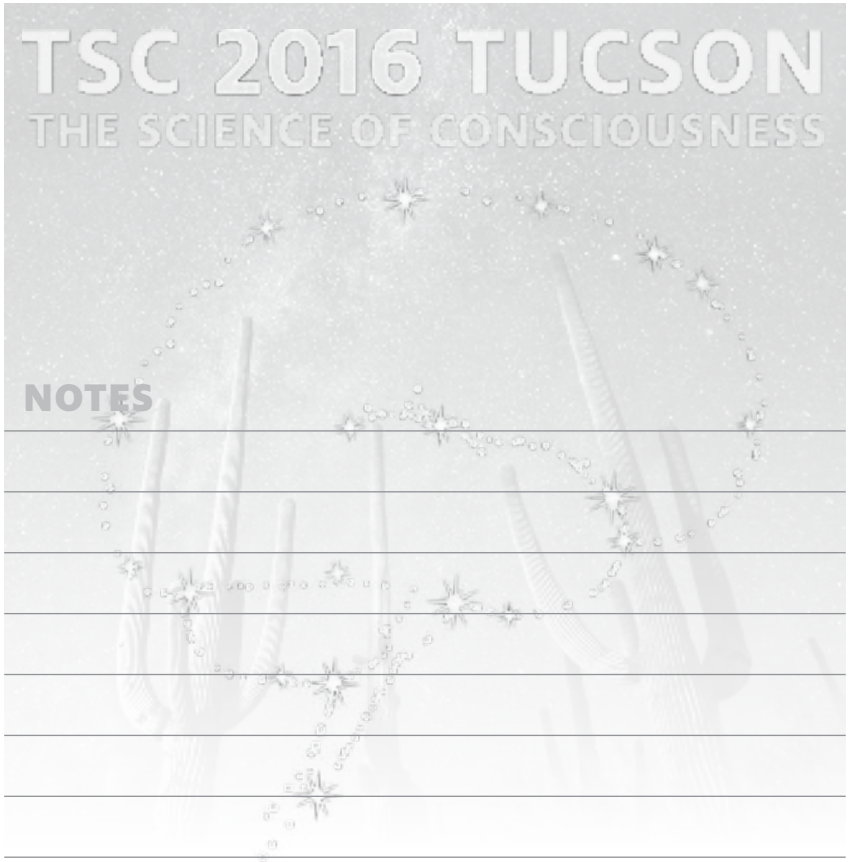
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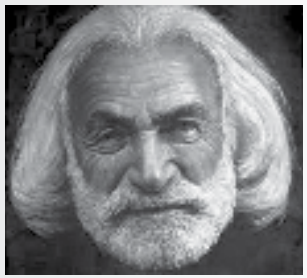
In Memoriam ~ Karl H. Pribram (1910-2015)



Karl H. Pribram, the eminent brain scientist, psychologist and philosopher, died of cancer on January 19, 2015, at age 95, at his home in Virginia. Dr. Pribram has been called the "Magellan of the Mind" for his pioneering research into the functions of the brain's limbic system, frontal lobes, temporal lobes, and their roles in decision making and emotion.

Born in Vienna, Austria in 1919, to a Czechoslovakian father and Indonesian mother (both distinguished bacteriological researchers) Pribram attended grammar school in Gstaad, Switzerland, and high school at Culver Military Academy in Indiana, from which he graduated in 1936. He received his BS degree from University of Chicago in 1939 and received his MD in 1941, becoming one of the first 300 board-certified neurosurgeons in the world.

During his years as a practicing neurosurgeon (1941-1948) first in Memphis, Tennessee and then in Jacksonville, Florida, he began his collaboration on primate research with Karl Lashley at the Yerkes Primate Center, where Pribram succeeded Lashley as director and also introduced numerous human surgical techniques to the field of animal research. During Pribram's subsequent ten years (1948-58) on faculty at Yale University in New Haven, CT, Pribram simultaneously established a research lab at the Institute for Living in Hartford, which "became a mecca for students intensely interested in the relationship between brain and behavior."

