NINS
National Institutes of Natural Sciences
SINCE APRIL 2004

Inter-University Research Institute Corporation
National Institutes of Natural Sciences

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- Center for Novel Science Initiatives
- NAOJ
- NIFS
- NIBB
- NIPS
- IMS
- Okazaki Research Facilities
- Okayama Astrophysical Observatory, NAOJ
- Hawai'i Subaru Telescope Base Facility (Hilo), NAOJ

- Chile ALMA-J Chile Office (Santiago), NAOJ

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National Institutes of Natural Sciences
SINCE APRIL 2004

Message from the President

Inter-University Research Institute Corporation
National Institutes of Natural Sciences
President
Katsuhiko SATO

Aiming for Further Progress in the Natural Sciences

The National Institutes of Natural Sciences (NINS) is an inter-university research institute corporation comprised of the National Astronomical Observatory of Japan, the National Institute for Fusion Science, the National Institute for Basic Biology, the National Institute for Physiological Sciences and the Institute for Molecular Science. An inter-university research institute is a type of world-class organization unique to Japan. In response to the research community, it has been organized as a core base to provide a center for collaboration and external use by researchers across Japan. As an inter-university research institute, in addition to promoting pioneering research in key academic areas, it is anticipated that NINS will serve as a center for cultivating future academic disciplines.

NINS aims at contributing to the further development of natural science in the five institutes, promoting cutting-edge and interdisciplinary research that makes use of related research fields of expertise. NINS has also been actively involved in cooperation and collaboration with universities and their affiliated research institutes. Furthermore, as a research center for natural science in Japan, through initiatives in exploring and uncovering problems in novel research fields and tasks in natural sciences, NINS is also enhancing human resources in each field through measures such as the education of graduate students.

In addition, NINS has set up the International Strategy Headquarters as an interdisciplinary research center for natural science. NINS plans to further strengthen the collaboration between Japan and organizations in Europe, the U.S., and East Asian countries. NINS is well positioned to implement the formation of international research centers in which outstanding researchers are organized on a global scale. In this context, NINS has already concluded agreements concerning international joint research with the European Molecular Biology Laboratory (EMBL), the European Southern Observatory (ESO), the National Science Foundation (NSF), and Princeton University as the first steps towards forming an international research center.

The world from the economic situation to the structure of society has undergone much change because of globalization. NINS has a good track record in research and in the development of young researchers through cooperation with universities, and for more progress, what is sought is to accelerate our own transformation amidst this big change. NINS has to rise to overcome this situation, see it as an opportunity, and enhance our organization's activities to fulfill our responsibility. Taking advantage of being part of a single corporation, the five institutes can uncover novel fields and new problems in natural science. To concretely put these aims into practice, from two research fields, NINS has established the new Center for Novel Science Initiatives, made up of the Brain Science Division and the Imaging Science Division. Through collaboration and cooperation with the research community, both within and outside our institutes, NINS is undertaking research in these areas. In addition to these, NINS is also considering exploring new areas. I am carrying out a wide variety of reforms through establishing dialogue with executives and young researchers from each research institutes and soliciting their opinions.

In conclusion, NINS will continue to develop the results of its research endeavors by such reforms. In various areas of the natural sciences, including astronomy, energy science, life sciences, and material science, we are implementing the highest standards of research in the world. At the same time, we are overcoming the barriers that exist between different fields and are nurturing new cutting-edge research areas. Our aims are to create new concepts of academic learning and to contribute to society.

We are grateful for your continuous support of our vision.

The executive members

What is an Inter-University Research Institute?

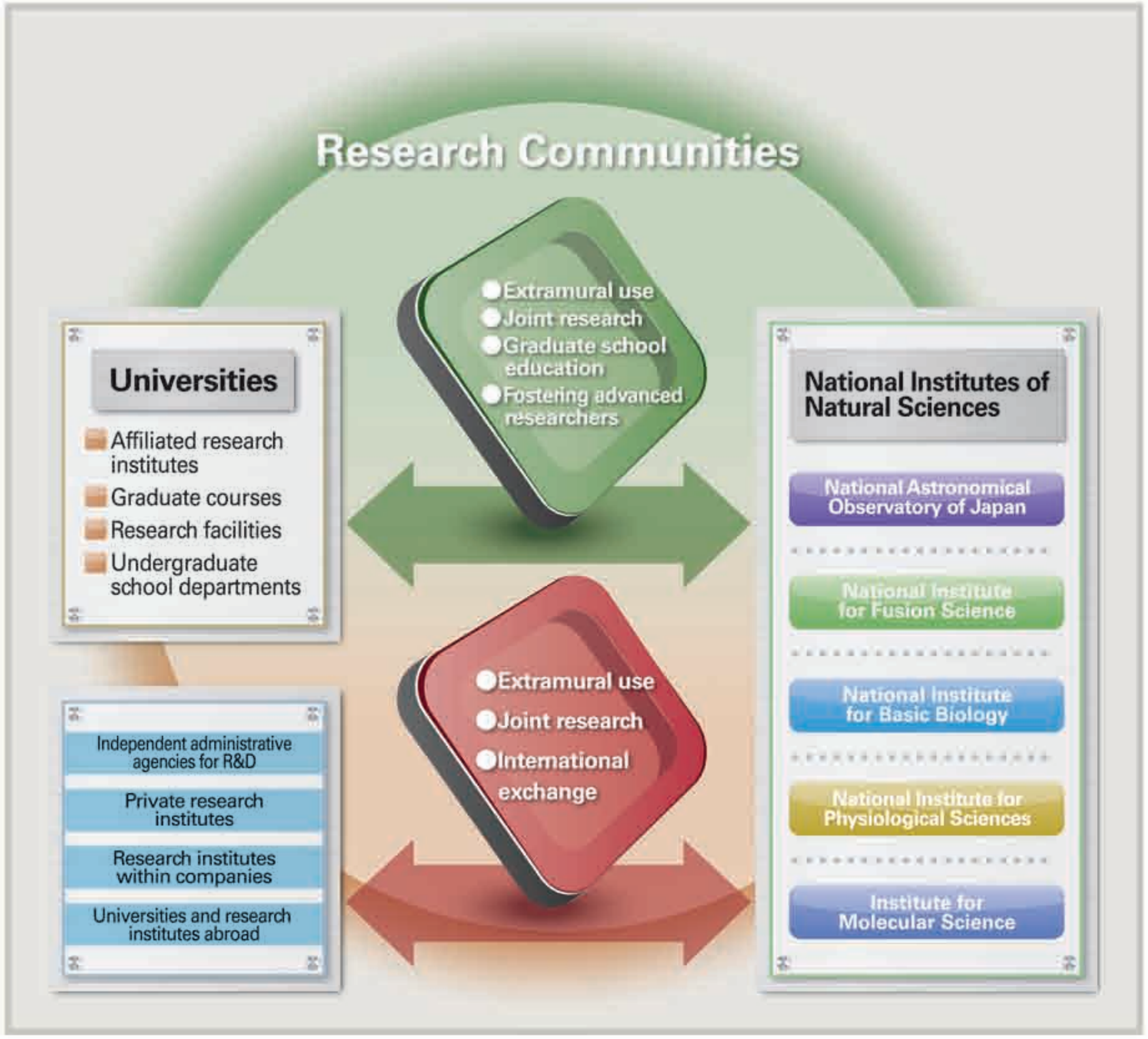
The World's Leading Research Institutes in Japan

