



# **Multimodal Imaging of Brain Activity and Connectivity**

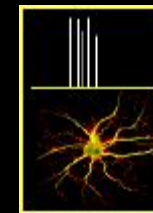
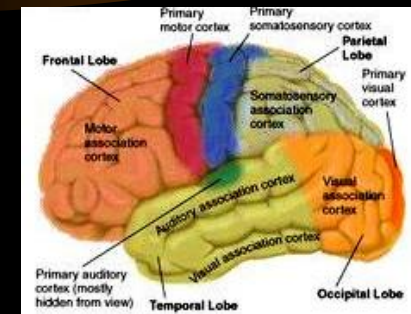
**Bin He, Ph.D.**

**Department of Biomedical Engineering and  
Center for Neuroengineering  
University of Minnesota**

**IOM Workshop June 25, 2008**

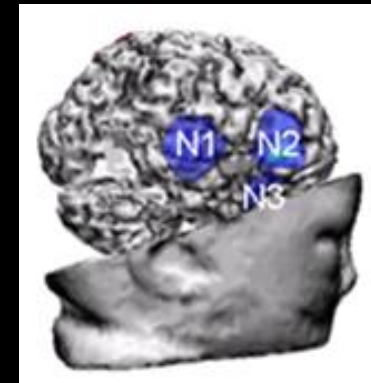
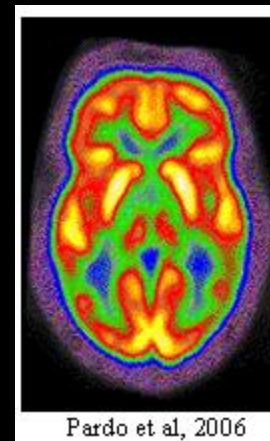
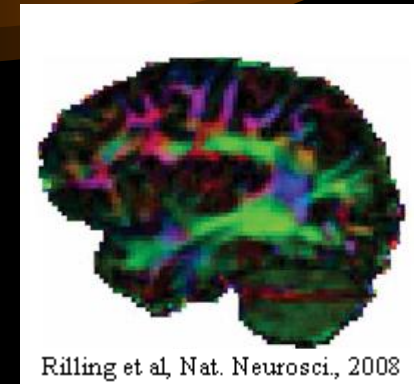
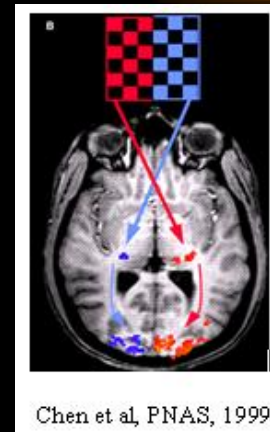
# Brain Activity is Spatiotemporal Process

- Brain activity is distributed in 3-dimensional space and evolves in time.
- High spatial resolution imaging modalities needed.
- High temporal resolution imaging modalities needed.
- Noninvasive imaging modalities needed for human brain imaging.



