

Magnetic approaches to bioimaging and functional brain dynamics

Shoogo Ueno

(University of Tokyo, Graduate School of Medicine, Professor)

【Outline of survey】

The purpose of this study is to develop a method for functional imaging of the brain with a high temporal resolution and a high spatial resolution based on control of neuronal activities by localized transcranial magnetic stimulation (TMS), current distribution magnetic resonance imaging (MRI), magnetoencephalography (MEG), and electroencephalography (EEG). These methods enable us to analyze electrical activities of neurons and the brain, to widen the understanding of the mechanism of dynamics of brain function, and to diagnose neuronal diseases. In addition, these methods lead to an integration of bioimaging from molecular and cellular level to neuronal system level of the human subjects. The current distribution MRI directly visualizes electrical activities of neurons. This method has a higher temporal resolution compared to conventional functional MRI. The localized TMS selectively facilitates or inhibits neuronal activities in targeted regions, which is useful for the understanding of dynamics of the brain function.

【Expected results】

This study develops an integrated system for functional imaging of the brain based on control of neuronal activities using TMS, and measurements of succeeding neuronal activities using current distribution MRI, MEG, and EEG. This system enables investigations of neuronal dynamics ranging from regional neuronal networks to the whole brain. This approach leads to the understanding of information processing associated with higher brain functions such as consciousness, cognition, memory, and association.

【References by the principal researcher】

- [1] S. Ueno: Biomagnetic approaches to studying the brain. IEEE Eng Med Biol 18: 108-120, 1999.
- [2] S. Ueno and N. Iriguchi: Impedance magnetic resonance imaging: A method for imaging of impedance distributions based on magnetic resonance imaging. J Appl Phys 83: 6450-6452, 1998.

【Term of project】 FY 2005 - 2009

【Budget allocation】 81,400,000 yen

【Homepage address】 <http://medes.m.u-tokyo.ac.jp/>