Network Neuroscience

Monday 11th June
NetSci 2018, Paris

Program, Abstracts, and Guide

Contents

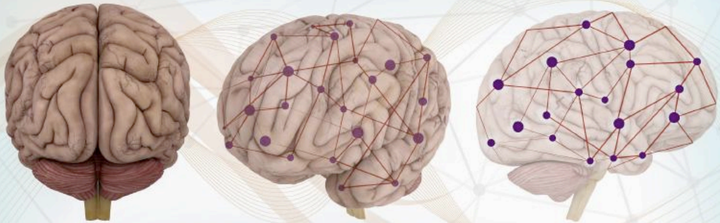
You can find an online version of this program on our website and Facebook page:

Website: http://netneurosci2018.com
Email: contact@netneurosci2018.com

www.facebook.com/networkneuroscience2018/

Sponsors

We wish to acknowledge the generous support of the **James S. McDonnell Foundation** and the **ARAMIS Lab (Inserm, CNRS, UPMC, ICM Inria).** We are extremely grateful for their contributions, which have helped make this Satellite possible, and are proud to be associated with them and their missions.



Network Neuroscience

Uncovering and understanding the relationship between elements in complex networks has helped propel Network Science in various fields, including neuroscience. The brain is inherently multiscale and multivariate in nature, and understanding each part of the hierarchy and their interconnectedness is vital to understanding brain structure, function and cognition. Genes and proteins interact on the subcellular level. Subsequent populations of cells connect - and integrate within different brain regions - to support and propagate coordinated excitations of neural signals. As dynamic patterns emerge within network circuitry, these signalling patterns integrate to ultimately self-organise the whole organ - itself a cohabitant within the body - which seeks to interact with its external environment and social systems. Studying the brain at these various levels has led to the emergence of Network Neuroscience: a Network Science affiliated field within the brain-based scientific frontier.

Network Science provides a new and natural mathematical framework for investigating functional and anatomical neuroimaging data, and represents a conceptual revolution that goes beyond standard approaches. Network based methods not only refine the outcomes of existing techniques, but also typify a paradigm shift for representing brain structure and dynamics. Equally importantly, the questions posed by neuroscience have the potential to inspire the development of new tools and areas within the broader field of Network Science itself.

The themes of this Satellite include, but are not limited to: (i) Interactome networks; (ii) Transcriptional and gene regulation networks; (iii) Structural brain networks (imaging); (iv) Functional brain networks (imaging); (v) Brain networks - theory, modeling and analysis; (vi) Signal processing and information flow; (vii) Circuit dynamics; (viii) Brain-behaviour interactions; (ix) Systems neuroscience. All themes apply to any species.

As many of you will know, this increasingly popular and vibrant satellite has been running for 3 years now, under the title of Brain Networks in 2015 and 2016 , and evolving to envelop the full scope of the emerging field of Network Neuroscience in 2017.

Program: Morning

Registration: **08:00** - **09:00**

Session I: Micro, Meso and Macro Scales
Chair: Petra Vertes

09:00 Introduction and Opening Remarks

09:10 Rodent Primate Differences in Cortical Networks (H. Kennedy)

09:35 Living Neural Networks: From Cells to Systems (A. Qutub)

10:00 Comparison of MRI Tractography and Anatomical Tract-Tracing of Cortico-Cortical Connectivity in the Ferret (C. Delettre)

10:15 Functional Connectivity: Can We Find a Common Ground? (A. Alinska)

Coffee **10:30** - **11:00**

Session II: Computational Approaches
Chair: Daniele Marinazzo

11:00 Opening Remarks

11:10 the Structure and Dynamics of Networks Many Layers (V. Latora)

11:35 Dynamic Information Routing in Networks of Oscillating Neuronal Populations (D. Battaglia)

12:00 Towards a Mathematical Theory of Communication in the Human Connectome (J. Goñi)

