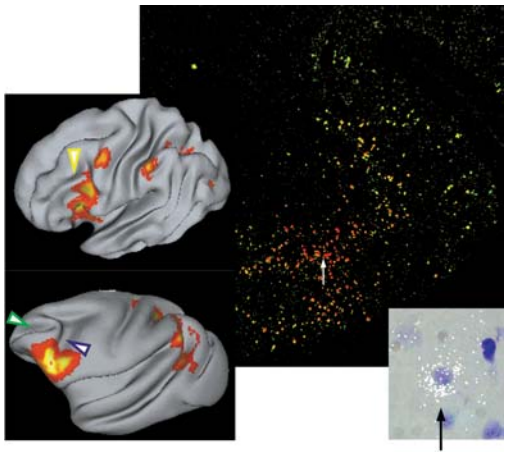
Functional Biology

Integrative Physiology

http://www.physiol.m.u-tokyo.ac.jp/indexe/indexe.html

Our laboratory specializes in the neuroscience research on cognitive functions in the primate. We investigate interactions among many neurons in the cerebral cortex, which create human cognitive abilities such as memory and its cognitive control. These studies have been done through integrative efforts using electrophysiological, molecular biological and neuroimaging approaches.

- Functions of memory neurons in the temporal cortex
- Roles of the top-down signal from the prefrontal cortex
- Functional differentiations of the prefrontal cortex in memory
- Molecular biological basis of declarative memory in the primate
- Development of high-field MRI for humans and monkeys



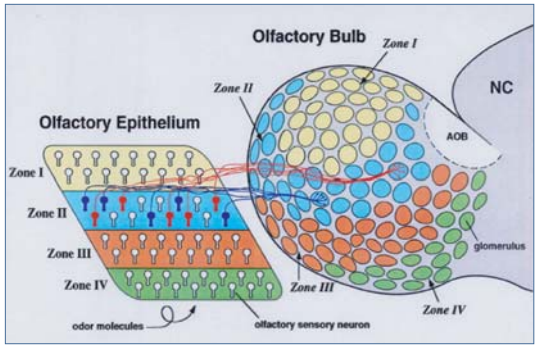
Brain activation in cognitive tasks (left) and gene expression (BDNF) in cortical neurons

Cellular and Molecular Physiology

http://morilab.m.u-tokyo.ac.jp/eindex.html

We aim at a better understanding of neuronal mechanisms involved in sensory perception of the external world and for the emotional state induced in the brain by sensory inputs. We are currently analyzing the central nervous system for olfaction, a sensory modality that has a strong influence on human emotion. Another major focus is to understand cellular and molecular mechanisms for contact-mediated interactions between neurons and immune cells that occur in pathological and physiological conditions.

- Functional analysis of the neuronal circuit in the central olfactory nervous system (Analysis of odor maps in the brain)
- Neurogenesis and neuron-elimination in the adult brain
- Cellular and molecular mechanisms for the contact-mediated interactions between neurons and immune cells in physiological and pathological conditions



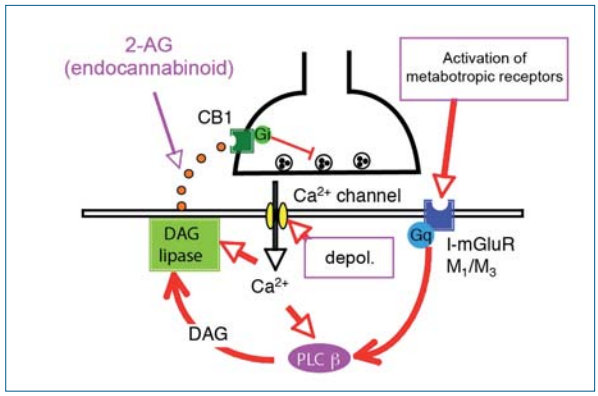
Neuronal circuits and 'odor maps' in the olfactory nervous system

Neurophysiology

http://plaza.umin.ac.jp/~neurophy/

Our laboratory studies the function of the synapse, a key structure for brain functions, and its changes related to postnatal development, learning, and memory. We make real time monitoring of neuronal activities, using various methodologies including electrophysiology, molecular biology, and optical imaging of functional molecules.