The National Institutes of Natural Sciences (NINS) consists of five inter-university research institutes: the National Astronomical Observatory of Japan (NAOJ), the National Institute for Fusion Science (NIFS), the National Institute for Basic Biology (NIBB), the National Institute for Physiological Sciences (NIPS), and the Institute for Molecular Science (IMS). In addition to playing a leading role in its respective research field, each institute has a collaborative relationship with NINS with the common goal of creating an interdisciplinary and international research base.

An inter-university research institute is a "research institute operated by the research community," a type of world-class organization unique to Japan. The inter-university research institute was organized as a core base to provide a place for joint research and extramural use by researchers across Japan. One such institution originated as the Research Institute for Fundamental Physics (Yukawa Hall) in Kyoto University, which was opened to the community in 1953 in response to requests from theoretical physicists throughout Japan.

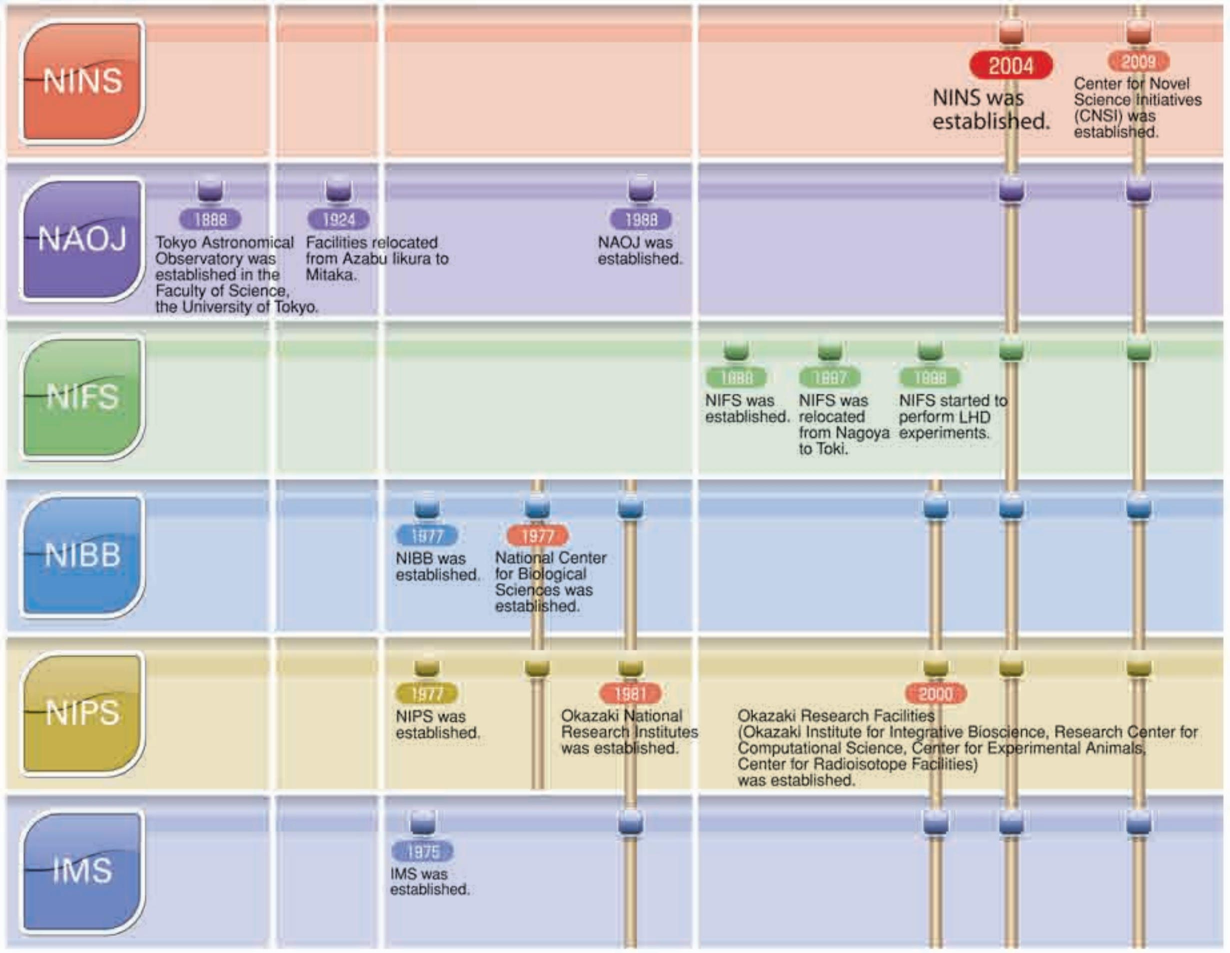
An inter-university research institute not only promotes pioneering studies on important research issues, but also provides opportunities for cutting-edge researchers throughout Japan to gather and engage in activities aimed at exploring future academic fields and creating new principles. New concepts of extramural use such as "joint usage of large-scale facilities" and "improvement of the intellectual foundation of academic materials" were later added to the original concept. While the research community's own management policy has been firmly maintained, many inter-university research institutes that do not belong to a specific university have been created.