12:15 the Effect of Network Structure in Neural Computing (P. Vilimelis-Aceituno)

Lunch **12:30** - **14:00**

Session III: Function and Dysfunction in the Human Brain

Chair: Robin Wilkins

14:00 Opening Remarks

14:10 Economical Brain Networks in Health and Disease (E. Bullmore)

14:35 Zooming in, Zooming Out: Linking Microscopic Brain Properties to Large-Scale Network Topology (L. Douw)

15:00 Multimodal Core-Periphery Structure as a Possible Biomarker for Alzheimer’s Disease (J. Guillon)

15:15 Glioma Occurs More Often in Non-Hub Brain Regions (T. Numan)

Coffee **15:30** - **16:00**

Session IV: Dynamics and Control

Chair: David Papo

16:00 Opening Remarks

16:10 Transient Dynamic Brain Networks in MEG and fMRI (M. Woolrich)

16:35 Control Principles in the Caenorhabditis Elegans Nervous System (E. Towlson)

17:00 Temporal Metrics for Exponential Random Graph Models of Dynamic Brain Networks (C. Obando)

Session V: Closing Session

Chairs: Qawi Telesford & Fabrizio De Vico Fallani

17:15 Lightning Talks

17:50 Concluding Remarks

18:00 Poster Session

18:45 End

Rodent Primate Differences in Cortical Networks - Henry Kennedy
Université de Lyon, France
09:10 - 09:35

The house mouse (Mus musculus) has evolved in close proximity with human beings. While genetic engineering has promoted the mouse as an experimental model in neuroscience and despite the well established similarities of the macaque visual system to that in human, in recent years the mouse has displaced the macaque as a model system for understanding the brain.. Recent publications allow us to compare and contrast the statistical properties of the cortical networks in mouse and macaque. Both mouse and macaque display lognormal distributions of inter-areal connection weights and an exponential decline in weight with distance, making it possible to propose in both species an exponential distance law which predicts many of the observed network features of the cortex. Recent connectome studies in mouse and macaque allow further comparisons of the organizational principles. These studies show major differences in these two species in the network density in (i.e., the percentage of possible connections that exist). In macaque the density is 67%, while in mouse it reaches nearly 100%. Hence the observed wide range of weights plays an important role in determining the specificity in the cortical network. These high densities in mouse are made possible by the strong connectivity between primary sensory areas, which is rare in macaque. Another difference between the two species is the predominance of infragranular layers in the cortical network of mouse. Further investigations will be necessary to determine the representativity of each species of the primate and rodent order and the relevance of each for understanding the human brain.

Living Neural Networks: from Cells to Systems - Amina Qutub
Rice University, Houston, USA
09:35 - 10:00

Cellular communication and an ability to switch modes of communication is particularly critical during processes of tissue growth and regeneration. Yet much about the way cells communicate and interact is still unknown. In this talk, I will share how we are developing and integrating methods in data science and visualization, modeling and experiments to interpret the way human stem cells communicate as they form networks of neurons and astrocytes. While studies have focused on one or two modes of cell communication, how the three are interconnected in differentiating cells: chemical signaling, spatial patterning and electrical activity, has yet to be well understood. The integrated quantitative-experimental work introduced in this talk is illuminating how healthy neural cells switch their modes of communication to form electrically functional neuronal networks – and how these "living neural networks" change in childhood neurodevelopmental disorders and neurodegenerative diseases. Ultimately this work aims to uncover how variations in cellular communication correlate to variability in daily measures of human cognitive behavior.

The Structure and Dynamics of Networks With Many Layers - Vito Latora
Queen Mary University of London, UK
11:10 - 11:35

Many complex systems are better described in terms of graphs with many-layers. Examples are biological networks whose units can interact through different types of interactions, social systems where the relations/communications among a group of individuals are inherently dynamic and the patterns of connections change over time, or man-made infrastructures consisting of inter-connected networks. In this lecture I will present a brief overview on the novel methods to deal with networks with many-layers, namely multiplex networks, temporal networks and networks of networks. I will concentrate, in particular, on how to describe mathematically the structure of multiplex networks, and how to model different types of dynamical process occurring over them. I will show cases in which multiplexity gives rise to the emergence of novel behaviors, otherwise unobserved in single-layer networks, and I will discuss the relevance of multiplex networks in neuroscience.

