

University of Pisa and Foundation of Mind present the Summer School on

“Consciousness and Cognition”

August 29 – September 6, 2020

Director: Bruno Neri



Bruno Neri received his "Laurea" degree "cum laude" from the University of Pisa in 1980, in 1983 he joined the “Dipartimento di Ingegneria dell'Informazione” of the same University, since 2000 he is Full Professor of Electronics. Prof. Neri has taught and teaches several courses in the fields of Instrumentation and Measurements, Electronics for Telecommunications, Wireless electronic systems, Design of microwave integrated circuit, moreover currently he holds a short course entitled "Science and contemplative practices" at the Master of the University of Pisa entitled "Neurosciences, Mindfulness and Contemplative Practices".

His current research interest is in the field of Mind Sciences regarding the effect of meditation on brain activity: in this framework he spend several weeks each year inside Tibetan Monasteries in India to carry out his research. In September 2017 he was co-chair of the Symposium "The Mindscience of Reality" in which His Holiness the Dalai Lama participated as a guest of honor.

Program Coordinator: Seán Ó Nualláin



Seán Ó Nualláin holds an M.Sc. in Psychology from University College, Dublin (UCD) Ireland & a Ph.D. in Computer Science from Trinity College, Dublin, Ireland. He has been Visiting Scholar at Stanford University in Philosophy and Neuroscience and a member of the Stanford faculty with two courses he developed and taught for credit there through the Symbolic Systems program: Neuroscience and Experience and Biosemiotics. At UC Berkeley he has been a Visiting Scholar in Computer Science at ICSI and Molecular and Cell Biology (both cell and developmental and neuroscience with Walter Freeman III). He has also been a Visiting Research Scientist in AI for 3 years at the National Research Council, Ottawa, Canada.

He is the author of a book on the foundations of Cognitive Science: “The Search for Mind” (Ablex, 1995; 2nd ed Intellect, 2002; Third edition Intellect, 2003) and editor of “Two Sciences of Mind” (Benjamins, 1997); editor of “Spatial Cognition” as well as co-editor of “Language, Vision, and Music” (Benjamins, 2002) . He is also author of “Ireland: a colony once again” (CSP, 2012) and “One Magisterium” (CSP, 2014) acclaimed as a masterpiece in a review by Stuart Kauffman. His “Being Human: the Search for Order” sold out its first print-run immediately and has been published in a second edition which was launched at Stanford University bookstore in May, 2004. After developing the first ever program in computational linguistics in Ireland, Sean has also worked as a professional folk and jazz musician. Sean is the author and editor of many other monographs and edited collections including most recently seven Volumes of Proceedings from 2014 to 2019 with his group called Foundations of Mind.

Cognition and consciousness

(Sean O Nuallain – Foundation of Mind)

Course objectives: As a result of this course, students should: Acquire sensitivity to the distinction between Cognition and consciousness; Acquire an overall view of the areas involved; Become aware of the continuity of the current research with precedents in history; Know the basic arguments in the philosophy of mind from Plato through Descartes, Berkeley, Hume, Kant, Levine and such popular putative contributions as that of Chalmers; become able to evaluate the many current and future claims that will be presented to them proposing a direct link from neural fact to subjective experience.

Lectures

1. Cognitive Sciences: definitions
2. Global work space theory – consciousness theories : Freeman, Tononi, Edelman, Linas and Pase
3. The contrastive approach in consciousness studies
4. Multimodal mapping. Spatial location and information integration
5. Summary and conclusions Texts – Copies of “The search for mind” and “Two sciences of mind” will be distributed

Consciousness between Western Philosophical Research and Eastern Wisdom Traditions

(Pierluigi Barrotta-Università di Pisa, Giulia Moiraghi – Independent Researcher)

Course objectives: Cognition and consciousness refer to the same object of study or does consciousness include a much wider dimension, of which cognition is just a part? Through a progression into insights drawn from Western philosophical approaches (especially phenomenology) and Eastern traditions and practices, students should acquire a sensitiveness to the existence of a dimension of consciousness that overcomes the distinction between subject and object and understand its role in the current quest to explain consciousness.

