Form 2-4-2

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

Field: (1)

1. Principal Researcher

Name Ko Matsui
Title Assistant Professor
Affiliation National Institute for Physiological Sciences

2. Project Title:

The role of neural-glial interaction on cerebellar motor learning

3. Japanese Group

Names, Titles and Affiliations of Principal Researcher and Collaborating Research Members

Principal Researcher	Ko Matsui,	Assistant Professor,	National Institute for Physiological Sciences
Collaborating Researcher	Ryuichi Shigemoto,	Professor,	National Institute for Physiological Sciences
Collaborating Researcher	Yugo Fukazawa,	Assistant Professor,	National Institute for Physiological Sciences
Collaborating Researcher	Naomi Kamasawa,	Assistant Professor,	National Institute for Physiological Sciences
Collaborating Researcher	Yusuke Takatsuru,	Postdoctoral Fellow,	National Institute for Physiological Sciences
Collaborating Researcher	Timotheus Budisantoso,	Graduate Student,	National Institute for Physiological Sciences
Collaborating Researcher	Laxmi Kumar Parajuli,	Graduate Student,	National Institute for Physiological Sciences
Collaborating Researcher	Wajeeha Aziz,	Graduate Student,	National Institute for Physiological Sciences

4. U.S. Group

Names, Titles and Affiliations of Principal Researcher and Collaborating Research Members

Principal Researcher	Craig E. Jahr,	Professor,	Vollum Institute
Collaborating Researcher	Jason M. Christie,	Postdoctoral Fellow,	Vollum Institute

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

From 04/01/2007 to 03/31/2010 (3 years)

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

We focused on the possibility that complex network of cells composed of both neurons and glial cells may play a role in cerebellar motor learning and we decided to analyze the neural-glial interaction in the cerebellum. Specifically, acute cerebellar slices were made and Bergmann glial cells (BGs) were injected with a fluorescent dye and the fine protrusions were observed with two-photon microscopy. Fine protrusions showed rapid motility and ring shaped structures were formed and dismantled within several minutes of observation. This suggests that the environment surrounding neurons is dynamically regulated. To understand how the distance between glutamate release sites and BG processes changes with time, we focused on the affinity difference between AMPA receptors (AMPARs) and glutamate transporters (GluTs). GluTs have much higher affinity for glutamate compared to AMPARs. If the processes expressing these glutamate sensors were displaced from the release site, the AMPAR mediated responses would likely be more decreased compared to the GluT mediated responses. As previous report has suggested that the morphology of BG protrusion is regulated by AMPAR activity, we blocked AMPAR activity by γDGG for a few hours and subsequently washed out γDGG and recorded synaptically evoked responses from the BGs. We found that the AMPAR component was reduced relative to the GluT component. However, the fast motility of BG protrusion that occurs in minutes' time scale was not affected by the AMPAR blockade. These results suggest that the fast motility of BG protrusion occurs spontaneously without AMPAR activation but the average location of the protrusions relative to the release sites may be controlled separately by the AMPAR activation. We would like to extend these preliminary findings and study whether dynamic morphological regulation occurs *in vivo* and also study the direct connection between neural-glial communication and cerebellar motor learning such as with HOKR training in the future.

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