In 1958-59, Pribram joined the Center for Advanced Study in the Behavioral Sciences at Stanford University in Palo Alto. During his subsequent 30 years at Stanford University (1959-1989), Pribram pioneered the field of neuropsychology (a term that he coined), leading groundbreaking research into the interrelations of the brain, behavior, and the mind. Upon becoming emeritus at Stanford in 1989, Pribram was named Eminent Scholar of the State of Virginia, and Distinguished Professor of Psychology and director of the BRAINS center (Brain Research and Informational Sciences), a research laboratory created for him at Radford University. Over this same period (1989-2013) he was also appointed Distinguished Professor in the Engineering and Computer Science Department at George Mason University, and (simultaneously, up to his death) also served as Distinguished Professor of Psychology and Cognitive Neuroscience at Georgetown University in Washington, DC.

Pribram authored more than seven hundred books and scientific publications, including: Plans and the Structure of Behavior (with George Miller and Eugene Galanter, 1960), which is credited with launching the "Cognitive Revolution in Psychology"; Languages of the Brain (1971), an early influence upon neural networks and pattern recognition; Freud's Project Re-assessed (with Merton Gill, 1976); and Brain and Perception (1991) which expands Pribram's long-established holonomic theory of memory and perception, and has become the subject of numerous popular books, including Michael Talbot's The Holographic Universe and Lynne McTaggart's The Field, among many others. He edited the publications of the proceedings of a series he founded of international brain conferences with papers presented by distinguished scientists and Nobel laureates, through the 1990s. Pribram's recent and final publication, The Form Within (2013), provides the 200-year history of brain research from his 70-year-long insider point of view. (Pribram's theory and data papers may be found on his website KarlPribram.com.)

Pribram was the recipient of more than sixty major international awards and honors, including a lifetime grant from the US Office of Naval Research; a Lifetime Research Career Award from the National Institutes of Health; a Lifetime Achievement Award from both the Society of Experimental Psychology and from the Washington Academy of Sciences; honorary doctorates in psychology and neuroscience from the universities of Montreal, Canada and Bremen, Germany; and an Outstanding Contributions Award from the American Board of Medical Psychotherapists. Pribram was also the first laureate to receive the Dagmar and Vaclav Havel Award for uniting the sciences and the humanities.

Karl Pribram is survived by Katherine Neville of Warrenton, Virginia, and his five children: John Pribram of Charlottesville, Virginia; Joan Pribram-Jones of Redwood City, California; Bruce Pribram of Brooklyn, New York; Cynthia Pribram-Byrne of Bruce,Wisconsin; and Karl S. Pribram of San Francisco, California. Also surviving him are five grown grandchildren: Sarah Pribram of Shelburne,Vermont; Megan Pribram of Brooklyn, New York; Aurora Pribram-Jones of Tustin, California; Thomas Pribram-Jones of Redwood City, California; and Andrew Pribram-Riddell of Prague, Czech Republic; as well as one great-grandchild, Aiyada Pribram-Jones of Thailand.

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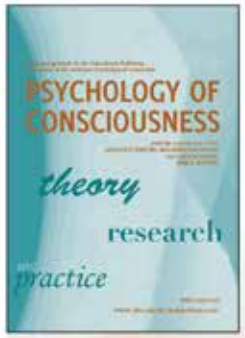

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Walter J Freeman
Division of Neurobiology
Department of Molecular & Cell Biology
University of California Berkeley

Congratulations to Walter Freeman on the occasion of his 90th Birthday!

