

Fundamental Concepts and Methods in Network Neuroscience

Andrew Zalesky Organizer
The University of Melbourne
Melbourne, Victoria
Australia

Alex Fornito Co-Organizer
Monash Biomedical Imaging
Clayton, Victoria
Australia

Educational Course

Understanding brain connectivity is now a major focus of the human brain imaging community. The widespread use of data from the Human Connectome Project (HCP) and UK Biobank, combined with new releases from related projects, such as the developmental, lifespan, and disease-related HCPs, mean that researchers require training in sophisticated analytic techniques that are not typically part of standard training programs. Many of these approaches are not “off the shelf” and require deep understanding of their subtleties for valid application. Critically, connectivity analysis is no longer an exotic approach used only by expert practitioners; it is now a standard part of most brain imaging analyses. It is therefore critical to ensure that researchers completely understand the strengths and limitations of their analytic tools to promote rigorous, robust and reproducible science.

This workshop will provide attendees with the unique opportunity to learn the pros, cons, and practical considerations of network neuroscience from experts in the field. As the field transitions to a post-HCP era in which connectivity analysis is the norm, the concepts and methods covered by this workshop will be an essential part of any neuroimager’s training.

Learning Objectives

The core objective of the workshop is to provide attendees with practical knowledge to map, analyse and visualize structural and functional brain networks using current best practices.

At the end of this workshop, attendees will understand:

- the strengths and weaknesses of different methods for parcellating the brain and defining network nodes;
- how to quantify and interpret different measures of structural and functional connectivity;
- how to define network communities and hubs, characterize communication processes on networks, and respect limitations of current analytic methods;
- appropriate techniques for statistical inference on networks;
- how to use both graph theoretic and biophysical models of brain network dynamics; and
- how to conduct multimodal analyses to gain greater insight into network organization

Target Audience

Our target audience includes neuroscientists trained in biological or psychological sciences who have had little prior exposure to graph theory and brain network mapping, as well as individuals with a more quantitative background who have knowledge of the area and are interested in how graph theory can be applied to characterize neural networks. The breadth of topics covered in the workshop means that it is suitable for people with varying levels of experience.