While maintaining its uniqueness and diversity, each institute makes a great contribution to the development of academic research in Japan as a Center of Excellence in its respective research field. Together, they also serve as an international core base to promote cooperation and exchange with research institutes and researchers abroad.

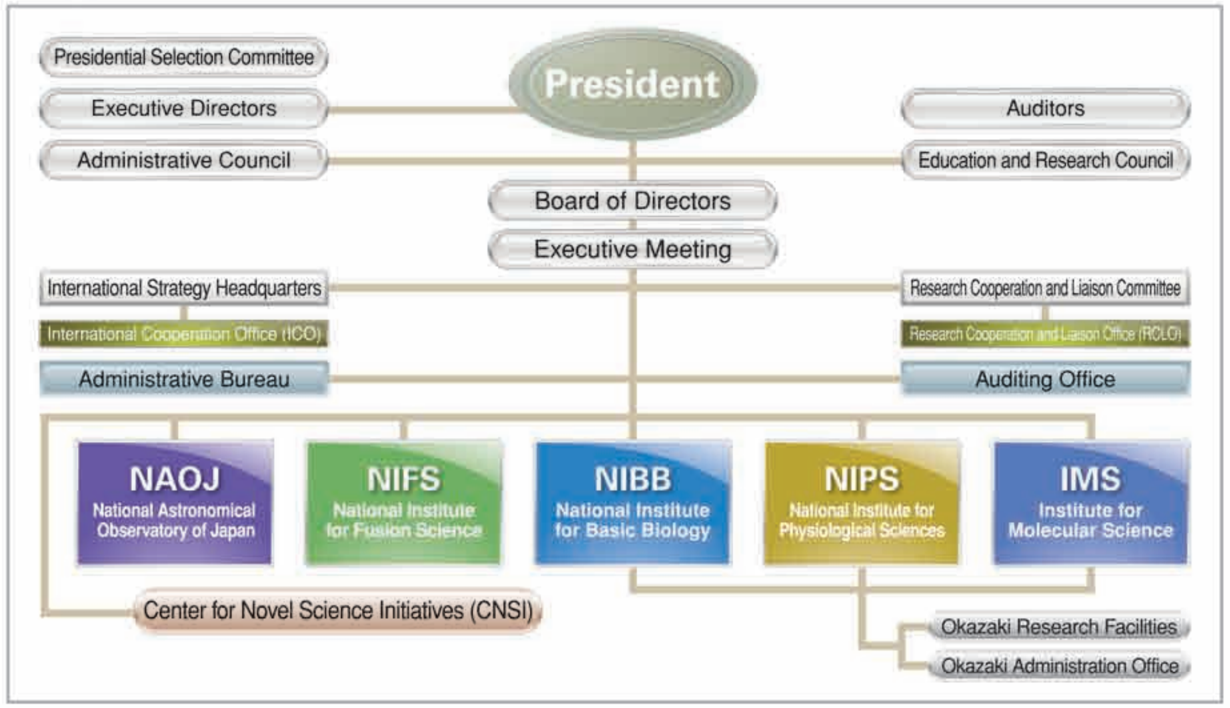


History & Organization

History



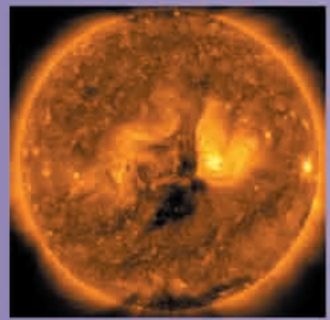
Organization



NAOJ

National Astronomical Observatory of Japan

NAOJ is the national center of astronomical research in Japan. It aims at developing astronomy and related sciences by promoting the open use of its state-of-the-art observation facilities such as the Subaru Telescope, organizing various joint-research programs, and encouraging versatile international cooperation.



X-ray image of the sun taken by the *Hinode* observational satellite

NIFS

National Institute for Fusion Science

NIFS conducts collaborative research into the basic sciences of high-temperature plasmas and fusion engineering. Our researchers from all over the world use computer simulations and experiments with the Large Helical Device (LHD) as their leading projects in order to realize "a sun on the earth," controlled fusion, which is a new, safe, and environmentally friendly energy source.

The LHD maintains high temperature plasmas in steady state.

NIBB

National Institute for Basic Biology

The earth is filled with living organisms exhibiting various forms and demonstrating shapes and behaviors adapted to diverse environments. NIBB, in collaboration with outside researchers, studies the essential phenomena underlying the characteristics and abilities that animals and plants have acquired over the long course of evolution.

The Medaka Bioresource Facility provides various strains and mutants of medaka to researchers worldwide.

NIPS

National Institute for Physiological Sciences

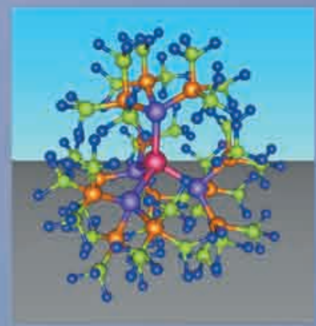
NIPS' goals are to uncover the mechanisms by which the human body functions. This is the basis of medical science and links to clarifying the pathophysiology of various diseases. Presently our focus is on brain science as the main part of "body and mind" research. Furthermore, as a national center of physiological research, the institute provides facilities and research staff for collaborative studies to scientists from universities and research institutes.

The reconstructed 3D image of the human brain from fMRI data, color-coded according to function.

IMS

Institute for Molecular Science

The aim of IMS is to investigate fundamental properties of molecules and molecular assemblies through both experimental and theoretical methods. Since its inception, IMS has made its facilities available to the worldwide scientific community, a policy which has fostered many joint programs involving IMS scientists.



A nanometer-scale dendrimer (tree-like molecule) with novel functions

Center for Novel Science Initiatives (CNSI)

Visualization of computer simulation of colliding galaxies (Simulation data: Takayuki Saitoh)

A neuronal network of the cerebral cortex, as observed in a living mouse, visualized under two-photon microscopy

Expanding research methods and inter-disciplinary exchange in natural sciences research is on the cusp of giving birth to new fields of research. NINS established the Center for Novel Science Initiatives (CNSI), which is composed of the Brain Science Division and the Imaging Science Division. CNSI is promoting the expansion of new creative research communities and research that is linked to academic development.

