

PROJECT SUMMARY (See instructions):

Title: Transformative MRI neurotechnology for micro-scale human cortical imaging

Magnetic resonance imaging (MRI) has given physicians and researchers the ability to study many different aspects of normal human brain development and disease. The Human Connectome Projects in the past few years have achieved remarkable increases in spatial and temporal resolution of MRI techniques for functional human brain imaging and white matter tractography. Despite this recent progress, the Human Connectome Projects have not been able to breach the 1-mm "voxel" spatial resolution barrier, specifically for blood oxygenation level dependent (BOLD) functional MRI, susceptibility imaging, and diffusion-tensor imaging (DTI) for fiber tracking.

The overarching objective of this U.T. BRAIN proposal is to bring non-invasive MRI into the micro scale (~200 micron isotropic voxels) resolution to begin to bridge studies of neuronal circuitry and network organization in the human brain. We set out to achieve dramatic gains in spatial and temporal resolution by focusing on developing: (1) transformative radiofrequency coil array, (2) innovative pulse sequence design, and (3) cross-validation of these neuroimaging technologies via neuroscience and clinical applications. This work will lead to new avenues to explore human brain circuitry at orders of magnitude higher spatial resolution than has previously been possible in living humans.

To achieve these objectives, three leading MRI Centers in Texas have teamed up to implement a 12-month program to define a blueprint for building this new transformative imaging platform and to identify needed blue-sky technology development at 7 Tesla. This team includes leading experts from multiple disciplines, from imaging physics, engineering, pulse sequence programmers, computer sciences, to neuroscience and neuroradiology. The goal of this collaborative U.T. BRAIN project is to enable this team to compete for the NIH BRAIN Initiatives, specifically the Next Generation Human Imaging RFA.

RELEVANCE (See instructions):

This is a new collaboration amongst three leading MRI Centers in Texas to implement a 12-month program to define a blueprint for building this new transformative imaging platform and to identify needed blue-sky technology development at 7 Tesla (this is the only human 7T scanner in Texas). This team includes leading experts from multiple disciplines, from imaging physics, engineering, computer sciences, to neuroscience and neuroradiology. There are three highly integrated aims, each lead by a leader from each Center. Each team leader is an internationally recognized leader in his MRI subspecialty. Individually, each team leader has a history of advancing imaging technologies and their applications. Dr. Steven Wright, (Texas A&M) will to lead the MR Hardware and Coils team within this U.T. BRAIN project. Dr. Tim Duong (UTHSCSA) will lead the Pulse Sequences and Image Recon team. Dr. Steven Warach, (UTSW) will be to lead the Neuroscience/Clinical Evaluation team. This proposal is aligned with NIH BRAIN Initiatives, specifically, the Next Generation Human Imaging RFA. The goal of this collaborative U.T. BRAIN project is singularly focused on enabling this team to compete for this RFA.