

MR Diffusion Imaging: From the Basics to Advanced Applications

Organizers:

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Diffusion Imaging is a non-invasive MRI technique that is sensitive to the diffusion of water molecules. As molecular diffusion is restricted by cell structures (e.g., membranes), it allows inferences about the microstructural organization of the brain. Moreover, tractography reconstructions based on Diffusion Imaging can reveal patterns of structural connectivity in cortical and subcortical brain regions. Limitations on spatial resolution, sensitivity to the diffusion process (low b-values), and orientation sampling have limited its full potential to study the human brain until few years ago. Thanks to recent technological developments, a new generation of MR scanners are now available that are able of collecting data at much higher spatial and angular resolution, much faster and with stronger diffusion contrasts or stronger b-values. These technological advancements have opened the door to new and more sophisticated analysis procedures making diffusion imaging today a very fast evolving neuroimaging field.

Course Schedule:

8:00-8:30

Diffusion MRI data acquisition

Jennifer Campbell, McGill University, Montreal, Canada

8:30-9:00

Methodological considerations on analyzing diffusion MRI data

Alexander Leemans, Image Sciences Institute, University Medical Center Utrecht, Utrecht, The Netherlands

9:00-9:30

Diffusion Imaging Models 1: from DTI to HARDI models

Flavio Dell'Acqua, King's College London, London, United Kingdom

9:30-10:00

Diffusion Imaging Models 2: from DTI to microstructure quantification

Els Fieremans, Center for Biomedical Imaging, New York, NY, United States

10:00-10:30

Break

10:30-11:00

Post Mortem and Preclinical Diffusion Imaging

Tim Dyrby, Danish Research Centre for Magnetic Resonance, Copenhagen, Denmark

11:00-11:30

Diffusion Tractography

Maxime Descoteaux, University of Sherbrooke, Sherbrooke, Quebec

11:30-12:00

Questions and Answers

12:00-13:00

Lunch

13:00-13:30

Group Comparison using Diffusion Imaging and application to brain plasticity

Anton Beer, Universität Regensburg, Regensburg, Germany

13:30-14:00

Connectomics analysis and Parcellation of the brain based on diffusion-weighted fiber tractography

Alfred Anwander, Max Planck Institute, Leipzig, Germany

14:00-14:30

Combining quantitative MRI measures to model brain development

Jason Yeatman, University of Washington, Seattle, WA, United States

14:30-15:00

Break

15:00-15:30

Methods for combining structural and functional connectivity

Fernando Calamante, The Florey Institute of Neuroscience and Mental Health, Melbourne, Australia

15:30-16:00

Diffusion Anisotropy - Historical Perspective, Research Utility and Clinical Challenges

Christian Beaulieu, University of Alberta, Edmonton, Canada

16:00-16:30

Question and Answer