Okazaki Research Facilities

The Okazaki Research Facilities consists of four centers: the Okazaki Institute for Integrative Bioscience, the Research Center for Computational Science, the Center for Experimental Animals, and the Center for Radioisotope Facilities. These facilities are intended for the common use of NIBB, NIPS, and IMS.

NAOJ
National Astronomical Observatory of Japan

↑ Spiral Galaxy NGC 6946

Director-General
Shoken MIYAMA

Astronomy is one of the oldest yet most active sciences. This fact alone means that humans possess the fundamental desire to seek their origins and the reason for their existence through the understanding of the universe. Since the establishment of the Big Bang Theory of the universe in the 20th century, astronomers have been striving to describe the dynamics of the evolution of the universe from material production, the generation of stars and planets, and the creation of life forms up to the birth of human beings. The 21st century will be the era for us to search the planets and for life outside the solar system.

NAOJ continuously seeks to develop new methods of observations to gain a deeper understanding of the objects and phenomena in the universe such as the Earth, solar system objects, stars, galaxies, clusters of galaxies, and the expanding universe. We hope to play a key role in establishing a new paradigm of nature.

ALMA

ALMA (Atacama Large Millimeter/submillimeter Array) is a partnership project among Europe, North America, and East Asia (Japan and Taiwan) in cooperation with the Republic of Chile to build an international radio astronomical facility on the 5,000-meter Chilean plateau. NAOJ is leading the construction and operation of ALMA. By combining signals obtained by 80 antennas, ALMA will unveil mysteries in the universe such as the formation of galaxies that are 13 billion light years away from us, the formation of stars and planets, and the synthesis of organic molecules. Full operations is planned to start in 2012.

Eight 12-meter parabola antennas located at the ALMA-Array Operations Site (5,000-meters above sea level) in Chile

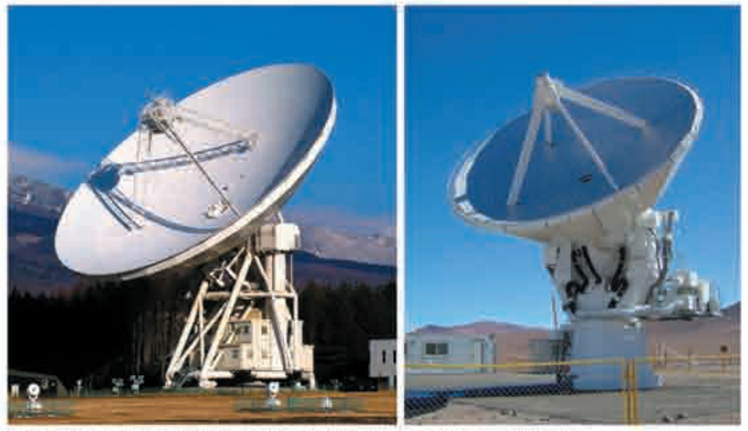
Subaru Telescope

The Subaru Telescope is our flagship observation facility. It is an 8.2-meter optical/infrared telescope located at the top of Mauna Kea of Hawai'i Island in the U.S. Its open use since 2000 has produced a number of excellent achievements from the discovery of the farthest galaxies and the observation of proto- and baby galaxies up to the mechanisms of proto-planetary systems.

The uniquely shaped enclosure of the Subaru Telescope located at the top of Mauna Kea of Hawai'i Island (Altitude: 4,200-meters)

Nobeyama Radio Observatory (NRO)

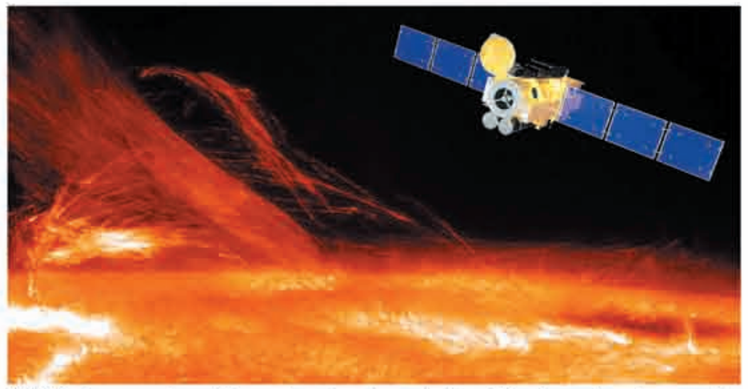
The NRO boasts a 45-meter antenna with the highest sensitivity in the millimeter wavelength. The radio telescopes excel in discovering interstellar molecules and black holes as well as revealing the evolution and structure of the universe. In Chile, the ASTE 10-meter telescope plays a world-leading role in submillimeter observations.



45-meter antenna (left) and ASTE 10-meter telescope (right)

