

Dreams and Reality of measuring brain connectivity in vivo with MRI

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The human brain can be described as a complex network, formed by spatially distributed, but functionally linked regions that continuously share information with each other. This arrangement ensures efficiency and resilience to damage. In this view, the characterization of brain connectivity is necessary to increase our understanding of how functional brain states emerge from their underlying structural substrate and how neurons and neural networks process information.

Magnetic Resonance Imaging (MRI) offers a range of techniques that enable the measurement of both, functional and structural connectivity. In this context, functional connectivity is defined as a correlation between remote neurophysiological events in temporal domain, while structural or anatomical connectivity refers to the physical pathways that connect the “nodes” of the network, i.e., the main white matter tracts of the brain. Characterising these properties non-invasively and defining the so-called “human connectome” has been the target of numerous efforts.

This talk will provide an overview of the methods used for mapping brain connections, with a specific focus on the combination of structural and functional information. Moreover, we will discuss some of the limitations and the pitfalls of these techniques.