

【Grant-in-Aid for Scientific Research(S)】

Integrated Science and Innovative Science (Comprehensive fields)



Title of Project : Unveiling Social Brain by Analyzing Prefrontal Brain Network: Applying Methodological from Microelectrode to fMRI

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Research Area : Comprehensive fields

Keyword : Cognitive Science, Social Brain, Working Memory

【Purpose and Background of the Research】

Previous studies on higher brain function has been focused on the “biological brain”, while present study focused on the “social brain” which works in highly interactive social context. We assumed unveiling the workings of prefrontal brain network may reveal properties of the “social brain”. By applying various techniques and subjects (from microelectrode to fMRI (functional Magnetic Resonance Imaging); from monkey to human), we explore how the executive function of the working memory controls social neuronal network (see Figure 1).

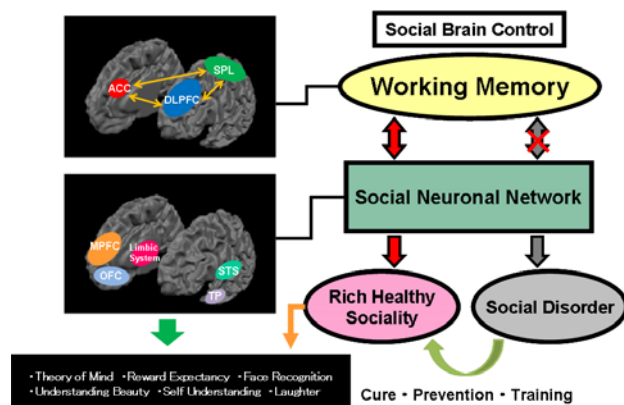


Figure 1. Diagram showing how the working memory's executive function controls social neuronal network (social brain).

We investigate the brain mechanism which makes for social consciousness (and its disorder) and understanding the self and the others (ToM) by interdisciplinary approach integrating cognitive neuroscience and humanities.

【Research Methods】

Seven major and multiple international scientists work together to unveil how the executive system of the prefrontal cortex controls the “social brain” using fMRI, TMS (transcranial magnetic stimulation), ERP (event-related potentials), tDCS (transcranial direct current stimulation) and microelectrode from monkey to human. Special interests are on the issues of cooperative/competitive behavior in relation to reward; understanding self and others (Theory of Mind) from the standpoint of

social neuroscience; understanding beauty and laughter from neuroaesthetics; social economical behavior from neuroeconomics.

Moreover, we explore how the malfunction of the prefrontal network results in social disorder. Finally, neuronal network model controlling “social brain” will be presented.

【Expected Research Achievements and Scientific Significance】

Unveiling the neuronal dynamics of the “social brain” will provide us how the “social brain” developed from social environment.

Furthermore, we expect to develop the ways to cure and prevent social disorder and keep healthy sociality by training.

【Publications Relevant to the Project】

Osaka N, Osaka M, Morishita M, Kondo H, Fukuyama H, Shibasaki H: The neural basis of executive function in working memory: an fMRI study based on individual differences. *Neuroimage*, **21**: 623-631, 2004.

Osaka N, Logie R, D'Esposito M (Eds) *Cognitive Neuroscience of Working Memory*. Oxford University Press, 2007.

Osaka N. (Ed) *Brain Representation of the Working Memory*. Kyoto University Press, 2008.

Yaoi K, Osaka M, Osaka N: Is the self special in DMPFC? : An fMRI study. *Social Neuroscience*, **4**: 455-463, 2009.

Osaka N (Ed) *Brain Imaging*. Baihukan Publisher, 2010.

【Term of Project】 FY2010-2014

【Budget Allocation】 165,700 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.social-brain.bun.kyoto-u.ac.jp/>