OHBM-DGKN Alliance: International Symposium on Network Reorganization after Stroke

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Symposium

Stroke is a leading cause of acquired, permanent disability worldwide. Although the treatment of acute stroke has been improved considerably, the majority of patients to date are left disabled with a relevant impact on functional independence and quality of life. The most critical driver of functional recovery post-stroke is neural reorganization. Here, neuroimaging techniques like fMRI and EEG have considerably advanced the understanding of the mechanisms engaged in neural reorganization and recovery of function.
This symposium provides a comprehensive overview on recent developments in the field of stroke recovery using neuroimaging and non-invasive brain stimulation. Novel techniques like dynamic functional connectivity mappings, concurrent TMS-EEG assessments as well as fMRI- and EEG-based network parameter estimates allow new insights into how a stroke lesion interferes with the functional integrity of different systems of the brain. Likewise, the combination of neuroimaging and neurostimulation techniques allows a better understanding of how brain plasticity can be modulated in order to promote the reorganization of neural networks. The symposium will also highlight important caveats and limitations of current models, and finally close with possible solutions and future directions.

Objective

- To understand how the brain responds to a focal lesion in order to overcome a neurological deficit
- To learn current brain stimulation strategies to support cortical reorganization of networks after stroke.
- To learn novel neuroimaging/brain stimulation techniques allowing individualized predictions of recovery and treatment responses.

Target Audience

This symposium is of interest to all scientists and clinicians involved in brain plasticity, stroke reorganization and recovery of function.

Presentations

Principles of Brain Reorganization after Stroke

Professor Christian Grefkes from the University of Cologne/Germany will open this symposium by providing an update about new studies on cortical reorganization after stroke with a special focus on the motor system. He will demonstrate that the combination of neuroimaging methods like fMRI and non-invasive stimulation techniques such as transcranial magnetic stimulation provides deep insights into the mechanisms driving functional recovery after brain lesions. Novel developments such as the combined use of TMS and EEG enable to extract network parameters of the lesioned motor system at the bedside of the patients, enabling a more personalized approach in treating patients with non-invasive brain stimulation based on the individual network pathology.

Presenter

Christian Grefkes, Dpt. of Neurology, University Cologne Cologne, Germany, NRW, Germany

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The Importance of Intrinsic Network States for Stroke Plasticity

Neuroimaging has classically focused on measuring activations induced by repetitive tasks. The resulting findings have led to the concept that training and rehabilitation needs to induce brain activations via repetitive exercise to induce performance gains. However, spontaneous neural interactions during awake resting states, as quantified with functional connectivity, also correlate with performance in tasks. The group of Professor Adrian Guggisberg from the University of Geneva/Switzerland has recently shown in EEG data that for visual and motor tasks best performance is achieved in persons who show an actual absence of classical task-induced activations, and, instead, high spontaneous phase coupling in the alpha band during rest. Thus abundant spontaneous neural interactions seem to enable efficient distributed processing, while classical task induced activations reflect effortful processing needed to compensate for lower network interactions. This suggests a need for new approaches in learning and rehabilitation which induce spontaneous network interactions rather than repetitive task activations.

Presenter

Adrian Guggisberg, Department of Clinical Neurosciences Geneva, Switzerland

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Network Neuroscience of Language Recovery after Stroke

In this talk, Professor Steven Small from University of Dallas/Texas suggest that language recovery from stroke depends on integration and segregation of network communities that have been evolutionarily co-opted for language, and that focusing language therapy on these biological networks might have long term advantages. He will illustrate such network-level translational neurology with a study of imitation-based treatment of aphasia targeting the dorsal language network. Understanding the basic neurobiology of human language is critical to developing approaches to regeneration and repair in aphasia after stroke. Human language evolved from the sensory, motor, emotional, and social functions of the primate brain, constructed on a biological framework of highly variable and dynamic interactions. Language performance consequently involves multi-system interactions across complex spatial and temporal representations in the human brain. The spatial encodings for language do not localize to one (or a few regions), and the temporal encodings do not occur on a single time scale. Professor Steven Small from University of Dallas/Texas will provide evidence from neuroimaging experiments that measures of variability and functional connectivity (static and dynamic) can be used to select candidates for aphasia therapy and to characterize biological outcomes.

Presenter

Steven Small, Univ. Dallas Dallas, TX, United States

Advancing Upper Limb Recovery after Stroke

The potential for recovery after stroke is currently not being realised by current treatment approaches. Professor Nick Ward from University Colloge London will lay out a rationale framework for the study of recovery after stroke, including the use of neuroimaging in the design of improved clinical trials. Therefore, this talk finalizes the scope of this symposium by providing an update of how neuroimaging may inform treatment of stroke patients in terms of clinical translation.

Presenter

Nick Ward, University College London London, United Kingdom