Form 1-3

Japan-U.S. Brain Research Cooperation Program
Researchers Dispatched to the U.S. Program FY2023: Report

Field: Neuroscience

1. Researcher

Name: Miari Arai
Title: Visiting Instructor
Affiliation: UT Southwestern Medical Center

2. Research Title: Analysis of expression of endogenous Immediate early genes in memory formation

3. U.S. Joint Researchers/Institutes
Please give the name, title and affiliation.
Takashi Kitamura
Associate professor
UT Southwestern Medical Center

4. Research Period, from/to (yyyy/mm/dd):
from 2023/5/30 to 2024/8/31

5. Abstract, Results, and Research Significance (300 Words):

I am focusing on immediate early genes (IEGs), whose expression is rapidly and transiently induced in response to neural activity, and am analyzing the redundancy of IEGs expression in memory acquisition. IEGs are widely used as markers of neural activity, but they are known to have different functions depending on their type. However, there is disagreement as to whether IEGs of different properties are expressed in different neuronal populations or whether they overlap. Therefore, I examined the intrinsic expression of multiple IEGs and their fluorescence intensity. To activate neurons, mice were performed to learn a combination of context and electric shock (context fear conditioning). Contextual information enters the hippocampus of the brain and is transmitted via the entorhinal cortex to the prefrontal cortex and amygdala. On the other hand, electric shock information enters the amygdala and is transmitted to the prefrontal cortex. Also, mice are placed in a chamber and fed, they form memories that combine the context and food (reward learning). Reward memory also involves the hippocampus, amygdala, and prefrontal cortex, but different regions are known to be activated than in fear memory. Sections of the hippocampus, amygdala, and prefrontal cortex of these two types of post-learning mice plus home cage mice (control) were prepared from three groups of mice, and immunohistochemistry was performed for multiple IEGs and analyzed for the number of expressed cells, overlapping nature, and fluorescence intensity. The number of neurons expressing c-Fos alone and double positive cells expressing both c-Fos and Npas4 increased in the brain regions after fear conditioning compared to the home cage group. The fluorescence intensities revealed an increase in neurons with higher fluorescence intensity after fear conditioning and reward learning compared to the home cage group, and existing cells exhibiting a wide range of intensities from low to high fluorescence intensity.

6. Other (Research-related concerns, particular points to note):

*Please attach any reference materials as necessary.