Hinode, a solar observational satellite

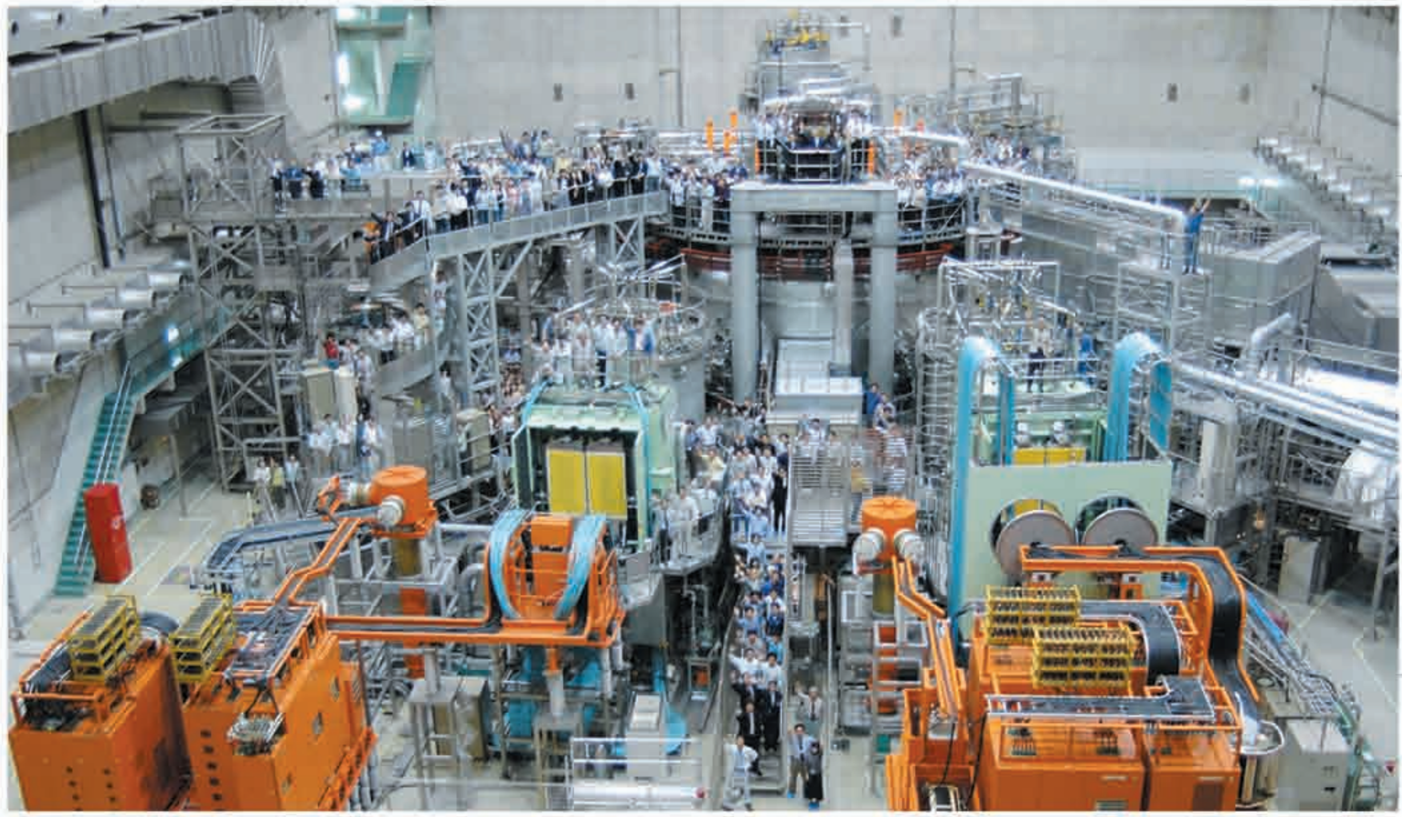
The *Hinode* (Solar-B), launched on September 22, 2006, is a highly sophisticated observational satellite. Its optical and x-ray telescopes and extreme-UV imaging spectrometer can obtain detailed images and spectra of the sun from the photosphere to the upper corona. NAOJ aims to uncover the formation of the corona and the origin of solar magnetic fields and coronal activities as well as to understand the processes of stellar plasma.



Artistic impression of the solar physics satellite *Hinode* and an image of a dynamic chromosphere taken by the Solar Optical Telescope on *Hinode* (Copyright NAOJ/JAXA)

NIFS

National Institute for Fusion Science



↑ Large Helical Device (LHD)

Director-General
Akio KOMORI

NIFS considers its research to actualize fusion energy as one of the "big sciences" in Japan and strongly promotes academic research in this critical area. The industry-driven, high-tech world that humans have achieved in the recent era is largely built upon energy sources such as nuclear power and fossil fuels like coal, petroleum, or natural gas. Unfortunately, heavy consumption of those fossil fuels results in generating a substantial amount of CO_2, aggravating problems in the global environment. Besides, there is a limit to our reserves. Furthermore, current nuclear power generation based on atomic fission reactions leaves serious issues, as typified by high-level radioactive wastes, still unsolved. On the other hand, as the global population continues to grow, energy consumption also increases proportionately. Under such circumstances, the research of safe, eco-friendly energy for the future is placed at the top of the agenda in the modern world. Supposing that we would actualize a fusion reaction, an energy source of the sun and stars, on the earth, it would mean that humans will have secured a perpetual source of energy, since deuterium, the fuel for a fusion reaction, is abundantly available in seawater. Also, utilizing low-radioactive materials will make materials of reactors reusable, leading to the realization of a "Sound Material-cycle Society" in its truest sense.
NIFS carries out active collaborative research with domestic and international universities, as well as research organizations. While fostering the next generation of excellent human resources, NIFS will continue to actively promote fundamental research in fusion plasmas with a view to the actualization of safe, eco-friendly fusion energy in the near future.

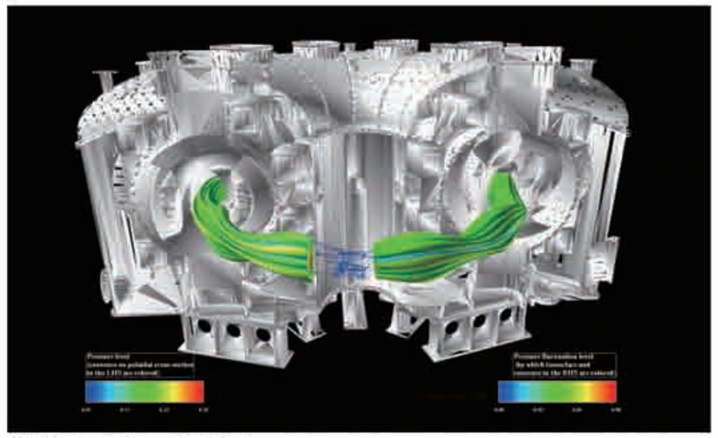
Research on high-temperature steady-state plasma utilizing the Large Helical Device

The Large Helical Device (LHD) project employs the world's largest superconducting helical coils based on the heliotron magnetic configuration that was originally developed in Japan. The objectives are to conduct research of high-temperature steady-state plasma confinement and its related science and engineering, and to promote academic research aimed at the future actualization of a fusion reactor. Plasmas with temperatures of 100 million degrees have been produced several thousand times a year, providing many opportunities for a variety of scientific collaboration.

