# ORAL SESSION: Neuroanatomy: Multiscale Connectomics

**Boris Bernhardt** Chair
McGill University
Montreal, Quebec
Canada

**Pierre Bellec** Chair
Centre de recherche de l'institut de gériatrie de Montréal
Psychologie, Université de Montréal
Montréal, Québec
Canada

Oral Sessions

## Presentations

### Cortical silencing results in paradoxical fMRI over-connectivity

Neuroimaging measurements of functional connectivity are commonly interpreted as an index of reciprocal interareal communication. However, direct experimental testing of this hypothesis has been lacking. The combined use of rsfMRI and cell-type specific neural perturbations in rodents [1] offers the opportunity to bridge this knowledge gap, enabling a disambiguation of the correlative nature of rsfMRI coupling. Here we combine viral and chemogenetic manipulations with resting-state fMRI (rsfMRI) in the mouse [2] to probe how silencing of a cortical node causally affects brain-wide functional coupling. We show that neural inhibition of the prefrontal cortex results in paradoxical overconnectivity of the mouse default mode network (DMN) and increased slow oscillatory activity, an effect relayed to wider cortical territories by polymodal thalamic areas. Our results challenge prevailing interpretations of functional connectivity and implicate a critical contribution of sub-cortical rhythm generators to the establishment of large-scale functional coupling.

**Presenter**

*Carola Canella*, Istituto Italiano di Tecnologia Rovereto, Rovereto
Italy

### Metabolic basis of human brain network nodes in resting-states of eyes-closed and eyes-open

Spontaneous resting-state brain activity is different in most of the brain areas between eyes-open (EO) and eyes-closed (EC) conditions, which are idealized resting-states in functional MRI (fMRI) studies[1]. It has been shown

that comparing EC to EO condition results in increase of glucose metabolism[2]. However metabolic foundations of fMRI-derived networks, specifically activated (e.g., sensory network) and deactivated (e.g., default mode network, DMN) nodes, remain poorly understood[3]. Here, we investigated aerobic glycolysis and excitatory-inhibitory balance in EC and EO conditions in visual cortex (VC, a non-DMN node) and posterior cingulate cortex (PCC, a DMN node).


### Presenter

*Yury Koush*, Yale University New Haven, CT
United States


## The Cortical Wiring Scheme of Hierarchical Information Processing

Integrating local and global features of cortical wiring is essential to appreciate how microstructural and macroscale brain organisation constrains function. Our aim was to resolve a structural manifold approximating the cortical wiring scheme in vivo in humans as closely as possible, and determine whether this could characterize multiple scales of cortical organisation (ie: cellular gradients, connectivity, and macroscale function).


### Presenter

*Casey Paquola*, Montreal Neurological Institute Montreal, Quebec
Canada


## Investigating the axon-diameter based human brain connectome using MRI

Throughout the history of neuroscience, it is repeatedly claimed that understanding the wiring pattern of the brain, will define its function. Yet, one of the major drawbacks in studying the connectome, is how to weigh its connections. To this end, diffusion MRI methods, provide the sole method that allows in-vivo exploration of the entire brain connectome. Nevertheless, DTI has several important limitations implicit within its model. Among them, changes in the common DTI indices are considered to be vaguely associated with microstructural features. Recent trends aim to use more sophisticated models of diffusion in order to measure microstructural features directly. In this study, we used such a method, AxCaliber3D, under developing in our lab, to assess axon diameter distribution throughout the brain. Being related to the conduction velocity along axons (Ritchie, 1982), we intend to define the conduction-velocity based connectome of the human brain. We believe that this newly defined connectome, might provide a better ground for connectome properties estimation.


### Presenter

*Hila Gast*, Tel Aviv University Tel Aviv, Israel
Israel

## Evolution of cortical myelination in chimpanzees

Comparing brain ontogeny across hominoid species provides important insights into the evolution of human cognition and behaviour [1]. However, developmental studies on cortical brain maturation in great apes are rare and mostly rely on captive primates [2]. The captive environment may not fully promote brain plasticity [3], and primates raised in captivity may not express their typical entire behavioural repertoire [4]. The ability to collect brains from chimpanzees in the wild and scan them post-mortem allows to overcome the limitations associated with the study of captive primates.


### Presenter

*Ilona Lipp*, Max Planck Institute for Human Cognitive & Brain Sciences Leipzig, N/A
Germany


## Towards an Accurate Identification of Vascular Territories in the Human Brain

A large part of the symptoms induced by stroke is related to disconnection of brain areas after ischemic lesion of cerebral white matter tracts (Catani and Mesulam, 2008). The precise vascularization of major white matter tracts is nevertheless only partially described, particularly the relative supply from main (anterior or ACA, middle or MCA, and posterior or PCA) cerebral arteries. The purpose of this study was to develop a method to accurately study the deep distribution territories of the cerebral arteries from human anatomical specimens and to obtain data usable as a ground truth for various imaging applications.


### Presenter

*Mykyta Smirnov*, UMR 1253, iBrain, Université de Tours, Inserm Tours, France
France