Dynamic Information Routing in Networks of Oscillating Neuronal Populations - Demian Battaglia
CNRS, University Aix-Marseilles, France
11:35 - 12:00

It has been proposed that changing patterns of oscillatory synchronisation in different frequencies underly the flexible reconfiguration of functional networks. Here we substantially strengthen and expand this hypothesis through the use of theory and computational modeling. We demonstrate first that information transfer mediated by oscillatory coherence is a viable mechanism even when oscillations are very transient, stochastic-like and short-lived, as observed in vivo. Second, we show that the self-organization properties of oscillatory dynamics are fit for the control of information routing. Notably, we reveal how the information exchange between two distant regions could be "remote-controlled" by acting on a third region (e.g. by enhancing its drive), thus calling the attention on how misleading could be interpretations of experimental data that neglect a complexity view.

Economical Brain Networks in Health and Disease - Ed Bullmore
University of Cambridge, UK
14:10 - 14:35

There has been growing interest in the network organization – or connectome -of the human brain. By graph theoretical analysis of connectivity matrices derived from magnetic resonance imaging (MRI) it has been shown that human connectomes have a complex topology, characterised by small-worldness, modularity, and the existence of hub nodes and rich clubs. Human brains are also parsimoniously "wired", with a strong bias towards short physical distances between connected regions; although wiring cost is not strictly minimized. Similar topological and parsimonious properties have been demonstrated in *C. elegans* and mouse connectomes, suggesting that brain networks generally have been selected by an economical trade-off between competitive pressures to minimize biological cost and to maximise behaviourally valuable topological integration. In a sense, this economical theory of a trade-off between brain network cost and topology is a quantitative reformulation of the seminal laws of conservation for material and time, originally proposed by Ramon y Cajal. High cost / high value network components, like connector hubs, are preferentially implicated by diverse clinical brain disorders, including schizophrenia and Alzheimer's disease. To understand the network phenotypes of neurodevelopmental disorders, like schizophrenia, we need to understand how human brain networks develop normally in young people. For example, in adolescence, structural covariance network hubs are associated with faster rates of intra-cortical myelination and over-expression of schizophrenia risk genes. It seems that network science is in a strong position to understand more completely both the nearly-universal principles and the specific biological details of connectomes, with implications for the future of brain network medicine.

Zooming in, Zooming Out: Linking Microscopic Brain Properties to Large-Scale Network Topology - Linda Douw
VU University MC Amsterdam, The Netherlands
14:35 - 15:00

Although brain network analysis has been applied on multiple spatial scales, for instance on cultures of individual neurons at the lowest level and using whole-brain neuro-imaging at the highest level, the interrelations between these scales have rarely been investigated. Determining the molecular correlates of anatomical and functional brain networks will help us understand the brain in health and particularly disease. I will present recent work looking into the synergy between microscopic tissue features and regional large-scale network topology across several patient populations (glioma, epilepsy surgery candidates, multiple sclerosis) using varying macroscopic imaging modalities (magnetoencephalography, resting-state fMRI, diffusion weighted imaging).

