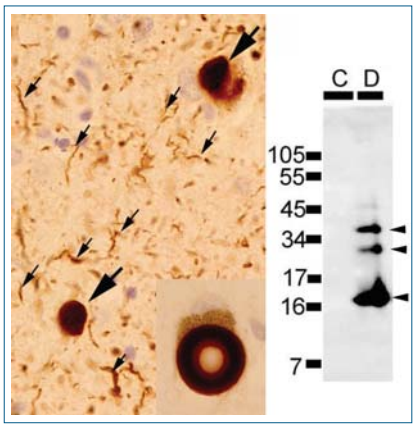
Neuroscience

Neuropathology

Elucidate the pathomechanism of neuronal degeneration and death in major neurodegenerative disorders (e.g., Alzheimer disease, Parkinson disease), and develop novel strategies for disease-modifying therapies.

- Structural and functional analysis of γ-secretase
- Molecular analysis of the mode of action of γ-secretase inhibitors
- Mechanism of Aβ production, aggregation and clearance
- Pathological function of β-amyloid binding proteins (e.g., CLAC)
- Mechanism of aggregation and neurotoxicity of α-synuclein
- Pathological function of familial Parkinson disease gene LRRK2
- Strategies for development and validation of disease modifying therapies for Alzheimer disease (J-ADNI Clinical Study)



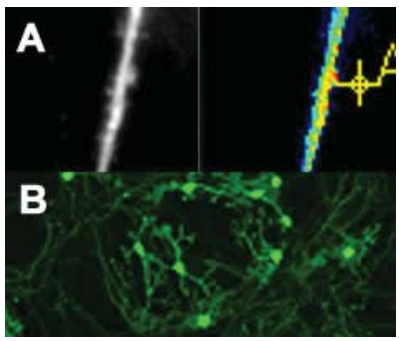
Phosphorylated α-synuclein deposited in Lewy bodies of Parkinson's disease and Lewy body disease

Neurochemistry

http://www.neurochem.m.u-tokyo.ac.jp/Homepage.html

Our brain is able to recognize and memorize external and internal events as they occur. A functional neural network further stands out by its capacity to extract patterns and rules, and to associate them with abstract meaning and affective valence. What are the local and global spectra of the molecular signaling events in neurons that underlie such complex information processing at the systems level? Are these events, in turn, converted into more profound modifications of the synaptic wiring mechanisms? To address these issues, we are currently investigating the chemistry and physiology of various neuronal protein complexes near and at synapses.

- Molecular investigation (including identification, characterization and real-time visualization) of signaling molecules involved in calcium-dependent synaptic modification, especially during signaling from synapse-to-nucleus, and back from nucleus-to-synapses
- Understanding molecular mechanisms controlling cytoskeletal dynamics and remodeling on both sides of the synapses, in the dendritic spines and in axon terminals



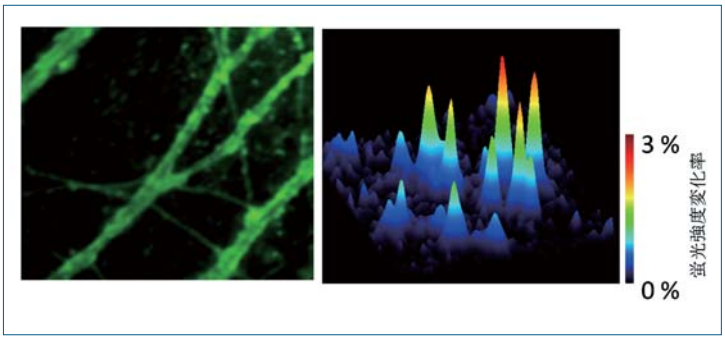
Real-time measurement of biochemical events triggered by glutamate uncaging at hippocampal spines (A); Visualization of actin cytoskeleton in cerebellar Purkinje cell dendrites (B)

Neurobiology

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

The goal of our research is to elucidate regulation mechanisms of various cell functions. Toward this goal, we have been developing novel technologies including live cell imaging and RNAi technologies.

- Development of novel strategy for generating fluorescent probes for live cell imaging
  We develop a high-throughput screening system for constructing high performance fluorescent probes for live cell imaging.
- Study of synapse physiology by glutamate imaging technique
  To clarify the dynamics of exocytosis in excitatory synapses, we have tried to quantitatively analyze released glutamate at individual synapses by using our original optical glutamate probe.
- Novel technology for construction of genome-wide RNAi library
  We are currently constructing a high performance genome-wide RNAi library based on our EPRIL technology.

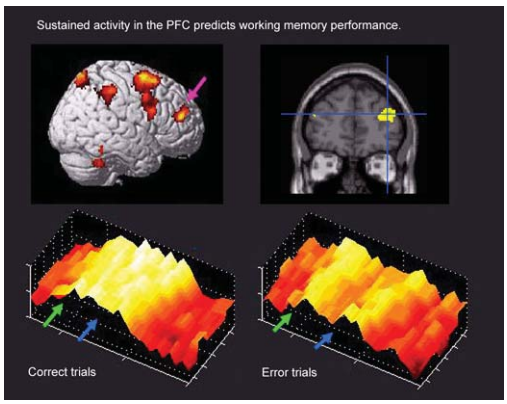


Cognitive Neuroscience

http://square.umin.ac.jp/dcntky/English/Etop.html

We are trying to understand the neural mechanisms of human cognition using functional MRI, EEG and TMS.