# Examples of Noninvasive Imaging

- **Functional MRI**
- **Diffusion Tensor MRI**
- **PET**
- **EEG/MEG Imaging**

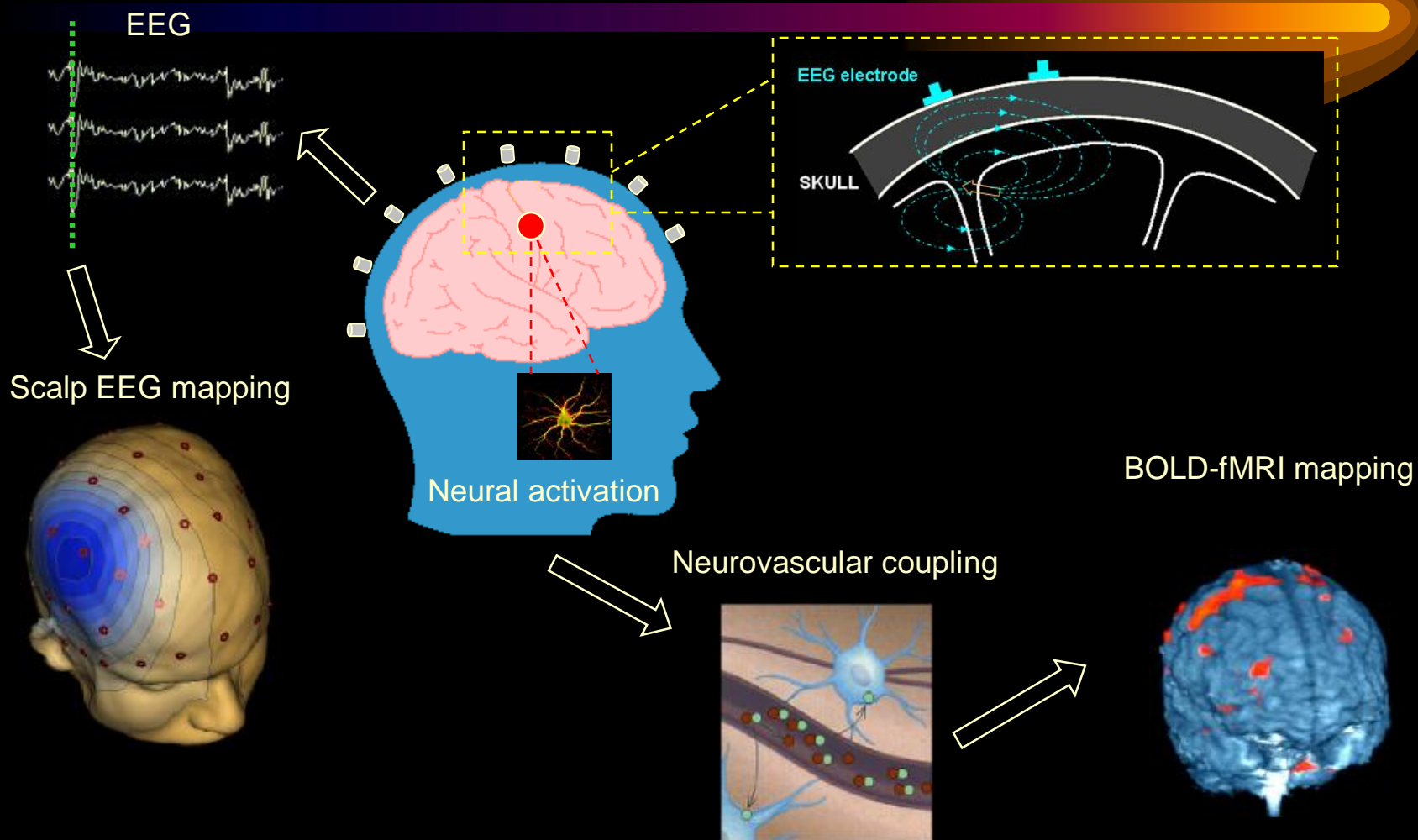


