Form 2-4-2

Japan-US Brain Research Cooperation Program
The Group Joint Study Report [field: 2]

1. The Representative of Group Joint Study:

Affiliation/ Title/ Name
Professor of Div. Neurophysiol., Osaka Univ. Grad. Sch. Med.
/ M.D. Ph.D./ Tadaharu Tsumoto

2. The Project Title:

Activity dependent control of development and plasticity of neural circuits of visual cortex.

3. Japanese Investigator 's Name, Title, Affiliation and Phone Number:

Chief: Tadaharu Tsumoto, M.D. Ph.D., Professor,
Div. Neurophysiol., Osaka Univ. Grad. Sch. Med., Japan-6-6879-3661

Collaborator:
Yoshio Hata, Ph.D., Associate professor
Satoshi Ichisaka, Ph.D., JSPS fellow
Katsuro Kameyama, Graduate student
Div. Neurophysiol., Osaka Univ. Grad. Sch. Med.,
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4. U.S. Investigator 's Name, Title, and Affiliation:

Chief: Michael P. Stryker, Ph.D., Professor,
Dept. Physiol., Univ. California San Francisco.

5. The Term of Research: **From** 2000.4.1 **To** 2003.3.31 (3 Years)

6. The Abstract, the Result and the Significance of Research(300 Words):

Neural circuits in the mammalian neocortex are modified by experience-induced neural activity during postnatal development. Monocular deprivation (MD) during early postnatal life remodels neural circuits of the primary visual cortex so that most neurons respond poorly to stimuli presented to the deprived eye and thalamic input from this eye is ultimately retracted. Although this remodeling has been thought to be initiated at thalamocortical synapses in cortical layer IV, recent experiments showed that physiological plasticity proceeds earlier in supragranular layers than in layer IV of the cortex. These findings suggest a possibility that thalamocortical reorganization is guided by earlier changes in intracortical connections. However, it is still unknown what type of modification in the

cortical circuit underlies this rapid plasticity in supragranular layers. To address this question, the present research aimed to develop an experimental procedure to examine morphological plasticity of functionally identified cortical circuits. We focused on the intracortical ascending axons from layer IV to III, which give strong excitatory inputs to supragranular cells. Optical imaging of the intrinsic signal allowed us to identify the ocular dominance columns and inject a retrograde tracer in layer III at a functionally identified cortical site, for example the border of the ocular dominance columns. Then we developed time-lapse labeling technique, that is, we injected two retrograde tracers at the same location in supragranular layers before and after MD. With this technique we can examine a possible change in the distribution of labeled layer IV cells in relation to the ocular dominance column pattern. Also, this technique is applicable to research of neural circuit dynamics in other cortical areas.

7. The Others (Practical Issues, Special Mention Matters):