I am fourth generation physician in my family. I was born and raised in Washington, D.C., studied physics and mathematics at M.I.T., electronics in the Navy in World War II, philosophy at the University of Chicago, medicine at Yale University, internal medicine at Johns Hopkins, and neuropsychiatry at UCLA. I have taught brain science in the University of California at Berkeley since 1959, where I am now Professor Emeritus. I received my M.D. cum laude in 1954, the Bennett Award from the Society of Biological Psychiatry in 1964, a Guggenheim in 1965, the MERIT Award from NIMH in 1990, and the Pioneer Award from the Neural Networks Council of the IEEE in 1992. I was President of the International Neural Network Society in 1994, and am Life Fellow of the IEEE. I have authored over 500 articles and 5 bocks: "Mass Action in the Nervous System" 1975, "Societies of Brains" 1995, "Neurodynamics" 2000, "How Brains Make Up Their Minds 2001; and "Imaging Brain Function with EEG" (2013) with Rodrigo Quian Quiroga.

In my career I described neural population dynamics with solutions to ordinary differential equations with fixed time coefficients and variable gain coefficients to model state changes with learning. I showed that cortical "spontaneous" activity is generated by mutual excitation in excitatory populations that are stabilized by refractory periods, not inhibition, giving scale-free spectra. I introduced power spectra in log-log coordinates and named the upper reaches of EEG spectra as gamma (30-80 Hz) from negative feedback and epsilon (80-160 Hz) from positive feedback. I localized gain changes with learning to the synapses not between input axons and pyramidal cells but between pyramidal cells forming Hebbian assemblies for generalization and abstraction. I pioneered spatial spectral analysis of EEG and ECoG for the design of electrode arrays and discovered the code used by cortex to display memories in scale-free spatial patterns of amplitude modulation (AM) of carrier frequencies in beta and gamma wave packets formed and ended by phase transitions. I introduced the Hilbert transform and discovered the conic phase gradient of the beta-gamma carrier, providing a key to the quantum field properties of wave packets. I introduced intentionality and the action-perception cycle into studies if the neurodynamics and neural correlates of consciousness.

Special Thanks to George Mashour

Founder, Center for Consciousness Science
University of Michigan, Ann Arbor

Congratulations and thanks to George Mashour MD, PhD who has founded the Center for Consciousness Science at the University of Michigan, Ann Arbor, and is co-sponsoring and co-chairing the TSC 2016 conference. Dr Mashour has a longstanding interest in consciousness, stemming from an undergraduate study of philosophy. His research group approaches consciousness across multiple disciplines (neuro-science, anesthesiology, biomedical engineering, psychology, philosophy) as well as multiple models and species. As an anesthesiologist, Dr Mashour deals with consciousness on a very practical level, day in and day out, and his research tools include studies of anesthesia, sleep and altered states, using advanced analytic and experimental tools. He received the prestigious Presidential Scholar Award in 2011 from the American Society of Anesthesiologists.

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And to the Entire Dayalbagh Educational Institute Agra India and DEI International Delegation to The Science of Consciousness – Tucson

The East-West Forum is now a familiar feature at the TSC series of conferences, starting with TSC 2012 at Tucson, TSC 2013 at DEI, Dayalbagh, India, TSC 2014 at Tucson again and TSC 2015 at Helsinki, Finland. The Fifth East-West Forum at TSC 2016 will be yet another landmark integration effort as part of the TSC-series. The above quote rather prophetically captures these momentous events, when not just two strong men from East and West stand face to face, but in fact, two galaxies of strong men from East and West meet at Tucson (Arizona) and Dayalbagh, Agra (India) also through video-conferencing.

A meaningful East-West dialogue seems feasible as has been increasingly evident from TSC-2012 through TSC-2015. To meet these challenges, the landmark Fifth East-West Forum at TSC-2016 is intended to be a place where one presents key ideas from both approaches and where these ideas can interact in the spirit of constructive mutual criticism, evaluation and enrichment. It appears plausible to evolve a science of inner experience (which is repeatable and verifiable) by attempting to integrate Eastern and Western scientific approaches and philosophy by verifying inner spiritual phenomenology of consciousness through well-established scientific epistemology, including three important stages of observation (awareness), report (description) and analysis (understanding) (Price and Barrell, 2012) while also availing of modern techniques of fMRI and MEG scans in capturing repeatable physiological / physical parameters of neural correlates accompanying inner spiritual experience during meditational practices.