# Questions

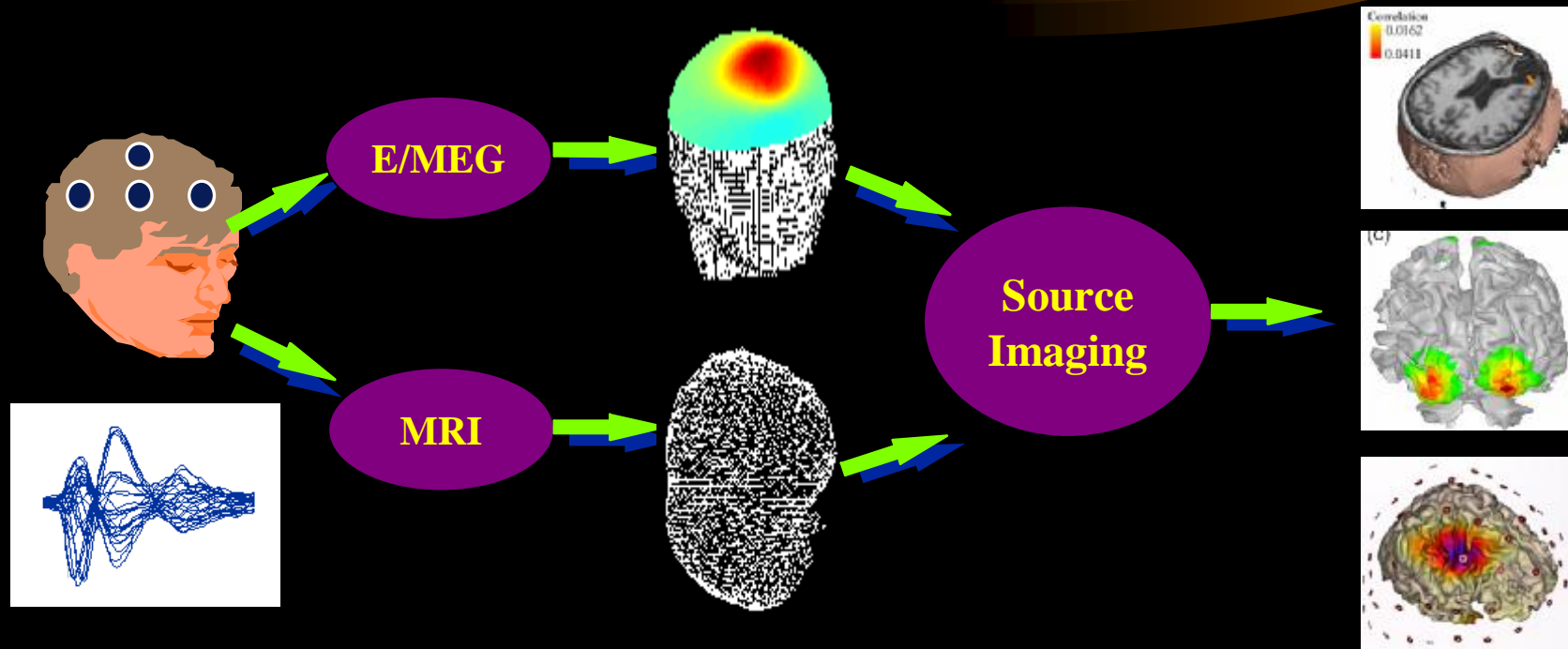


- **Can we non-invasively image the distributed brain activity with mm spatial resolution and ms temporal resolution?**

