NEURAL RESOURCES OF COGNITION

MRI Club Meeting

Abstract: Magnetic resonance imaging (MRI) offers powerful non-invasive methods for investigating brain microstructure, yet the biological validity of many MRI-derived measures remains an active area of research. Recent advances have combined specialized MRI sequences, computational microstructure models, and high-resolution three-dimensional microscopy in animal models to validate MRI metrics against underlying tissue architecture. Building on this framework, our current research aims to develop MRI-based biomarkers of extracellular matrix (ECM) integrity in the human brain. We focus on diffusion tensor imaging (DTI)-derived free-water imaging, which quantifies extracellular water content and may be sensitive to alterations in ECM organization and perineuronal net integrity. In addition, quantitative susceptibility mapping (QSM) provides measures of tissue magnetic susceptibility related to iron accumulation, a process linked to oxidative stress, neuroinflammation, and ECM remodeling. By integrating these complementary MRI approaches, we seek to establish non-invasive markers of ECM integrity and improve our understanding of extracellular microstructural changes associated with brain aging and neuropsychiatric disorders.

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