"Oh, East is East and West is West, and never the twain shall meet,
Till Earth and Sky stand presently at God's great Judgment Seat;
But there is neither East nor West, Border, Nor Breed, nor Birth,
When two strong men stand face to face,
though they come from the ends of the earth!"
—(Rudyard Kipling (1889) : The Ballad of East and West)

HAPPY BIRTHDAY DAVID CHALMERS!

Dave rocked the first TSC in 1994 with his iconic talk on the 'hard problem', galvanizing an international movement in consciousness studies. He discussed the logical possibility of 'zombies', creatures who outwardly looked and generally behaved like us, but lacked any inner conscious experience, or feelings. If zombies could indeed exist, what critical features would be lacking in their brains? Following the conference, Dave's 28th birthday was celebrated on a hike through the Grand Canyon with other speakers and colleagues.

Dave joined the TSC Program Committee for the 1996 conference where, in another memorable talk, he introduced his famous 'consciousness meter' (looking suspiciously like a hair dryer). He pointed it at various audience members to search for zombies (pretending to find them in the personae of materialists Patricia Churchland and Daniel Dennett). It was truly hilarious, but deftly showed the serious futility in detecting consciousness using technology. Soon thereafter Dave moved to Tucson and the philosophy faculty at the University of Arizona, becoming the youngest 'Regent's Professor' in school history. He became a key part of the 'U of A's' Center for Consciousness Studies ('CCS'), founded in 1997 with a grant from The Fetzer Institute by Al Kaszniak, Alwyn Scott, Jim Laukes and Stuart Hameroff. Dave served as CCS director from 1999 to 2004, when he returned to his native Australia and subsequently New York.

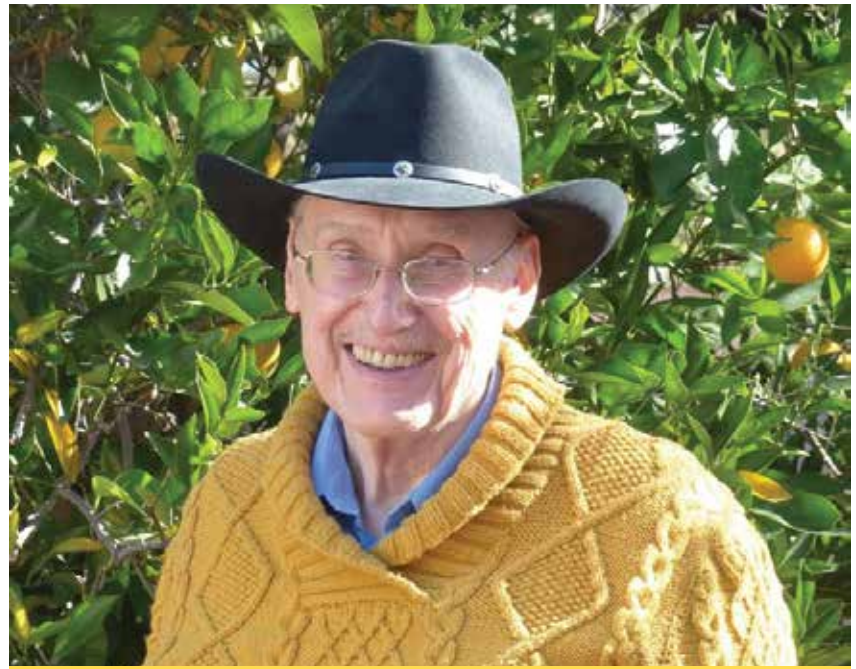
In the past few years, Dave has lived in New York and elsewhere with his partner, Brazilian cognitive scientist Claudia Passos.

Dave continued to co-organize TSC 'Tucson' conferences with Stuart Hameroff and Abi Behar-Montefiore through the 2014 'twenty year anniversary' conference, but has now taken a well-deserved 'step back' from active conference organization. We're very happy for his continued involvement.