# Multimodal Neurovascular Recordings

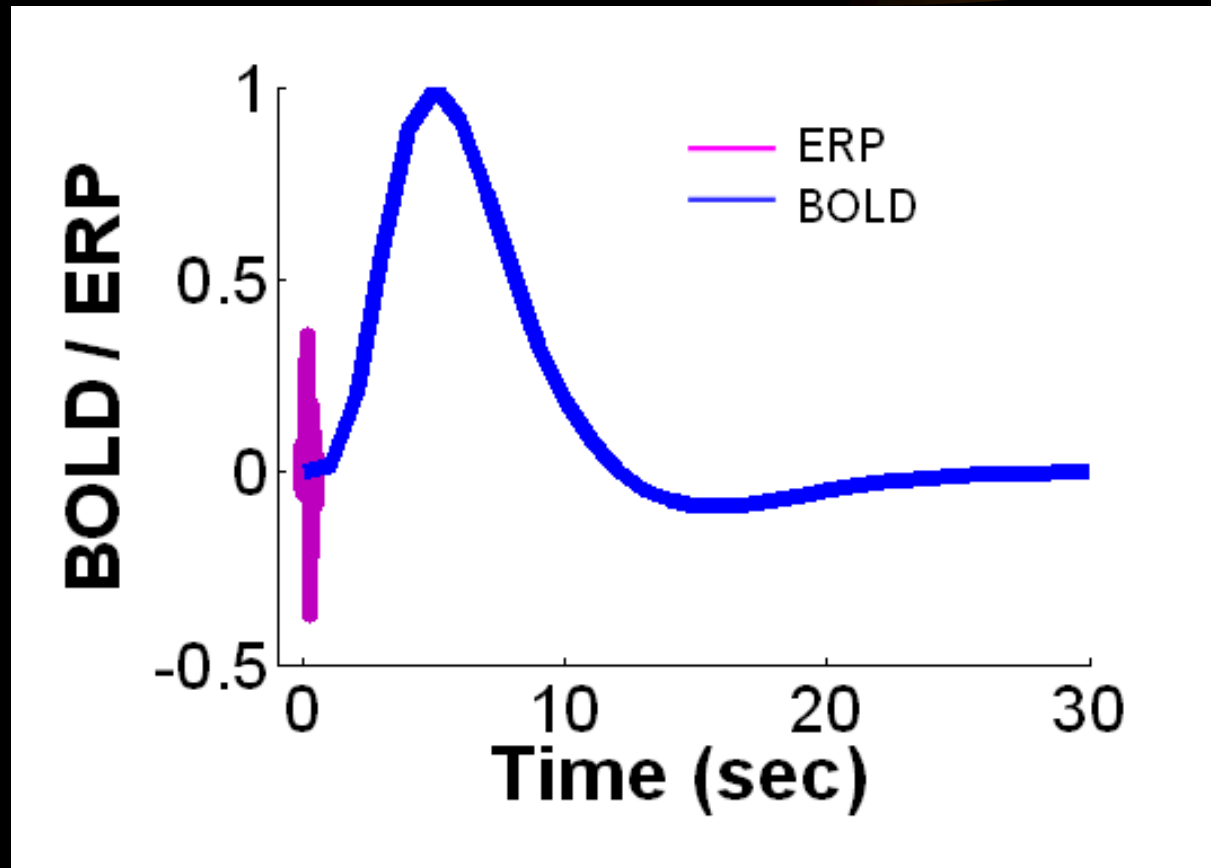


# Imaging Neural Activity from EEG/MEG