Transient Dynamic Brain Networks in MEG and fMRI - Mark Woolrich
University of Oxford, UK
16:10 - 16:35

In recent years interest has grown in the study of large-scale networks of functionally specific brain regions. However, it is unclear how the apparently slow dynamics typically associated with fMRI resting state networks relate to the much faster time scales of cognitive processing. In this talk I will discuss the use of hidden Markov models and a combination of fMRI and MEG data to characterise networks as transient brain states that switch on and off over time across a range of time-scales. In MEG, we see switching at fast 50-100ms time-scales, characterised by transient bursts of phase-locking networks. In resting MEG and fMRI, we established that the switching is not random, with certain transitions being much more frequent than others. Intriguingly, we found that there was a tendency for the brain to either switch between networks associated with sensorimotor processing, or to switch between networks associated with more complex cognition, with only occasional switches between the two types. The patterns of this dynamic switching was also found to be heritable, and related to the individual subject's psychology.

Control Principles in the Caenorhabditis Elegans Nervous System - Emma Towlson
CCNR, Northeastern University, USA
16:35 - 17:00

Recent studies on the controllability of complex systems offer a powerful mathematical framework to systematically explore the structure-function relationship in biological, social, and technological networks. With a connectome featuring well-defined input nodes (sensory neurons), and experimentally testable behavioural responses (muscle contractions and relaxations) acting as outputs, the nematode worm C. elegans provides an ideal test-bed for network control principles.
We frame the locomotor response of C. elegans to mechanosensory input as a target control problem, allowing us to quantify the level of controllability of the muscles in the healthy C. elegans. We then probe the role of each neuronal class by systematically ablating it and reassessing the level of controllability. We predict that control of the muscles or motor neurons requires 12 neuronal classes, which include neuronal groups previously implicated in locomotion by laser ablation, as well as one previously uncharacterised neuron. We also investigate the involvement of individual neurons within each neuronal class, and predict that only particular single cell ablations will affect locomotion. We validate our predictions experimentally through cell-specific laser ablation and worm tracking experiments, finding that the ablations lead to behavioural defects. We show that our predictions are robust to deletions of weak connections, missing connections, and rewired connections, indicating the potential applicability of this analytical framework to larger and less well-characterised connectomes. Equally importantly, our results offer the first direct experimental confirmation of the predictive power of network control principles in real-world complex systems.

Comparison of MRI Tractography and Anatomical Tract-Tracing of Cortico-Cortical Connectivity in the Ferret - Céline Delettre, Leigh-Anne Dell, Arnaud Messé, Benoit Larrat, Sebastien Meriaux, Jean-Francois Mangin, Isabel Reillo, Camino de Juan Romero, Victor Borrell, Roberto Toro and Claus Hilgetag.

10:00 - 10:15

The anatomical wiring of the brain is a central focus in network neuroscience. Diffusion MRI tractography offers the unique opportunity to investigate the brain fiber architecture non-invasively and in vivo ; however, its accuracy is still highly debated. In this study, we aimed to validate the results obtained from diffusion MRI tractography of the ferret brain by comparing them to invasive anatomical tract-tracing data, the gold standard to date

Functional Connectivity: Can We Find a Common Ground? - Anna Alińska, Juan Camilo Avendaño Diaz, Agnieszka Tymorek, Paulina Anna Dąbrowska, Agnieszka Dębska, Florencia Garro, Marcin Koculak, Emilia Kolada, Aleksander Molak, Grzegorz Link, Çağdaş Topçu, Małgorzata Wierzba and Natalia Z. Bielczyk

10:15 - 10:30

Defining connections in the graphs, though, requires quantifying the dependence between the nodes. Does an optimal method to quantify functional connectivity exist? Or is the choice dependent on the data properties? How to define the functional connectivity for a particular problem? How should the choice of the method for functional connectivity depend on the data properties? Using a range of methods for quantifying functional connectivity, we summarize a number of conclusions that can contribute to more efficient and in depth functional connectivity research.