- Working memory and cognitive control
- Attention, perception and consciousness
- Mind-reading and prediction of behavior

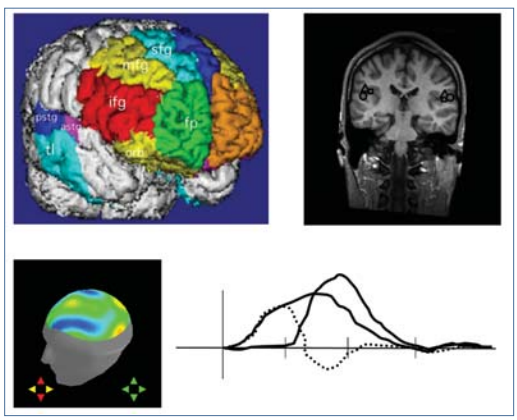


Neuropsychiatry

http://www.h.u-tokyo.ac.jp/patient/depts/n_md.html

Our department mainly investigates schizophrenia and pervasive developmental disorders not only by biological approaches which integrate neuroimaging, genetic and animal studies, but also by psycho-social approaches. We also promote the systematic clinical research training programs and the cooperation with the basic neuroscience research.

- Integrated Neuroimaging studies in Schizophrenia Targeting Early intervention and Prevention
  http://plaza.umin.ac.jp/arms-ut/
- Todai Twin Project with Integrative Neuroimaging
  http://npsy.umin.jp/study/exam.html
- Multimodal neuroimaging studies of pervasive developmental disorders
- Clinical trials to establish the medical equipment as a clinical test useful for the pharmacological treatment of mental disorders



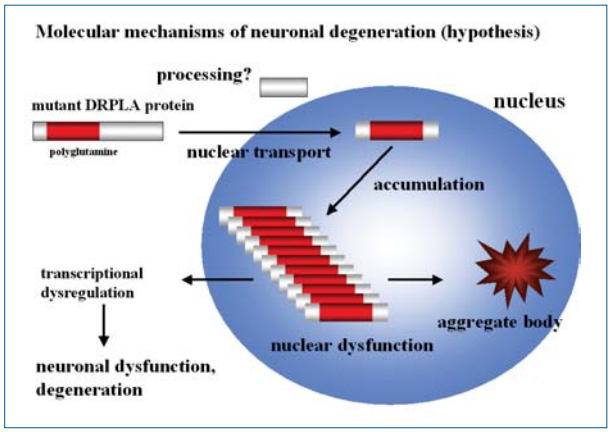
Multi-modality neuroimaging in neuropsychiatry using a combination of high-resolution MRI, EEG, MEG, NIRS, and PET

Neurology

http://square.umin.ac.jp/neurotky/

Our Department is promoting research programs to elucidate the pathophysiological mechanisms of neurological diseases including neurodegenerative diseases, immune-mediated diseases and neuromuscular diseases, and to establish therapeutic approaches for these diseases. We are also providing excellent programs to train neurologists.

- Molecular Genetics (identification of disease genes and development of therapeutic approaches)
- Molecular pathopysiology of neurological diseases (RNA editing, and protein structures)
- Immune-mediated diseases (autoantibodies)
- Neuropysiology and cognitive neuroscience (magnetic stimulation, NIRS, MEG, PET, and fMRI)
- Neuropathology of neuromuscular diseases (pathological studies on biopsy and autopsy materials)
- Multicenter-based clinical research
- Development of new therapeutics

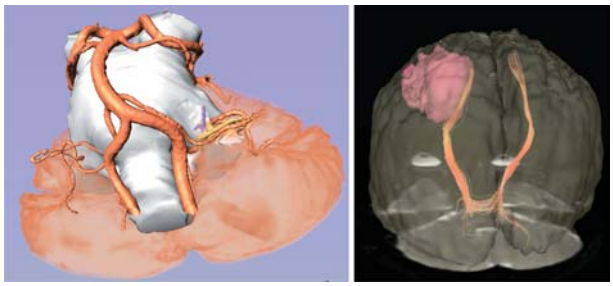


Neurosurgery

http://www.h.u-tokyo.ac.jp/neurosurg/

The 21st century has been designated as "The Century of the Brain". To lead Japanese Surgical Neuroscience, we have devoted our activities to the following: advanced Clinical Neurosurgery, Neuroscience Research and Graduate and Postgraduate education.

- Skull base surgery in managing benign or malignant skull base tumors and cerebrovascular disorders
- Functional neurosurgery including epilepsy surgery
- Development of new therapeutic strategies for malignat brain tumors
- Cinical study on gamma-knife surgery
- Application of brain functional imaging for neurosurgery
- Application of VR technology for surgical simulation
- Experiment on cerebral ischemia
- Development of new stenting device for endovascular surgery



Simulation images using 3D-fusion images and tractography.