Form 3-3-2

Japan-U.S. Brain Research Cooperation Program
Information Exchange Seminar Program FY2016: Report

Research Field: _____2_____

1. Seminar title:
2. Current trends and future directions of synaptic plasticity research

3. Dates, from/to (mm/dd/yyyy)
From 06222016 to 06252016
4. Location:
University of Maryland, Baltimore, USA
5. Coordinators

Japanese Coordinator
Name Takuya Takahashi
Title Professor
Affiliation
Yokohama City University

U.S. Coordinator
Name Hey-Koung LEE
Title
Affiliation

6. Participants:

Japan: Invited participants 12___ people Others 16___ people

(Please give names, titles and affiliations of invited participants)

Haruhiko Bito (University of Tokyo, Tokyo, Japan, Professor)
Yasunori Hayashi (RIKEN BSI, Saitama, Japan, Team Leader)
Kenzo Hirose (University of Tokyo, Japan, Professor)
Tadashi Isa (National Institute for physiological science, Aichi, Japan)
Dai Mitsushima (Yamaguchi University, Yamaguchi, Japan, Professor)
Mariko Miyata (Tokyo Women's Medical University, Japan, Professor)
Atsushi Miyawaki (Riken, Saitama, Japan, Director, Keynote speaker)
Masanori Murayama (Riken, Saitama, Japan, Team Leader)
Shigeo Okabe (University of Tokyo, Tokyo, Japan, Professor)
Tomomi Shimogori (Riken, Saitama, Japan, Team Leader)
Takuya Takahashi (Yokohama City University, Kanagawa, Professor, Japan, organizer)
Michisuke Yuzaki (Keio University, Tokyo, Professor, Japan)

U.S.: Invited participants 13____ people Others 30____ people

(Please give names, titles and affiliations of invited participants)

Andres Barria (University of Washington, US, Associate Professor)
Thomas Blanpied (University of Maryland School of Medicine, US, Associate Professor)
Lu Chen (Stanford University, US, Associate Professor)
Hee Jung Chung (University of Illinois, US, Assistant Professor)
Pascal Kaeser (Harvard University, US, Assistant Professor)
Hey-Kyoung Lee (Johns Hopkins, US, Associate Professor, Organizer)

Zheng Li (NIMH, US, Chief)
Jeffrey Magee (HHMI/Janelia Farm Research Campus, Group Leader, US)
Franck Polleux (Columbia University, US, Professor)
Elizabeth Quinlan (University of Maryland College Park, US, Professor)
Gavin Rumbaugh (Scripps Florida, US, Associate Professor)
Scott Soderling (Duke University, US, Associate Professor)
Richard Huganir (Johns Hopkins, US, Professor, Keynote speaker)

6. Seminar Outline and Significance:

The strength of communication at individual synaptic contacts is a key parameter governing the performance of neural circuits and thus a foundation of all complex human behaviors. Revealing the mechanisms that determine how synapses operate is therefore widely seen as essential for achieving a broad understanding of brain and nervous system function. Principles of neural transmission have been known for several decades, but both the diversity and details of these mechanisms are only recently becoming clear. Genetic and biochemical documentation of the molecular constituents of synapses have now opened the door to a deep mechanistic understanding of synaptic transmission. This promise is being filled, as new electrophysiological and optical techniques to monitor and manipulate synapse function (ref), new imaging and reporter technologies to define molecular interactions and signaling (ref), and new capabilities for moving between reduced and intact preparations are all driving profound new insights. Much of the interest in understanding synapses stems from the realization that development and experience drive changes to brain function that in many cases rely on changes of synapse strength. This has been most intensively studied in the context of animal learning, and there is now overwhelming evidence that strengthening or weakening of existing synapses in established circuits mediate modification of behavior (Mayford et al., 2012; Tonegawa et al., 2015) . Accordingly, many questions stemming from this central observation have developed into major fields of research. What are the cellular and molecular mechanisms involved in the induction, expression, and maintenance of synaptic plasticity? How many types of plasticity are there, and what distinguishes these types? How do mechanisms at single synapses interact with translational, genetic, and epigenetic mechanisms of plasticity? What rules describe how plasticity of synaptic strength influences activity within complex neural circuits that produce behavior? Collaborative work will be ever more necessary as we attempt to link our increasingly detailed views of the operation of single synapses with the broader questions of circuit function.

Understanding the mechanisms and roles of synaptic plasticity has taken on grave new urgency as researchers around the world have discovered more and more ways in which diseases are linked to altered synaptic functioning. Key questions drive much work in the field now. How do disruptions of healthy synaptic plasticity result in cognitive disorder? At what points do disease mechanisms interfere with normal plasticity mechanisms?

Excitement surrounding these questions has driven continuous expansion of this field over many years. This is evident in the frequency of publications tied to the key words “synaptic plasticity” (Figure 1) that illustrates the large and growing importance of this research. However, this proliferation of data and the rapid expansion of the field brings many tactical difficulties. Researchers have a harder time staying abreast of recent developments so they can focus on the biggest questions for the future. New graduate students and postdocs entering the field have less chance to meet and converse at length with others in the field. These serious difficulties are magnified many times when considering the international nature of modern neuroscience.

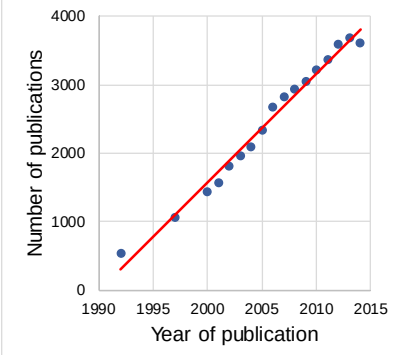


Figure 1. Single-year Pubmed results for the search term “synaptic plasticity” from 1990 to 2014. The results are well fit by a linear trend as shown in red. Data from the ‘90s are 5-year averages.

These problems mean that face-to-face contact and extended discussion is needed more than ever. Our meeting is designed to bring together new and established researchers from the US and Japan. While we will undoubtedly reflect on our major successes, our major goal for the workshop is to identify and focus on the new questions for the future that are the common interests central to the field. These common areas of interest will provide the most fruitful collaborations.

7. Seminar Results and Future Implications:

This workshop gathered relatively small group of neuroscientists to exchange scientific information and to foster future collaborations. In particular, we gathered early, mid and senior level investigators studying different aspects of synaptic plasticity ranging from molecular signaling, circuit level plasticity, and synaptic dysfunction related to mental illnesses Furthermore, the size of the workshop and scheduling of frequent coffee breaks and group meals allowed intimate interaction between the participants outside of the scheduled talks to further promote exchange of ideas under informal settings. In addition, we asked 2 trainees (student or postdoctoral fellow) per lab, which will allow the new generation of scientists to get immersed into the field. We finally selected short talks from the submitted abstracts of the trainees, which allowed them to gain exposure. In sum, this workshop accomplished the goals of scientific exchange, training, and fostering collaboration among the US and Japan participants.

7. Other (implementation issues, feedback, etc.

For this size of meeting, the budget provided by this grant was extremely small. Only 5 sp eakers was supported by this grant. It is very important to gather top scientists from Japa n and US for

not only for Japanese science but also for the advance of science in the world. I hope budg et size will be expanded in the future.