Towards a Mathematical Theory of Communication in the Human Connectome - Enrico Amico, Duong-Tran Duy Anh, Tipnis Uttara, Meenusree Rajapandian, Mario Ventresca, Harezlak Jaroslaw and Joaquín Goñi

12:00 - 12:15

Human brain connectivity may be seen as a multi-layered complex network with one slowly evolving structural topology (i.e., the human connectome as estimated by whole-brain structural connectivity or SC) and one rapidly evolving functional architecture (i.e. functional connectivity or FC) that is embedding a rich repertoire of functional patterns. In this work, we introduce three key measurements of any system where different communication processes are taking place on top of a fixed structural topology, namely processing load, broadcast strength and path capacity. Processing load (PL) estimates how much the signal has changed between the source and the target.

The Effect of Network Structure in Neural Computing - Pau Vilimelis-Aceituno, Gang Yan and Yang-Yu Liu

12:15 - 12:30

Reservoir Computing (RC) is one of the rare computing paradigms which can be used both as a theoretical neuroscience model and as a machine learning tool. Despite extensive research efforts, the impact of the reservoir topology on the RC performance remains unclear. Here we explore this fundamental question and show, both analytically and computationally, how structural features determine the type of tasks that these recurrent neural networks can perform.

Multimodal Core-Periphery Structure as a Possible Biomarker for Alzheimer's Disease - Jeremy Guillon, Valentina La Corte, Michel Thiebaut de Shotten, Bruno Dubois, Oliver Colliot, Mario Chavez and Fabrizio De Vico Fallani

15:00 - 15:15 .

We propose a multilayer network approach to analyze simultaneously structural and functional brain networks inferred from diffusion weighted imaging (DWI), functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG). We finally extracted the multiplex core-periphery structure in order to evaluate the impact of Alzheimer's Disease on key brain regions that are the one belonging to this multimodal core.

Glioma Occurs More Often in Non-Hub Brain Regions - Tianne Numan, Anand Eijlers, Kim Meijer, Jolanda Derks, Menno Schoonheim, Martijn Steenwijk, Philip de Witt Hamer, Petra Pouwels, Elizabeth Gerstner, Steven Stufflebeam, Brian Alexander, Koene Van Dijk, Daniel Cagney, Jeroen Geurts, Jaap Reijneveld and Linda Douw

15:15 - 15:30

Anatomical location in glioma (primary brain tumors) is also non-random, but its relationship with network properties is unknown. Here, we investigated whether tumor probability of glioma patients relates to healthy regional network topology (in an fMRI dataset) and healthy NLGN3 expression (in Allen Brain Atlas data). Based on prior work, we hypothesized that tumor probability would be higher in premorbidly highly active and/or connected regions with high NLGN3 expression.

Temporal Metrics for Exponential Random Graph Models of Dynamic Brain Networks - Catalina Obando and Fabrizio De Vico Fallani

17:00 - 17:15

In this work, we adopted a statistical model based on temporal exponential random graphs (TERGM) to reproduce time-evolving networks. Here, we defined temporal triangles and 2-paths as parameters of the TERGM and we showed that they can perfectly model the main properties of synthetic Watts-Strogatz networks assessed by link prediction capacity, as well as global- and local-efficiency. We finally applied our approach to dynamic brain networks of 10 stroke patients using resting state fMRI, and we show that by including temporal metrics our TERGM is also able to fit main reorganizational network changes over time.

Lightning Talks

1 - Uncovering the Structural Correlates of the fMRI Signal During Task and Rest With Graph Spectral Analysis
Nikou Damestani, Paul Expert, Federico Turkheimer, Rong Ye, Angie Kehagia, Steve Williams and Anna Combes

2 - Brain Network Dynamics for Visuomotor Behaviors
Andrea Brovelli

3 - Identification of Driver Nodes in Genetic Networks Regulating Macrophage Activation
Giulia Bassignana, Jennifer Fransson, Oliver Colliot, Violetta Zujovic And Fabrizio De Vico Fallani

4 - Integrating Large Brain Networks and Network Perturbation Analysis in Epilepsy Data
Adam Li, Sridevi Sarma And Viktor Jirsa

