Learning in the fast-lane: New insights into neuroplasticity from micro-structural MRI

Yaniv Assaf

Department of Neurobiology, The George S. Wise Faculty of Life Sciences, The Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel

Neuro-plasticity is one of the key processes in brain's physiology. While functional aspects of neuro-plasticity can be studied in-vivo using microscopy and electrophysiology as well as non-invasively with fMRI and EEG, investigation of the **structural** characteristics of neuro-plasticity requires histological or other invasive approaches.

In the last decade, structural MRI studies of long-term brain plasticity revealed significant volumetric/regional changes following weeks of training. Yet, none of the known hallmark mechanisms of neuroplasticity can explain these effects. As a consequence, the micro-structural and cellular correlates of these structural plasticity changes are not well understood. In addition, the mechanism in which these significant brain structural changes are built over time is still unexplored.

In the presentation, we will explore the origins of structural plasticity, as revealed by MRI, and its evolution in time (from seconds to months). For that purpose we will utilize diffusion MRI to explore the micro-structural aspects of neuroplasticity. By demonstrating several plasticity studies performed in rodents and humans with diffusion MRI we will try to unravel the cellular mechanism responsible for this phenomenon. We will discuss the impact of using MRI in studying neuroplasticity – the ability to localize and explore this basic process of brain physiology, in-vivo and for the whole brain both in rodents and humans.