The Physiology and Pathology of the Parietal Lobe in Visuomotor Integration

Optic ataxia (OA) is classically defined as a deficit of visually guided movements that follows lesions of the posterior part of the posterior parietal cortex (PPC). Since the formalization of the double stream of visual information processing and the use of OA as an argument in favor of the involvement of the posterior parietal cortex (dorsal stream) in visually guided movements, research on the spatio-temporal mechanisms underlying visuomotor processing in this structure has intensified. With the advent of new imaging techniques, analysis methods, and modeling frameworks, research has also begun to decode the human PPC and its neuropsychology. This symposium brings together researchers who study parietal cortex function from different, but complementary perspectives, addressing the motoric and cognitive control of finger, hand, arm or eye movements in monkeys, humans and patients, using neuroimaging (fMRI, MEG), computational, and neuropsychological approaches.

Learning Objectives: Having completed this workshop, participants will have:
1. Gained a deep insight into the computational and physiological architecture of the posterior parietal lobe, and how these relate to clinical deficits; and
2. Learned how novel imaging techniques and advanced analysis methods can be applied to investigate sensorimotor integration and coordination.

Topographic Organization and Functional Response Properties of the Human Posterior Parietal Cortex
Sabine Kastner, Princeton Neuroscience Institute, Princeton University, Princeton, New Jersey, NJ, USA

S.K. will describe the topographic organization and functional response properties of several areas along the intraparietal sulcus with respect to motion encoding, attention signals, representation of eye movements and representation of non-spatial information. She will also compare the organization of human PPC to that of the macaque monkey.

Integration of Sensory and Motor Signals by Population of Parietal Neurons Within and Across Reference Frames
Pieter Medendorp, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, Nijmegen, Netherlands

P.M. will discuss how populations of parietal neurons exchange information within and across reference frames when integrating sensory and motor signals. Using magneto-encephalography, he will show the effector-specific temporal dynamics of neuronal cooperation in parietal cortex during sensory-guided saccade and reaching tasks.

Coding of Hand Actions in Human Parietal Cortex
Jody Culham, Culham Lab, Neuroimaging of Action and Perception, The University of Western Ontario, London, Ontario, Canada

J.C. will provide novel results on the coding of hand actions in human parietal cortex. Using fMRI, including multivariate pattern analyses methods, she will consider the role of the superior parietal-occipital cortex (SPOC) and the anterior intraparietal sulcus (aIPS) in hand (grip), arm (transport) and wrist (orientation) movements.

Parietal Modules for Coding Limb Position and Space
Ferdinand Binkofski, Division for Neurological Cognition Research, RWTH Aachen University, Aachen, Germany

F.B. will take all of the above evidence, in combination with presentation of his own neuroimaging results in patients, to provide a mechanistic explanation for the symptoms underlying optic ataxia. He will show how effector-specific and spatial-specific activity patterns in well defined parietal modules addressing the posterior to
anterior organization of spatiotemporal coding in posterior parietal cortex. He will also provide a synthetic summary of the symposium’s content.