

Japan-US Brain Research Cooperation Program
The Report of Information Exchange Seminar in 2005 fiscal year

[field: Neural mechanisms of cognition and learning]

1. The Seminar Title:

Coordination of Structural and Functional Synaptic Plasticity

2. The Term: From Y.2006 M.March D.13 To Y.2006 M.March D.15

3. The Location:

Maui, Hawaii

4. The Representative's Name, Title and Affiliation:

Japanese Coordinator:

Shigeo Okabe, Professor, Tokyo Medical and Dental University

US Coordinator:

Peter Penzes, Assistant Professor, Northwestern University

5. The Participants:

Japan: The Invited participants 14 people

The others 3 people

Name, Title and Affiliation of the Invited participants

Haruhiko Bito	Associate Professor	University of Tokyo Graduate School of Medicine
Teichi Furuichi	Team Leader	Brain Science Institute, RIKEN
Takuji Iwasato	Principal Investigator	Brain Science Institute, RIKEN
Toshiya Manabe	Professor	Institute of Medical Science University of Tokyo
Shigeo Okabe	Professor	Tokyo Medical and Dental University
Ryuichi Shigemoto	Professor	National Institute for Physiological Sciences
Tomoaki Shirao	Professor	Gunma University Graduate School of Medicine
Michisuke Yuzaki	Professor	Keio University School of Medicine
Aya Ishida	Graduate Student	Keio University School of Medicine
Wataru Kakegawa	Assistant Professor	Keio University School of Medicine
Toshiyuki Mizui	Graduate Student	Gunma University Graduate School of Medicine
Tetsushi Sadakata	Researcher	Brain Science Institute, RIKEN
Yuko Sekino	Associate Professor	Institute of Medical Science University of Tokyo
Kazuhiro Sohya	Researcher	Brain Science Institute, RIKEN

US: The Invited participants 11 people

The others 1 people

Name, Title and Affiliation of the Invited participants

Chiye Aoki	Professor	New York University
Hollis Cline	Professor	Cold Spring Harbor Lab
Yasunori Hayashi	Principal Investigator	RIKEN-MIT Neuroscience Research Center
Robert Malenka	Professor	Stanford University School of Medicine
Venkatesh Murthy	Associate Professor	Harvard University

Suzanne Paradis	Postdoctoral Fellow	Children's Hospital
Peter Penzes	Assistant Professor	Northwestern University Feinberg School of Medicine
Peter Scheiffele	Assistant Professor	Columbia University
Morgan Sheng, MBBS	Professor	RIKEN-MIT Neuroscience Research Center
D. James Surmeier	Professor	Northwestern University
Edward Ziff	Professor	New York University School of Medicine

6. The Abstract and the Significance of this seminar (300 words):

Synaptic plasticity in glutamatergic synapses is an important element for brain functions such as learning and memory. It is thought to be expressed by either regulation of transmitter release from the presynaptic component or modulation in distribution and function of glutamate receptors on the postsynaptic membrane. Among candidate regulatory processes of synaptic plasticity, regulatory mechanisms of glutamate receptor number and distribution in the postsynaptic spines are under intense investigation. However, detail of the molecular processes, which should involve interactions of the postsynaptic density (PSD) scaffolding proteins and the cytoskeletal polymers, is not yet clarified. In this workshop, researchers studying the mechanisms of induction and expression of postsynaptic plasticity were mainly invited and presented their recent finding related to this topic. The participants were emphasized to propose new working hypotheses on molecular mechanisms of synaptic plasticity. In the presentations, extensive discussions were carried out on several topics including; roles of PSD protein, cytoskeletal polymers, cell adhesion molecules, and neurotrophic factors on synaptic plasticity (M. Sheng, E. Ziff, P. Scheiffele, Y. Hayashi, T. Shirao, S. Okabe, T. Furuichi), functions and modulation of glutamate receptors associated with higher-order brain functions (T. Manabe, T. Iwasato, M. Yuzaki, R. Shigemoto), identification and characterization of new signal transduction pathways modulating synapses (S. Paradis, P. Penzes, H. Bito), regulation of synapse strength on the network level (V. Murthy, T. Tsumoto), and roles of specific synaptic connection in the context of whole animal development/pathology (H. Cline, D. J. Surmeier). A variety of experimental techniques applied to different brain circuitries, including cerebellum, hippocampus, basal ganglia, amygdala, and sensory cortex, were presented and common features of synapse plasticity across different brain regions were discussed. The participants were able to share recent advancements in this field and also could be aware of the importance of integrative approaches in future research. It was also a shared opinion emphasizing importance of analyzing *in vivo* synaptic connections involved in specific higher-order cognitive functions.

7. The Result of this seminar and the results expected (300 words):

The major results of this seminar can be summarized in the following two points.

- A. The seminar helped the participants to clarify the frontiers of research in synapse plasticity through the presentations and discussions on research activities in biochemistry, cell biology, and physiology of synapse functions. These activities are; (1) introduction of more sophisticated genetic manipulation of animals in the precision of single amino acid level and also under the precise spatiotemporal control, (2) efforts to analyze a wide range of neuronal networks, such as the striatum, amygdala, and sensory cortex, in addition to the classical systems, such as the hippocampus and the cerebellum. (3) extensive application of cell biological methods, which was accelerated by identification of molecules involved in the process of signal transduction during induction and expression of synapse plasticity. (4) advancement of techniques studying synaptic structure and function enabling precise determination of molecular density and number in single synapses. There were also discussions on the future aspects of studies on synapse plasticity. In general, participants emphasized multidisciplinary approaches by combining new quantitative techniques with sophisticated genetic manipulations for precise analysis of plasticity-related brain functions *in vivo*.
- B. This seminar helped young scientists be exposed to the environment of vigorous scientific

discussions in the international atmosphere. Young participants presented their own data as posters and oral presentations were provided by two young participants after evaluation of all posters by senior scientists. There were also intensive discussions after the presentation and helped them relate their own work with related experimental data in the other laboratories. In view of educational merits, this seminar provided an indispensable environment stimulating young participants and broadening their knowledge.

8. The Others (Other Comments):

This seminar was judged to be quite valuable by most participants, as there was vigorous exchange of opinions and new ideas throughout the seminar and also most of the oral presentations were on very recent topics including some unpublished data. It would be important to have seminars with similar atmosphere regularly for further development of collaboration and information exchange among scientist in the field of synapse plasticity. In this seminar we received less U.S. young participants compared with Japanese. Possible ways to increase young participants from the U. S. side should be discussed in future.