Title of Project : Neural Diversity and Neocortical Organization

Term of Project : FY2010-2014

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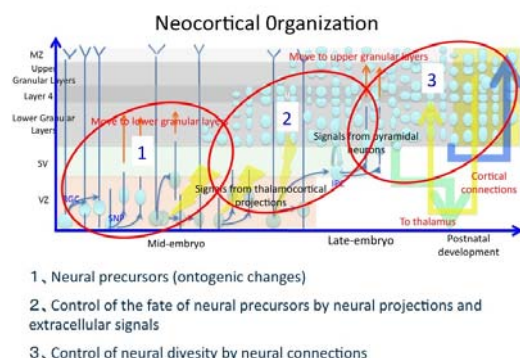(National Institute for Basic Biology, Brain Biology, Professor)

【Purpose of the Research Project】

Our research project aims at understanding basic mechanisms how neural stems cells generate various neurons and form the neocortex. We are studying the following three steps. 1) The first step is that epitherial cells of the ventricle zone divide and generate various neurons. 2) The second step is that phenotypes of neurons are determined by the thalamocortical projections. 3) The third step is that postmitotic neurons can still change their diversity by the environmental inputs and neural connections, which form the structure of the neocortex. Through these steps, the various types of neurons are generated and the neurons are organized to make appropriate connections by forming layers and areas. Our research projects set three research areas to study these processes. By combining planned research studies and selected research studies from applications, we want to build up new research areas that can offer a new venue to study the neocortical organization.

【Content of the Research Project】

In order to study the above research project, we set the three research areas as shown by the following figure.

1、Neural precursors (ontogenic changes)
2、Control of the fate of neural precursors by neural projections and extracellular signals
3、Control of neural divesity by neural connections

The planned research studies are following.
A01: Generation of neural diversity from stem cells
1. Mechanisms for the diversity of neural stem cells (Ryuichiro Kageyama, Kyoto University)
2. Analysis for mechanisms to generate diversity of neocortical cells by neural stem cells (Yukiko Goto, University of Tokyo).
3. Analysis for mechanisms of the differentiation from stem cells to glial cells (Takuya Shimazaki, Keio University)

A02: Neural diversity and projections
1. Regulation of proteolysis of cell surface molecules and neural development (Makoto Noda, Kyoto University)
2. Analysis for mechanisms of the generation of neural diversity by axonal projections (Masayuki Masu, Tsukuba University)
3. Molecular mechanisms for neural differentiation and layer specific projections (Noriko Osumi, Tohoku University)

A03: Determination of neural diversity (layers・areas・neural codes)
1. The structure and function of neocortical layers (Masayoshi Mishina, University of Tokyo)
2. Analysis for functions of area and layer specific molecules (Tetsuo Yamamori, National Institute for Basic Biology)
3. Decoding of the neural code of behavior at the molecular level (Ikue Mori, Nagoya University)

We will also select approximately 21 selected research studies from application research proposals.

【Expected Research Achievements】

By completing the research project, we expect that we will have better understanding of the molecular diversity of neurons. This will help us enormously not only to give us tools to indentify neurons more precisely but also to understand the mechanisms for formation of the neocortical structure.

【Key Words】

Neocortex: the structure that is only found in the mammalian brain. The neocortex plays as a center for receiving information from sensory organs, proceeding the information and integrating the information to output as behavior. The neocortex consists of areas, each of which has the specialized function.

【Homepage Address】

http://www.md.tsukuba.ac.jp/neocortex/