Pierluigi Barrotta

Lectures

1. *Gestalt* perception: from a passive to an active mind theory
2. The qualitative character of experience and the ‘what is like question’
3. The easy and hard problem in consciousness studies
4. The ‘third way’ of Phenomenology. From Husserl to Merleau-Ponty

Pierluigi Barrotta is currently Full Professor of Philosophy of Science ("Galileo Galilei" Chair) and Director of the Department of Civilizations and Forms of Knowledge of the University of Pisa. He is the author of seven books, editor of twelve volumes and has published over 40 essays in Italian and

foreign magazines. His academic interests range from the relationship between science and society, to the history of science, to the theories of scientific rationality, to the epistemology of economic and environmental sciences. His latest book on "Science and Democracy" was published by the Carocci publishing house.

Giulia Moiraghi

Lectures

5. Being-in-the-world, embodiment, and the indivisibility of object and subject
6. The importance of phenomenal consciousness in certain Eastern philosophies
7. A theory of attention in Yoga *Darshan*
8. Interrelatedness in selected Buddhist and tantric Shivaist traditions

Giulia Moiraghi is a post-doctoral scholar in Philosophy and has been a Yoga practitioner for 20 years. After a *summa cum laude* Master's Degree in Contemporary Aesthetics from the University of Milan in 2005, she completed a Ph.D. in Philosophy at the University of Verona in 2010. She is the author of several essays on philosophical, artistic and yoga subjects and of two books: *In cammino verso la cosa. Heidegger dall'estetica all'ontologia*, Mimesis, 2006, and, with Corriere della Sera, *Cura e Ardore. Il rigore e la passione della pratica yoga*, RCS, 2017. She is a certified yoga teacher, a Y.A.N.I. member (National Association of Yoga Teachers) and teaches yoga and meditation since 2013. She developed, through breathing techniques and postures, "Fenomeno Yoga": an embodied phenomenological method and project in which the practice of yoga creates a bridge of communication between Eastern contemplative practices and Western philosophical insights. She has just been included in the teaching panel of Mind and Life Europe.

Neurodynamics (or Computational Neuroscience)

(David Bernal-Casas – University of Barcelona)

Course objectives:

- Demonstrate knowledge and understanding of fundamental concepts of computational neuroscience.
- Explain the main physical characteristics of biological neurons (synaptic mechanisms and membrane potential, action potential generation and propagation) and how they can be modelled.
- Implement simple (one or two compartments) models of LIF neurons.
- Explain features and underlying mechanisms of different computational models of synaptic plasticity.
- Build computational models of small cortical circuits as simple networks of learning neurons and be able to understand the functioning of, and modify more complex ones.

Lectures:

- The biology of the neuron (basic synaptic mechanisms, channel conductance, membrane potential)
- The generation of action potential (Hodgkin-Huxley model)
- Leaky integrate-and-fire (LIF) neurons
- Resonate-and-fire (RAF) neurons
- Population dynamics
- General structure of cortical layers, general cortical connectivity
- Synaptic plasticity

David Bernal-Casas studied Physics at the University of Barcelona. After finishing his studies he got a scholarship at the University of Heidelberg where he did a PhD in Computational Neuroscience. In his doctoral work he used stochastic dynamic causal modelling (sDCM) for fMRI responses to investigate the modulatory effect of genetic risk variants for schizophrenia on the prefrontal-hippocampal network and describe how these alterations influence behavior in healthy participants and patients.

Life sciences and the biosemiotics of signs

Can the origin of life processes coincide with the emergence of semiosis?

Franco Giorgi PhD

University of Pisa (retired)

Course objectives: Biosemiotics attempts to regain the meaning of situated relationships. In this perspective, the emerging relationships are conceived as contingent encounters of an ongoing process of semiosis, and the resulting signification as inherently associated with an interpreted choice. Through this course students will become acquainted with the semiotic nature of sign relationships both in biological and human-made systems, understand how cells act as semiotic units capable of interpreting their own environment through signs exchange, and eventually comprehend how sign perception and epigenetic regulation are causally linked through differential gene expression.

