Biophysics, acquisition methods, and interpretation of laminar specific functional MRI

Organizer:

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Motivation and Importance:
The laminar structure of the neocortex is universal. In spite of some variation in structure and cell type, the composition of the 6 cortical laminae is conserved in virtually all neocortical areas and amongst all mammalian species. Therefore, it is expected that the function of the cerebral cortex is based on a canonical micro-circuit of anatomical and functional connectivity within and between layers. However, the function of cortical layers remains largely unknown.
Hardware advancements and optimization of acquisition techniques at high fields have pushed the spatial resolution of fMRI from voxel edges of 3 mm to 0.5 mm. As has been demonstrated in recent studies, fMRI at high-magnetic field is capable of reaching the resolution of cortical layers in humans. The symposium will focus on acquisition methods, biophysics and interpretation of laminar-specific functional MRI.

Timeliness:
A substantial number of sites own now a high-field magnet, and therefore the infra-structure necessary for reaching the resolution of cortical layers. However, in most cases, this potential is not realized. The aim of the symposium is to expand the awareness of the Human Brain Mapping community of the possibility of laminar-specific functional imaging.

Learning Objectives:

1. Be aware of the laminar specificity of neurophysiological and BOLD responses.

2. Be informed about pulse sequences at high-field and analysis methods that greatly improve the spatial specificity of fMRI by enhancing contributions from capillaries and suppressing contributions from large vessels.

3. Learn of studies which have implemented these methods successfully for imaging human brain function at the resolution of cortical layers.

Inter-laminar functional connectivity and neurovascular coupling during spontaneous activity and evoked responses

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Quantitative neuroenergetic basis of laminar specific imaging of cortical and subcortical regions

Fahmeed Hyder, Yale University, New Haven, CT, USA

Data-acquisition methods for high-resolution fMRI in humans at high fields

Essa Yacoub, University of Minnesota, Minneapolis, MN, USA

Layer resolution fMRI to investigate cortical feedback in the visual cortex

Lars Muckli, Centre for Cognitive NeuroImaging, Research Institute of Neuroscience and Psychology, Glasgow, UK