Robert T. Knight

Professor

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Education:
M.D., Northwestern University
Research Area:
Cognitive Neuroscience
Secondary Research Area:
Developmental
Laboratory:
Knight Cognitive Neuroscience Lab

Research Interests:
Attention and memory; neuropsychology and physiology; cognitive neuroscience

Research Description

Robert T. Knight, M.D., is a Professor of Psychology and Neuroscience

Research Areas:

The laboratory studies the contribution of prefrontal cortex to human behavior. We use electrophysiological, fMRI and behavioral techniques to study controls and neurological patients with frontal lobe damage in an effort to understand the neural mechanisms subserving cognitive processing in humans. The laboratory also records the electrocorticogram directly from the cortical surface in neurosurgical patients with implanted electrodes to study the electrophysiology of network activity supporting goal-directed behavior in humans. The laboratory uses this information to develop brain machine interfaces for motor and language prosthetic devices.

Current Projects

Human evolution is paralleled by a massive increase in the connectivity of the frontal cortex to other brain regions. The evolution of the prefrontal cortex is crucial for the development of human cognitive and social behavior. Damage to prefrontal cortex in humans from neurological or developmental disorders results in profound alterations in the ability to think, plan and interact in a socially appropriate manner. The laboratory is interested in the neural mechanisms by which frontal cortex controls distributed neuronal ensembles in other brain regions critical for both cognitive and social

behavior. To achieve these aims the laboratory employs neuropsychological, neuroanatomical, electrophysiological and fMRI techniques to study the physiology of prefrontal function in normal subjects and in neurological patients.

The laboratory also records the electrocorticogram (ECoG) from neurosurgical patients during both acute intra-operative surgical procedures and in epileptic patients with subdural electrodes implanted for an extended period. This line of research aims to understand the network properties and neural coding supporting behavior in the human neocortex. The laboratory is actively developing the use of these ECoG signals for the development of brain-machine interfaces for motor and language prosthesis in neurological patients with disabling motor or language disorders.

Some broad areas under current investigation include: What is the timing and neural coding of interactions between prefrontal cortex and other brain regions engaged during attention and memory performance? What is the role of ultra-high cortical gamma oscillations and distributed network coherence in human behavior? Can ultra high gamma oscillations recorded from the human cortex be used to control robotic devices for paralyzed patients?

Selected Publications

Teaching

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