Radu Mutihac

University of Bucharest, Romania

Human connectome alterations in Dementia at rest

Recent studies of the human brain connectivity alterations using resting-state/sleep functional magnetic resonance imaging (rsfMRI), diffusion tensor imaging (DTI), and, more recently diffusion spectroscopic imaging (DSI) data have advanced and enlarged our knowledge on the organization of large-scale structural and functional brain networks, which consist of spatially distributed, but functionally linked regions that continuously share information. Brain's energy is largely consumed at rest during spontaneous neuronal activity (~20%), while task-related increases in metabolism energy are minor (<5%). Spontaneous low-frequency correlated fluctuations in blood oxygenation level dependent (BOLD) rsfMRI signals at the level of large-scale neural systems are not noise, but orderly and organized in a series of functional networks that permanently maintain a high level of temporal coherence among brain areas that are structurally segregated and functionally linked in resting-state networks (RSNs). Some RSNs are functionally organized as dynamically competing systems both at rest and during task-related experiments. The default mode network (DMN), the most important RSN, is involved in realization of tasks like memory retrieval, emotional process, and social cognition. Cortical connectivity at rest was reportedly altered in several forms of dementia and psychiatric disorders. Most recently, human brain function has been imaged in fMRI, and thereby accessing both sides of the mind-brain interface (subjective experience and objective observations) has simultaneously been performed. As such, functional neuroimaging moves onto new potential applications like reading the brain states, brain-computer interfaces, lie detection, aso. The present contribution aims to highlight the fundamentals and review the up-to-date findings in imaging modalities dedicated to alterations in human connectomics investigated by diffusion tensor imaging (DTI) for white matter (WM) and rsfMRI for grey matter (GM) studies, respectively, with direct impact on diagnostics and prognostics of dementia.

Speaker Biography

Radu Mutihac, Chair of Medical Physics, University of Bucharest, and works in Neuroscience, Signal Processing, Microelectronics, and Artificial Intelligence. He has conducted his research at the University of Bucharest, International Centre for Theoretical Physics (Italy), Ecole Polytechnique (France), Institut Henri Poincaré (France), KU Leuven (Belgium). Data mining and exploratory analysis of neuroimaging time series were addressed during two Fulbright Grants in Neuroscience (Yale University, CT, and University of New Mexico, NM, USA). His research in fused biomedical imaging modalities was carried out at the Johns Hopkins University, National Institutes of Health, and Walter Reed Army Institute of Research, MD, USA. He published over 120 scientific papers in reputed peer-reviewed journals, 12 monographs, and contributed with chapters in other 11 textbooks published by renowned scientific publishing houses. Following his scientific activity, He has also been nominated as Member of the Editorial Board of 8 journals in the field of Neuroscience: J. Romanian College of Medical Physicists, J. Childhood & Developmental Disorders, J. Neurology and Clinical Neuroscience, Medical and Clinical Reviews, J. of Translational Neurosciences, Epilepsy J., The Neurologist - Clinical and Therapeutics J., and Advances in Neurology and Neuroscience.

e: mutihac@gmail.com

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