- Postnatal development of synaptic function and organization in the cerebellum
- Retrograde synaptic modulation mediated by endogenous cannabinoids
- Synaptic integration in intact animals
- Synaptic plasticity and motor learning in the cerebellum



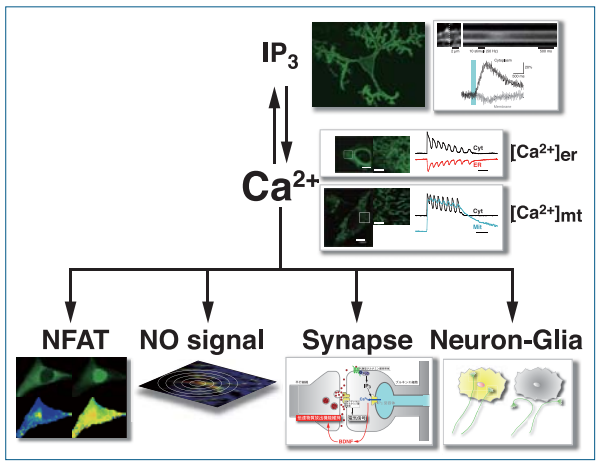
Molecular mechanisms of endocannabinoid-mediated retrograde modulation of synaptic transmission

Cellular and Molecular Pharmacology

http://calcium.cmp.m.u-tokyo.ac.jp/

Spatiotemporal distribution of signalling molecules is extremely important in defining cell signals. We are developing indicators of important signalling molecules and visualize their spatiotemporal distribution within intact cells. Using such novel imaging methods we aim at elucidation of the physiological roles of calcium signalling and related signalling mechanisms in various types of cells including neurons of the central nervous system.

- Development of novel fluorescent indicators of signaling molecules
- Elucidation of the mechanism for spatiotemporal regulation of Ca^{2+} signals
- Exploration of new cellular functions that are regulated by Ca^{2+} signals
- Visualization and analysis of molecular events at synapses



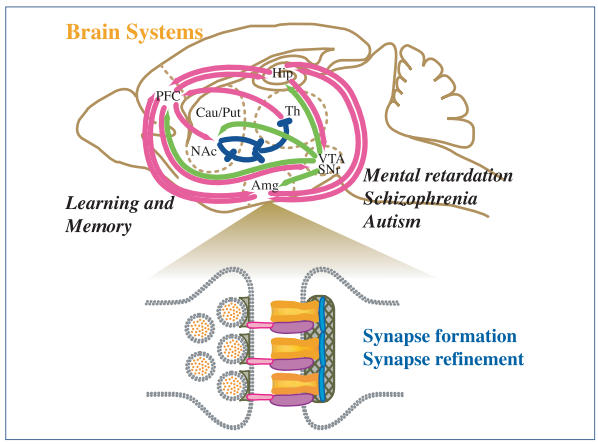
Outline of our research on Ca^{2+} signaling

Molecular Neurobiology

http://www.pharmacol2.m.u-tokyo.ac.jp/

We have been investigating the molecular basis of higher brain functions by focusing on the glutamate receptor and memory. Previous studies have led to the hypothesis that there is a common principle between memory signaling and synapse formation. The combination of conditional gene targeting in mice and molecular genetics in zebra fish will facilitate our understanding of the mechanism of higher brain function at the molecular, cellular and neural network levels.

- Regulation of brain functions by glutamate receptors in specific brain regions
  - Identification of neural networks for learning and memory
  - Regulation of learning and memory
  - Roles of glutamate receptors in decision-making
- Signaling from glutamate receptors to memory
- Molecular mechanisms of synapse formation and remodeling
  - Molecular mechanism of synapse formation during development
  - Molecular mechanism of synapse remodeling in the adult brain



From synaptic molecules to brain function and dysfunction