Lectures

1. The nature of the scientific explanation and the semiotic theory of signs: the flow of genetic information from DNA to proteins.
2. Code duality and the transition from analog to digital coding: genome evolution and the epigenetic regulation
3. Autopoiesis, structural coupling and semantic closure: the plasma membrane and semiotic selection

Franco Giorgi graduated in Biological Sciences at the University of Pisa in 1969. He then obtained a PhD in Epigenetics at the University of Edinburgh (Scotland) in 1975. From 1980 to 1990 he has worked as Associate Professor of Developmental Biology in the Faculty of Science, University of Pisa (Italy). On 1990, he became Full Professor of Biology at the Faculty of Medicine, University of Pisa. Over the years, Franco Giorgi has studied several morphological and functional features of the ovarian and embryonic development with particular reference to the processes of receptor mediated endocytosis and post-endocytic ligand modification. He has also worked on several research projects dealing with wound healing, collagen degradation and TSH receptors. After retirement he has become an active member of the International Society of Biosemiotic Studies.

Quantum Mechanics

(Shantena Augusto Sabbadini - Pari Center for New Learning)

Course objectives:

The course aims at giving the students a sufficient understanding of the basic principles of quantum mechanics to allow them to properly frame the subtler issues connected with the interpretation of the theory and their possible relevance for a discussion of consciousness, of the mind-body problem and of the nature of reality itself.

Lectures

- From classical to quantum mechanics (QM)
- Basic axiomatic structure of QM
- Interpretations of QM (1)
- Interpretations of QM (2)
- QM and consciousness

Shantena Augusto Sabbadini is a physicist, philosopher and a scholar of Chinese classics. As a physicist he worked at the University of Milan on the foundations of quantum physics and at the University of California on the first identification of a black hole. In the 1990's he was scientific consultant for the Erano Foundation, an East-West research institute founded in 1933 under the supervision of C.G. Jung. In that context he produced innovative translations of the *I Ching* and of the Taoist classics. He directs the [Pari Center for New Learning](#), an international institute located in the small medieval village of Pari, Tuscany. His latest books are *Pilgrimages to Emptiness* (Pari Publishing, 2017), *Buchi neri* (Lindau, Turin, 2018) and *Vacuum: The Ultimate Ground of Being*, with Maurizio Consoli (World Scientific, Singapore, expected to come out in 2020).

An Introduction to Artificial Intelligence

(Beatrice Lazzerini – Università di Pisa)

Course Objectives:

This course aims to offer students the opportunity to learn the basic concepts and models of nature-inspired computational techniques, and to know how to apply them to a wide range of application areas. Students will be exposed to the advantages and challenges of using computationally intelligent systems with human-like capabilities in terms of reasoning, learning and adaptation.

Lectures

- Introduction to Artificial Intelligence (AI) techniques
- Machine learning
- Artificial neural networks: shallow neural networks, deep neural networks, learning paradigms
- Potentialities and risks of AI
- Freedom of choice and privacy
- Global trends in AI research. A European vision for AI
- Current and future AI applications
- Artificial Intelligence vs Biological Intelligence

Beatrice LAZZERINI is a Full Professor of Computer Engineering at the Department of Information Engineering of the University of Pisa, Italy. She teaches “Intelligent Systems” for the Master of Science in Computer Engineering of the University of Pisa, and "Computational Intelligence" for the Master of Science in Embedded Computing Systems, which is jointly offered by the University of Pisa and Sant’Anna School of Advanced Studies, Pisa. Her research interests include Computational Intelligence, with a particular emphasis on fuzzy systems, neural networks and evolutionary computation, and their applications to clustering, classification, profiling, image processing, data fusion, context awareness, risk analysis and management, diagnosis, forecasting, multi-objective optimization, multi-criteria decision making. She has co-authored seven books and has contributed to more than 230 peer-reviewed papers in international journals, books and conferences. She is a co-editor of two books. She was involved and had roles of responsibility in several national and international research projects and scientific events.