LHD vacuum vessel

Large-scale simulation research project

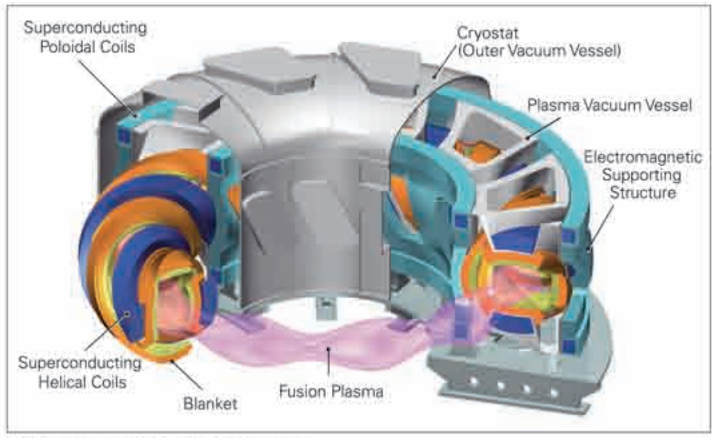
Computer simulation research is indispensable in studying plasmas that have strong nonlinearities causing a variety of complexities. Using a large-scale computer simulation system, this project aims at systematizing plasma physics, clarifying the physical mechanism of various phenomena in fusion and related plasmas. Complexity science is also explored to support such systematization.



MHD simulation of LHD plasma

Fusion engineering research

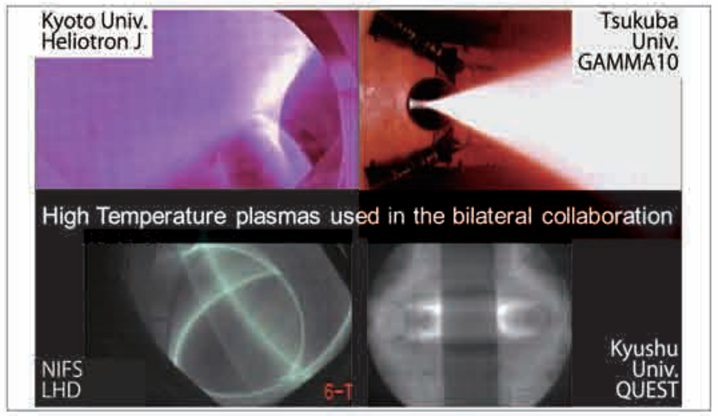
The research focuses on both the detailed design of LHD-type fusion energy reactor and various engineering challenges to make it possible to construct a fusion demonstration reactor. Researches on key components in fusion reactors, such as the superconducting coil system, high performance blanket, first wall and divertor, are carried out, while keeping consistency with the demonstration reactor designs.



Helical-type fusion reactor FFHR

Cooperative Research with Universities

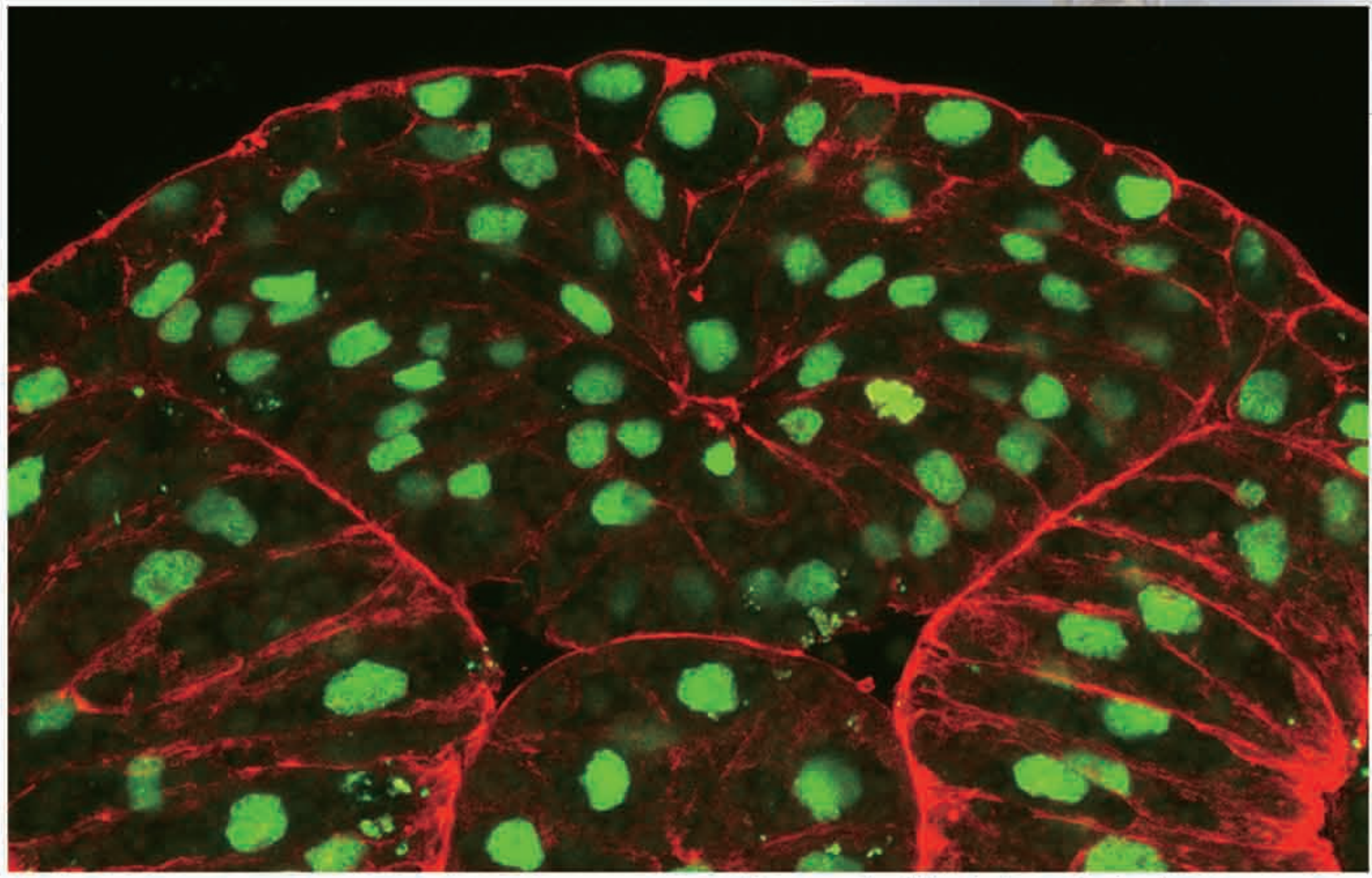
The cooperative relationship between NIFS and universities allows us to make good use of plasma devices. By effectively sharing our LHD and other university-owned experimental facilities, we investigate the physics of steady-state ultra-high-temperature plasmas, and also work to meet engineering requirements for the realization of a fusion reactor. Providing plenty of interactive opportunities at the forefront of fusion study, collaborative activities also help yielding excellent young researchers including graduate students.



