

Japan-U.S. Brain Research Cooperation Program
Group Joint Study Project Program FY2018 - FY2021: Report

Field: Behavioral/Systems/Cognitive

1. Principal Researcher

Name: Jijia Yang

Title: Research Associate Professor

Affiliation: Faculty of Interdisciplinary Science and Engineering in Health Systems, Okayama University

2. Research Title: Neural substrates of visuo-haptic cross-modal roughness and hardness recognition in the human brain

3. Japanese Group Organization

Jinglong Wu, Professor, Okayama University

Yoshimichi Ejima, Professor, Okayama University

Satoshi Takahashi, Associate Professor, Okayama University

Yinghua Yu, Assistant Professor, Okayama University

Hiroki Yamamoto, Assistant Professor, Kyoto University

4. U.S. Group Organization

Peter Bandettini, Chief of section on Functional Imaging Methods, National Institutes of Health

Peter Molfese, Staff Scientist, National Institutes of Health

Vinai Roopchansingh, Staff Scientist, National Institutes of Health

Laurentius Huber, Postdoctoral Fellow, National Institutes of Health

5. Research Period, from/to (yyyy/mm/dd) and total number of years.

From 2018/04/01 to 2022/03/31 (4 Years, extended due to COVID-19 pandemic)

6. Abstract, Results, and Research Significance (300 words):

The use of fMRI in conjunction with neural models provides new opportunities to gain important insights from current knowledge. During the last five years, human studies have demonstrated the value of high-resolution fMRI to study laminar-specific activity in the human brain. In this project, we focused on developing the laminar fMRI method and used the method to address how humans perceive an object by touch. During more than four years of collaboration, we successfully developed a new laminar fMRI imaging sequence that acquired the high laminar sensitivity blood oxygen level-dependent (BOLD) and the laminar specificity vascular space occupancy (VASO) signals at the same time. We adapted this new method to several new studies and provided a lot of evidence about the hierarchical sensory processing at the laminar level in humans. Furthermore, we successfully installed this laminar imaging sequence in the 7T MRI scanner of the National Institute for Physiological Sciences and started the first human laminar fMRI project in Japan. We envision that our works will prompt more researchers to focus on improving the laminar fMRI methodology and to apply this method in the understanding of human cognition from a laminar neuroimaging perspective.

7. Other (Research-related concerns, particular points of note):

Four journal papers have been published in high-impact international journals such as Science Advances, NeuroImage. The findings related to this project have been reported more than ten times at several international conferences, and several new collaborations have been started.

*Please attach any reference materials as necessary.