Non-ordinary states of consciousness: i) investigation techniques; ii) inner and outer empiricism

(Tania Re – Unesco Chair “Anthropology of Health – Biosphere and Healing Systems” Univ. of Genoa; Bruno Neri, Andrea Zaccaro, Nicola Vanello and Angelo Gemignani – Università di Pisa)

Course Objectives:

The course presents some experimental results deriving from the observation of brain activity in non-ordinary states of consciousness compared with ordinary ones. The first part of the course is dedicated to measurement techniques (FRMI and EEG) and to the processing of the related signals, followed by the description of the main effects on the neuronal networks of these states. In the last part, the results of two field research relating to the effects of psychotropic substances in shamanic cultures and to those of deep meditation in Tibetan monks in retreat will be presented.

Lectures (8 h)

- Functional Magnetic Resonance Imaging vs Electro-encephalography (**Nicola Vanello, 1h**)
- Digital signal Processing of Biological signals (**Nicola Vanello, 1h**)
- Phenomenology of Non-ordinary states of Consciousness (**Angelo Gemignani, 2h**)
- Non Ordinary states of Consciousness induced by natural substances (**Tania Re, 1h**)
- A review on the effect of Meditation on Brain Activities (**Andrea Zaccaro, 1h**)
- Concentrative vs Analytic Meditation: Report from a Tibetan Monastery (**Bruno Neri, 2h**)

Angelo Gemignani is a medical doctor, psychiatrist and doctor in psychology, full professor of neuroscience at University of Pisa, Director of the Department of Surgical, Medical and Molecular Pathology & Critical Care Medicine; Director of the Master in Neuroscience, Mindfulness and Contemplative Practices; Director of Clinical Psychology branch of the Pisa University Hospital. His didactic activity includes many different topics, i.e. the psychobiological bases of human behavior, the neural correlates of mental disorders, integrative cerebral functions and clinical psychology. His research activity is mainly devoted to the study of psychobiological mechanisms of a) sleep functions, b) consciousness and its related non-ordinary states (i.e. induced by meditation), c) distress and negative emotions. (i.e. sleep and consciousness changes in healthy volunteers simulating the human flight to Mars).

Bruno Neri (Director of the Summer School)

Tania Re is graduated in Clinical and Community Psychology, specialized in Gestalt Therapy at the CSTG in Milan and as a complementary therapist in Switzerland, deepening the study and practice of bio-natural disciplines. She was a student of Prof. Benson of the "Mind-Body Institute" in Boston where she learned the mind-body techniques, hypnosis and visualization techniques for the accompaniment of people with chronic and oncological diseases. Over the years she has specialized in Health Anthropology and Ethnomedicine. She is a founding member of the Unesco Chair "Health, Anthropology, Biosphere and care systems" at the University of Genoa and currently collaborates with the Tuscany Regional Center for Phytotherapy (CERFIT) and with the Gestalt Therapy Study Center (CSTG) of Milan. He teaches Ethnomedicine and Medical Anthropology at University Courses and Masters in health and works in Italy and Switzerland. His field research is carried out in

indigenous communities in South America by studying traditional medicines, plants and healing rituals.

Nicola Vanello, PhD in Automatics, Robotics and Bioengineering, is Professor at the University of Pisa. His research activity is related to models and methods for biomedical signal and image processing. In particular, his skills concern the study of cerebral functions in complex cognitive tasks, and the development of exploratory and confirmatory models for data analysis, using electroencephalography and magnetic resonance imaging (MRI). His research interests include the analysis of speech signal with a special focus in the estimation of subjects' mood and emotional state. He is author of several papers, contributions to international conferences and chapters in international books.

Andrea Zaccaro PhD, psychologist, is currently a research fellow in psychobiology at the University of Pisa, Italy. His research is based on the investigation of the neurophysiological bases of altered states of consciousness induced by contemplative practices such as meditation and respiratory techniques (i.e. pranayama), mainly focusing on their effects at the phenomenological, cognitive, neurophysiological, and cardio-respiratory level”