High temperature plasmas in bilateral collaboration (Kyoto Univ., NIFS, Tsukuba Univ., Kyushu Univ.)

NIBB

National Institute for Basic Biology



↑ A cross sectional view of a frog embryo forming organs

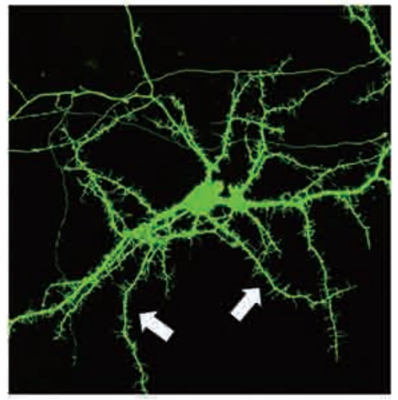
Director-General
Kiyotaka OKADA

Among the innumerable celestial bodies in our universe, the earth appears unique in that it is filled with a variety of living organisms. Over the course of 4 billion years of evolution, animals and plants have acquired diverse forms as well as astonishing abilities and continue to survive on this remarkable planet through the propagation of their offspring. Living organisms are believed to have evolved by increasing the genetic information inherited from their ancestors and by changing the functions of those genes. We believe increased knowledge of the intricate processes of life and the adaptation mechanisms of living organisms will lead to solutions to many of the problems facing us, such as our planet's worsening environment.

To understand the survival strategies of organisms, we study the basic principles common to all creatures and the mechanisms that enable diversity by using model animals and plants in collaboration with worldwide researchers. In order to provide high quality experimental organisms and to enable state of the art data analyses, we maintain the "NIBB Bioresource Center" and the "NIBB Core Research Facilities" and work to continually improve our collaborative facilities. As an inter-university research institute, NIBB supports the progress of diverse fields of biological research in collaboration with universities and institutes throughout the world.

Protein synthesis at the dendrite is indispensable for neuronal network formation

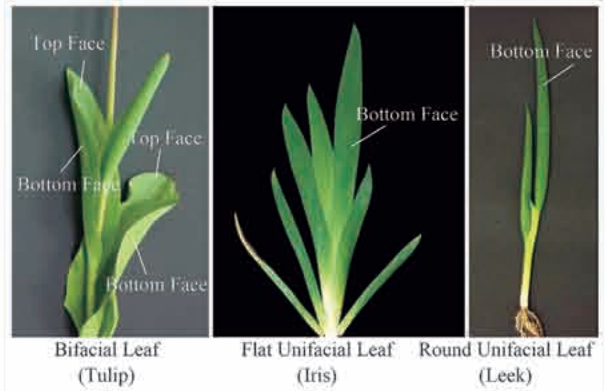
Most cells synthesize proteins in the cytoplasm near the nucleus. In nerve cells, however, messenger RNAs (mRNAs) for dozens of proteins are transferred to the dendrite, which is the part of the nerve cell where stimuli from the neighboring cells are received, and the proteins are synthesized within the dendrite. However the significance of such localized protein synthesis has been obscure. We recently showed that an mRNA binding protein called RNG105 is essential for the mRNA transfer and that nerve cells lacking RNG105 cannot form a normal neural network. These findings provide clues to understand malformations in neural networks found in psychiatric diseases.



A typical image of a nerve cell. About six dendrites (arrows) spread out from the cell body to form branches.

Morphogenetic mechanisms of unifacial leaves seen in irises and leeks

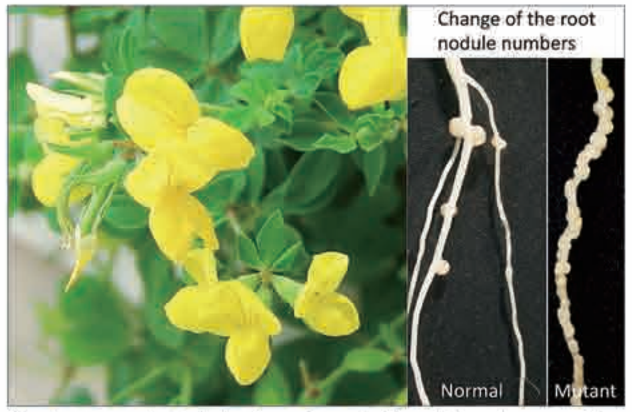
Plant leaves usually have a flat shape in which the top face, which receives light, and the bottom face, through which oxygen and carbon dioxide are exchanged, have different structures. In contrast to such leaves (bifacial leaves), irises and leeks have unifacial leaves which have only one kind of face similar to the bottom face of bifacial leaves. Leaves of irises and leeks are yet different from each other in that the former are flat and the latter are round in their cross sections. We studied the genetic mechanisms of formation and flattening of unifacial leaves and found that a gene called "DROOPING LEAF" (DL) is essential in flattening of the leaf. This provides a step towards genetic engineering of the shape of plant leaves.



