

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

Integrated Science and Innovative Science (Comprehensive fields)



Title of Project : Elucidating the Neural Basis and Development of Prosocial Behavior

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Research Area : general

Keyword : sociability, functional MRI

【Purpose and Background of the Research】

Human society is based on the cooperation among genetically unrelated individuals: They act voluntarily to benefit others (i.e., prosocial behavior/altruism), an attribute unique to human beings. Meanwhile, humans as discrete organisms act in accordance with egocentric principles of behavior, common to other living things. Thus to explain the acquisition of a trait such as altruism, cultural evolution and the concurrent development of genes and culture need to be examined.

Conventionally, human prosocial behavior has been discussed in the context of perspective taking and empathy. Perspective taking, also referred to in a broad sense as “mentalizing”, refers to the ability to understand other peoples’ thoughts, feelings and points of view (Mano et al. 2009). The neural basis of mentalizing involves the medial prefrontal cortex, the posterior cingulate gyrus and the temporo-parietal junction. The neural processes underlying empathy involve the mirror neuron system and the limbic cortex. According to social exchange theory, altruistic behavior is selected to maximize social rewards and therefore can be explained within the same framework as economic behavior. In fact, both social rewards (i.e., having a good reputation among others) and monetary rewards activate the striatum, which is the neural basis of the reward system (Izuma et al. 2008). This suggests that good reputation holds positive value as a reward and is therefore processed in the brain in a manner similar to monetary rewards. In addition, the fact that the medial prefrontal cortex is activated by social rewards suggests that social reputation is represented by this area and then “valuated” by the striatum. Thus, the processing of social rewards involves the interaction between the reward system (including the striatum) and the neural basis of mentalizing (Izuma et al. 2008).

Based on these findings I propose a model in which prosocial behavior, by being motivated internally (through the avoidance of empathetic pain) and externally (with social rewards

valued by mentalizing), requires the concurrent development of empathy and mentalizing. The hypothesis will be tested by analyzing behavior over the course of development, comparing it among disease groups, and detecting cultural differences, mainly using functional MRI.

【Research Methods】

Functional MRI will be applied to normal, disease and different cultural groups to clarify the neural basis of a self-other similarity and distinction, a control/inhibition mechanism, and the relationship between empathy and mentalizing. This will aid to elucidate the neural basis of prosocial behavior.

Longitudinal analysis of infants’ behavior will prove that the ability to recognize similarity between oneself and others is gained first, followed by self-control accompanied by self-cognition.

Longitudinal analysis of school-age children’s behavior and their MRI will depict the developmental course of prosocial behavior.

【 Expected Research Achievements and Scientific Significance】

This study aims to utilize functional neuroimaging, longitudinal behavior analysis of developing children, comparison among disease groups and evaluation of cultural effects to elucidate the developmental foundation of prosocial behavior. Combining the techniques of neuroscience with developmental social psychology, this research will offer a new academic avenue for explaining complex human social behavior.

【Publications Relevant to the Project】

- Izuma K, Saito DN, Sadato N (2008) Processing of social and monetary rewards in the human striatum. *Neuron* 58:284-294.
- Mano Y, Harada T, Sugiura M, Saito DN, Sadato N (2009) Perspective-taking as part of narrative comprehension: a functional MRI study. *Neuropsychologia* 47:813-824.

【Term of Project】 FY2009 - 2013

【Budget Allocation】 164,800 Thousand Yen

【Homepage Address and Other Contact Information】

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