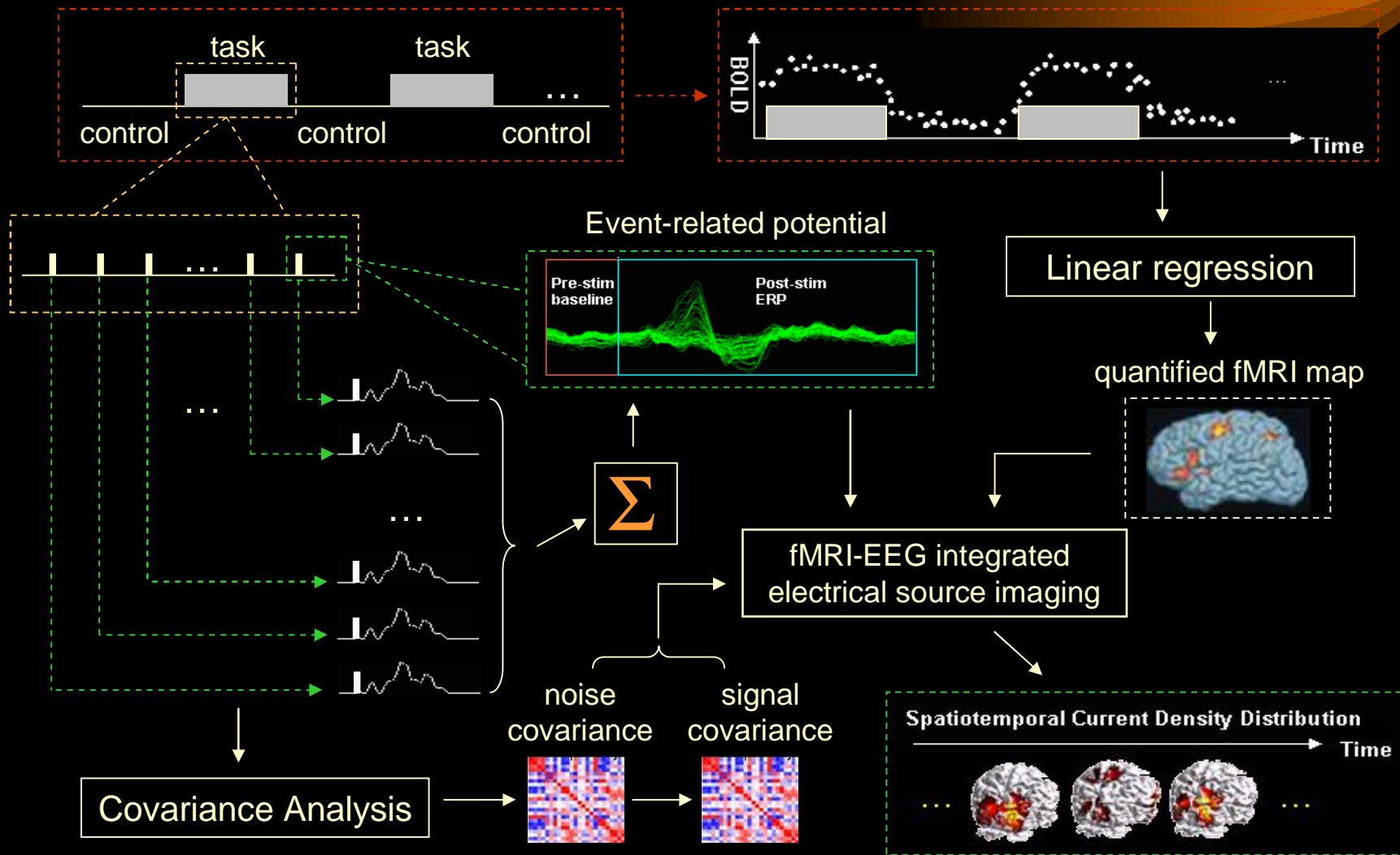




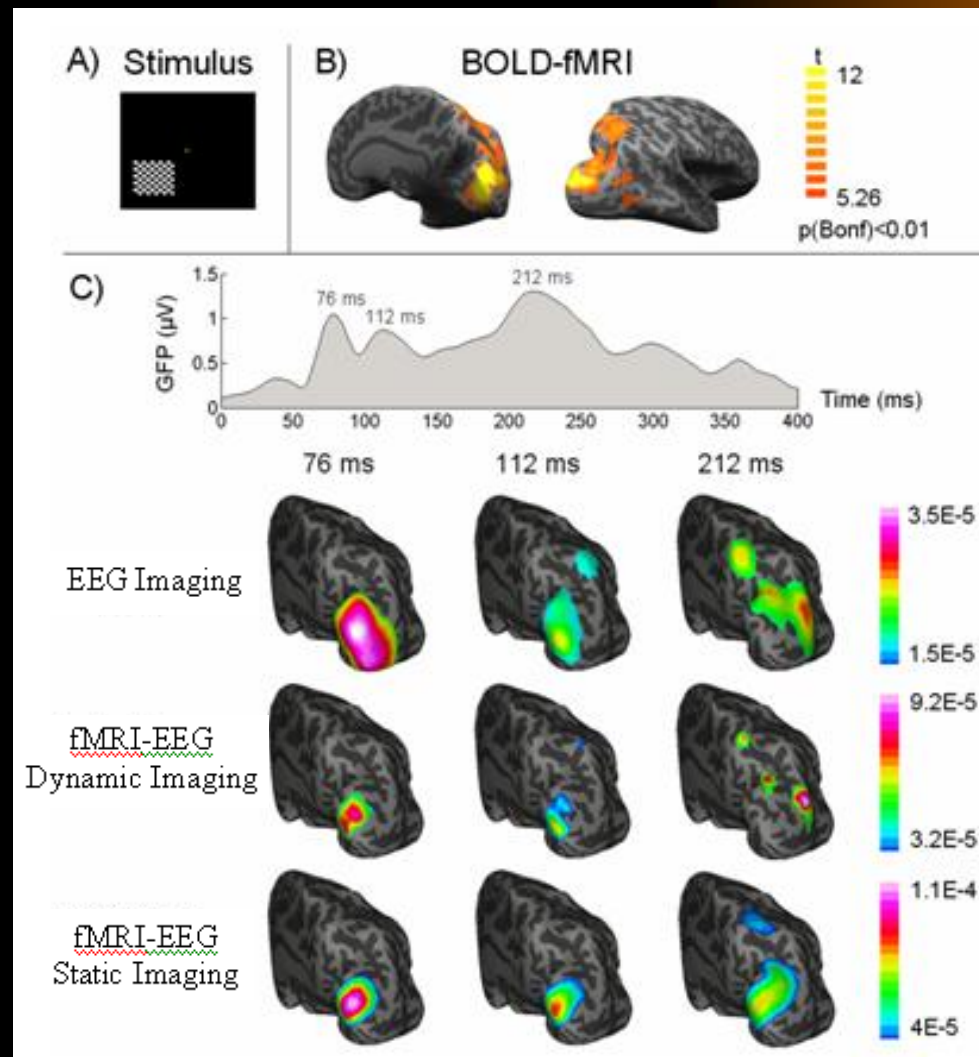
# Grand Challenge in Integrating fMRI with EEG