5 - a Network Model of Axon-Glial Communication
Darragh Walsh

6 - Neural Network Development From Single Cells
Amina Qutub, Arun Mahadevan, Byron Long and Andrew Ligeralde

7 - Massive Hierarchical Parcellations
Ouri Wolfson, Olusola Ajilore and Bo Xu

1. Measuring Controllability Through Synchronization
Gemma Rosell-Tarragó, Albert Díaz-Guilera.

2. The Effects of the Psychedelic Brew Ayahuasca on Human Functional Brain Networks
Aline Viol, Fernanda Palhano-Fontes, Heloisa Onias, Draulio B. De Araujo, Gandhimohan M. Viswanathan, Philipp Hövel.

3. Structural Connectivity Guides Direct Cortical Stimulation Through Optimal State Transitions
Jennifer Stiso, Ankit Khambhati, Tommaso Menara, Ari Kahn, Kathryn Davis, Joseph Tracy, Timothy Lucas, Fabio Pasqualetti, Danielle Bassett. S

4. Mesolimbic Dopamine and Salience Network Function: an Integrative PET and MR Study
Robert Mccutcheon, Matthew Nour, Sameer Jauhar, Paul Expert, Tarik Dahoun, Fiona Pepper, Mitul Mehta, Oliver Howes.

5. Brain Functional Network Alterations Due to Increasing Demands of Visuospatial and Auditory Working Memory Task
Miriam Kosik, Karolina Finc, Kamil Bonna, Simone Kühn, Włodzisław Duch.

6. Kernel Methods for Supervised Classification of Structural Brain Networks
Benjamin Chiêm, Frédéric Crevecoeur, Jean-Charles Delvenne.

7. Modeling Brain Dynamics in Brain Tumor Patients Using the Virtual Brain
Hannelore Aerts, Michael Schirner, Ben Jeurissen, Dirk Van Roost, Eric Achten, Petra Ritter, Daniele Marinazzo.

8. A New Tool for Neurosurgeons - Computer Models That Simulate Epilepsy Surgery
Ida A. Nissen, Cornelis J. Stam, Elisabeth C.W. Van Straaten, Linda Douw, Petra J.W. Pouwels, Sander Idema, Johannes C. Baayen, Demtrios Velis, Misa Taguchi, Piet Van Mieghem, Arjan Hillebrand.

9. Node Centrality Changes During Ageing Are a Potential Risk Factor for Later Onset of Alzheimer's Disease
Antonio Díaz-Parra, Oliver Kennion, David Moratal, John-Paul Taylor, Marcus Kaiser, Roman Bauer.

10. A Minimally Invasive Neurostimulation Method for Controlling Abnormal Synchronisation in the Neuronal Activity
Malbor Asllani, Timoteo Carletti, Paul Expert.

11. Navigability of Structural Brain Networks in Hyperbolic Space
Filip Miscevic, Olaf Sporns.

12. Cortico-Cortical and Cortico-Thalamic Connectivity of Occipital, Temporal and Posterior Parietal Visual Areas in the Ferret (Mustela Putorius)
Leigh-Anne Dell, Paul R. Manger, Alexandros Goulas, Giorgio Innocenti, Claus C. Hilgetag.

13. Altered Integration And Segregation in Disorders of Consciousness
Andrea Luppi, Michael Craig, Ioannis Pappas, Ram Adapa, Paola Finoia, Guy Williams, Judith Allanson, John Pickard, David Menon, Emmanuel Stamatakis.

14. Is the Brain a Resource Discovery Network?
Aishwarya Vijayan, Ouri Wolfson.

15. Task-Related Functional Network Reconfiguration Over the Course of 6-Week Working Memory Training
Karolina Finc, Miriam Kosik, Kamil Bonna, Włodzisław Duch, Simone Kühn.

16. Consensus Clustering Approach to Group Brain Connectivity Matrices
Javier Rasero, Mario Pellicoro, Leonardo Angelini, Jesus Cortes, Daniele Marinazzo, Sebastiano Stramaglia.

