

## Interdisciplinary Area



### Title of Project : The Evolutionary Origin and Neural Basis of Empathetic Systems

Toshikazu Hasegawa

( The University of Tokyo, Graduate School of Arts and Sciences, Professor )

#### 【Purpose of the Research Project】

“Empathetic systems” have a pivotal role in cooperative and synchronized behaviors as well as in our understanding of each other. They also have a psychological function in determining social orders and fairness. Recently, empathetic systems have been observed in human infants, suggesting that these systems are inherent to human nature. In addition, behaviors related to empathy have been reported in non-human primates other than humans, and other species such as rodents.

In this research project, we aim to identify the origin of empathetic systems in animals, and determine the specific functions that have been acquired in humans through the evolutionary process. To understand the true picture of empathetic systems in humans, it is necessary to investigate their function in the human brain, to discover the origin of these systems, to identify the neural circuit responsible for empathy, and the genetic and molecular basis underlying these systems. We hypothesize that empathetic systems have an instinctive and adaptive function that promotes the fitness of each animal and group living, and that humans have acquired, through the evolutionary process, a unique, higher function. Using the latest techniques in brain imaging, genetic and molecular analysis, we aim to discover the biological significance of these empathetic systems.

#### 【Content of the Research Project】

- 1) Identifying the common neural pathways regulating empathetic systems, and the unique aspects in humans, focusing on their social function.
- 2) Understanding the evolution of the empathetic systems unique to humans by using comparative cognitive research and genetic analysis.
- 3) Uncovering the neural and molecular basis of empathetic systems in the brain.

#### 【Expected Research Achievements and Scientific Significance】

This project has 6 goals: 1) understanding the common neural pathways that regulate empathetic systems, in particular focusing on emotional contagion, 2) uncovering the unique nature of empathetic systems in humans by using a comparative cognitive approach, 3) revealing the evolution of human empathetic systems, 4) analyzing behavioral characteristics related to these empathetic systems and their association with genetic diversity in animals, 5) identifying neural circuits responsible for the empathetic systems, 6) analyzing the molecular basis underlying the neural circuits of empathetic systems. Once this research into the neural and evolutionary basis of empathy has been completed, we will be able to propose a novel cross-disciplinary approach that unites cognitive and social sciences and neuroscience, in other words, a new approach to “social brain sciences”. In the present project, we will initially focus on the innate and primitive functions of empathetic systems. These results will shed light on future directions of study into the higher levels of empathetic systems, which might be specific to human beings. In addition, the identification of the neural and molecular basis of empathetic systems could reveal biological bases for impairments and potential medical treatments for functional deficits in empathetic systems.

#### 【Key Words】

Emotional Contagion: a tendency for two or more individuals to emotionally converge, either on negative or positive emotions.

Oxytocin: neuropeptide hormone that regulates social cognition, affiliation and empathy in the central nervous system.

【Term of Project】 FY2013-2017

【Budget Allocation】 861,600 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.empatheticsystems.jp/>  
empathy.admin@darwin.c.u-tokyo.ac.jp