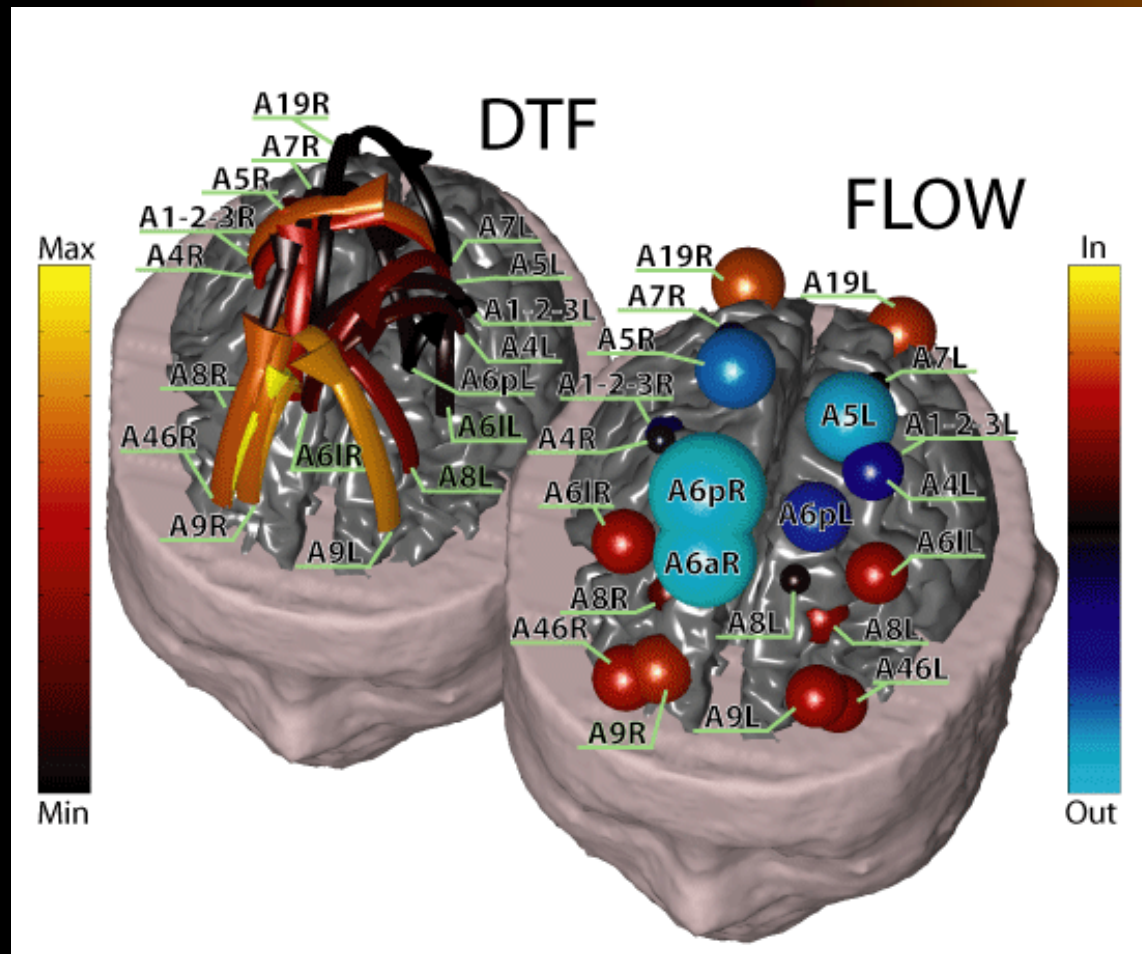
# Dynamic fMRI-EEG Integrated Neuroimaging



# Spatiotemporal Dynamic Multimodal Imaging in Human



# Imaging Connectivity and Networks



# Summary

- **Where - Brain Mapping and Localization**
  - BOLD fMRI mapping
  - *Neurovascular coupling mechanisms*
- **When – Electrophysiological Imaging**
  - EEG/MEG mapping
  - *EEG/MEG source imaging*
- **How - Mapping Brain Connectivity and Networks**
  - Multimodal neuroimaging integrating fMRI and EEG/MEG
  - *Reliable simultaneous fMRI/EEG recordings*
  - *Quantifying neurovascular coupling*
- **What –**
  - Better understand brain functions
  - Aid clinical diagnosis and treatment of nervous disorders

# Grand Challenge



- **Imaging brain connectivity and network dynamics beyond localization**