A world class philosopher, Dave's work on philosophy of mind has broadened to cognitive science, language, extended mind, panpsychism, the nature of verbal disputes, constructivism, quantum mechanics and virtual reality. He's also known, especially at TSC, for his good humor, charm and wit, and for forays into entertainment and fun-loving behaviors with deeper meanings.

At the 1999 'Quantum Mind' conference in Flagstaff, Arizona, Dave, Pradeep Mutalik and Stuart Hameroff were drinking beer on a balcony at a blues bar. As the band played 'Bad to the Bone', they began to muse on the paradox of whether zombies could have the blues. Zombies would certainly have reason to feel sad, but lack the capacity to feel anything. To the background music, Dave began to sing: "I act like you act" (Dah DAH, dah DUM) — "I do what you do." (Dah DAH, dah DUM) — "But I'll never know," (Dah DAH, dah DUM) — "What it's like to be you." (Dah DAH, dah DUM) — "Cause I got....the Zombie Blues" (Blues riff).

The rest, as they say, is history. Dave first performed the Zombie Blues at the Poetry Slam at Club Congress in downtown Tucson during the 2000 TCS conference and at TSC conferences ever since. He is also the lead singer of the Zombie Blues Band which performed at the 'Qualia Fest' in 2012 in New York. **Happy 50th Dave. We love you, man.**



Alvin J. Clark is Professor Emeritus of Molecular Biology and Genetics at the University of California, Berkeley. At present he is associated with the laboratory of Professor of Neuroscience Linda Restifo at the McKnight Brain Institutes, University of Arizona. Professor Clark's interest in consciousness studies stems from his exposure to a monistic philosophy that was part of the Shaivism taught and practiced in 10th and 11th century Kashmir. As he understands it, that philosophy asserts that consciousness is the ultimate source of all that is. Professor Clark is therefore curious about the relationship of that ultimate consciousness with the consciousness that he experiences as a human. His main interest at the moment is to understand what influence human genetic diversity has on human consciousness.

THANK YOU ALVIN J. CLARK

THE UNIVERSITY OF ARIZONA Center for Consciousness Studies

CENTER FOR CONSCIOUSNESS SCIENCE

Mani L. Bhaumik

Quantum Gravity RESEARCH

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The Science of Consciousness
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2016 Bhaumik Prize in Consciousness Studies

The 2nd Bhaumik Prize in Consciousness Studies is awarded to the University of Arizona Center for Consciousness Studies Department of Anesthesiology

Mani L. Bhaumik, PhD
Member, Board of Advisors
Physical Sciences Division, UCLA

A UCLA physicist, inventor, author and philanthropist Dr. Mani Bhaumik earlier in his career directed the Laser Technology Laboratory at Northrop Corporation and in 1973 showed that 'excimer' lasers could be efficient enough for practical applications. Most notably, it can cut through living tissue without burn damage, a feature which became essential for 'Lasik' eye surgery.

Bhaumik passionately advocates for public awareness of quantum physics, cosmology and their implications for humanity and spiritual development. Now a retired physicist, bestselling author and lecturer, Dr. Bhaumik continues to be very active in research on the ontology of quantum physics and consciousness and is passionate about sharing with the public the astounding advances in quantum physics and cosmology and their implications for our lives, work, technology and spiritual development. This he endeavors to do through books, articles, lectures and TV programs like the awardwinning Cosmic Quantum Ray.

The Bhaumik prize highlights the celebration of the TSC 23rd Anniversary program, a feature to commemorate the many years of the TSC-CCS conferences and the support of continued research in the field of consciousness studies. Dr. Bhaumik is a visiting scholar at the UCLA, Department of Physics and Astronomy. He is conducting theoretical research on the foundation of quantum theory and its possible link to consciousness. He is also providing significant financial support to the quantum gravity research at UCLA, which could help in comprehending the Gravity Waves recently observed by LIGO, thereby getting us a step much closer to our understanding of the unification of the forces and particles of nature.

In 2014 The First Bhaumik Prize was award to Sir Roger Penrose in Tucson at the 20th Anniversary of the TSC Conferences.