17. Effects of Spatial Smoothing on Group-Level Differences in Functional Brain Networks
Ana Maria Triana Hoyos, Enrico Glerean, Jari Saramäki, Onerva Korhonen.

18. Can Local-Community-Paradigm and Epitopological Learning Enhance our Understanding of How Local Brain Connectivity Is Able to Process, Learn and Memorize Chronic Pain?
Vaibhav Narula, Antonio Giuliano Zippo, Alessandro Muscoloni, Gabriele Eliseo Biella, Carlo Vittorio Cannistraci.

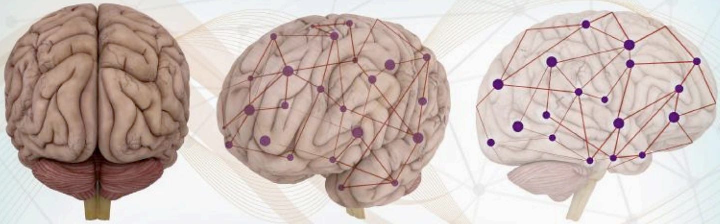
19. Short and Long-Term Changes of Functional Network Segregation Over the Course of Working Memory Training
Kamil Bonna, Karolina Finc, Miriam Kosik, Włodzisław Duch, Simone Kühn.

20. Toward Latent Network Geometry Markers in Neuroscience and Precision Medicine
Alberto Cacciola, Alessandro Muscoloni, Vaibhav Narula, Ali Al-Fatlawi, Alessandro Calamuneri, Salvatore Nigro, Emeran Mayer, Jennifer Labus, Giuseppe Anastasi, Aldo Quattrone, Antonino Naro, Rocco Calabrò, Liang Zhang, Anand Kumar, Alex Leow, Olusola Ajilore, Angelo Quartarone, Demetrio Milardi, Carlo Vittorio Cannistraci.

21. The Claustrum Is the Hub of the Dense Cortical Network
Ana Ribeiro Gomes, Szabolcs Horvát, Pierre Misery, Camille Lamy, Kenneth Knoblauch, Henry Kennedy.

22. Modulation of Conscious Visual Perception During the Entrainment of Fronto-Parietal Synchrony With Rhythmic Patterns of Transcranial Magnetic Stimulation in the Human Brain
Chloé Stengel, Marine Vernet, Julià Amengual, Antoni Valero-Cabré.

23. Uncovering the Dynamics of Consciousness on Multiplex Networks: a Preliminary Analysis
Marco Alberto Javarone, Srivas Chennu.



Network Neuroscience

Organizing Committee

Fabrizio De Vico Fallani (chair) (Inria & Institut du Cerveau et de la Moelle Épinière, France)
Danielle Bassett (University of Pennsylvania, USA)
Javier. M. Buldú (URJC & Center for Biomedical Technology, Madrid, Spain)
Raffaella Burioni (Università di Parma, Italy)
Guido Caldarelli (IMT Institute for Advanced Studies Lucca, Italy)
Andrea Gabrielli (Istituto dei Sistemi Complessi (ISC) - CNR, Rome, Italy)
Tommaso Gili (IMT School for Advanced Studies Lucca, Italy)
Joaquín Goñi (Purdue University, USA)
Daniele Marinazzo (UGhent, Belgium)
Johann. H. Martínez (Inserm U1127, Institut du Cerveau et de la Moelle Épinière, France)
David Papo (Université de Lille 3, France)
Olaf Sporns (Indiana University, USA)
Qawi K. Telesford (University of Pennsylvania, USA)
Emma Towlson (Northeastern University, USA)
Martijn van den Heuvel (University Medical Center Utrecht, The Netherlands)
Petra Vértes (University of Cambridge, UK)
Robin W. Wilkins (University of North Carolina-Greensboro, USA)

Thank you for joining us,
we hope to see you in 2019!