Examples of plants having bifacial and unifacial leaves

A gene controlling both the number of root nodules and plant form in legumes

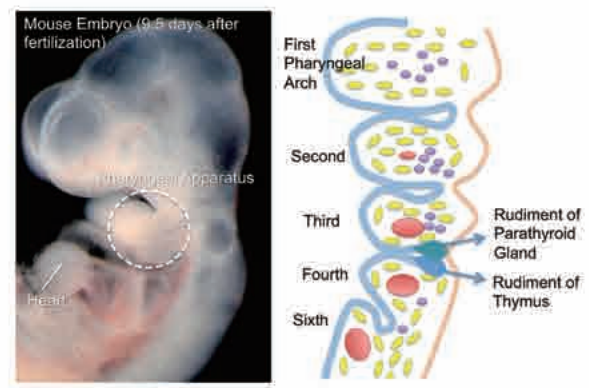
Root nodules, found in the roots of legumes such as peas and beans, are a special organ where symbiont microbes live. Because of these the plants can produce nutrients from atmospheric nitrogen and proliferate in nutrient starved areas thanks to the functions of the microbes. We discovered a gene controlling the number of the root nodules in a legume model plant, *Lotus japonicus*. The gene named "KLAVIER" also controls bloom timing and plant forms, such as the shape of stems and pods and number of flowers. Understanding the special abilities of legume plants is expected to lead to solutions to food and environmental issues.



The legume plant, *Lotus japonicus* (left) and the change of the root nodule numbers by disruption of KLAVIER gene (right)

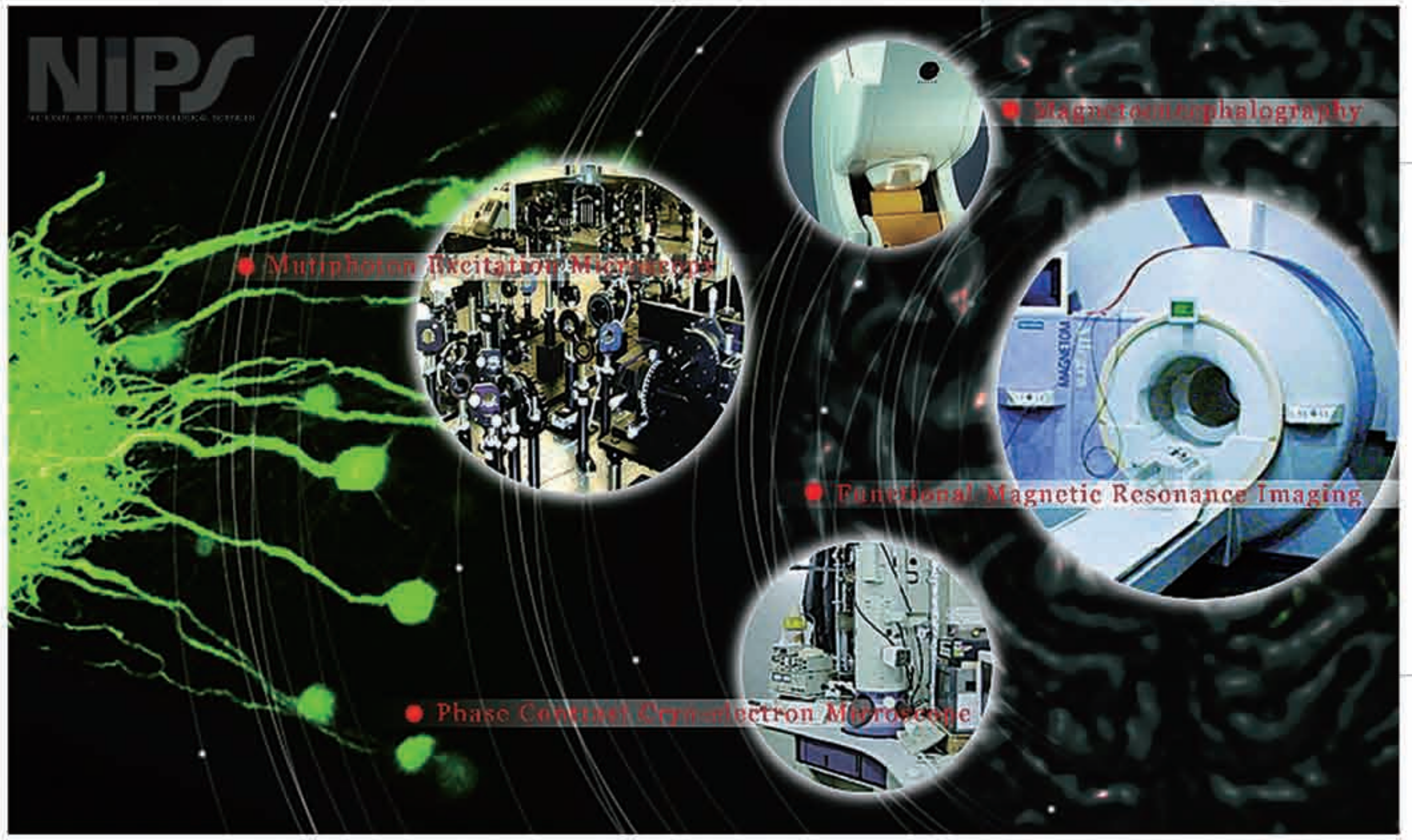
A gene indispensable for the formation of the heart, arteries, thymus and parathyroid glands

During the development of vertebrates, such as humans and mice, a transient structure called the pharyngeal apparatus gives rise to important organs such as the thymus, the parathyroid glands, and contributes to the development of arteries and the cardiac outflow tract. Formation of the pharyngeal apparatus itself and the development of organs from it are known to require a gene called Tbx1. We further showed that a gene called Ripply3 is indispensable for organ development from the pharyngeal apparatus and that Ripply3 controls the function of Tbx1. This result is important in understanding organ development processes and gives insight in elucidating mechanisms of congenital malfunction of multiple organs.



The pharyngeal apparatus of the mouse embryo (left) and its cross section (right)

NIPS
National Institute for Physiological Sciences



↑ Specialized equipments and large-scale facilities for joint researches to promote brain science

Director-General
Yasunobu OKADA

NIPS' mission is to conduct research at the forefront of physiological science by examining the living body at various levels of organization, thus leading to a holistic understanding of the functioning of the human body. Recent progress in life sciences has been truly remarkable, and there have been tremendous developments especially in molecular biology and genetic engineering. Non-invasive imaging techniques have also become very useful for clarifying the physiological functions of the human body. Recently, NIPS has been mainly focusing on brain science, and it is now considered to be one of the best brain research institutes not only in Japan but also in the world.

A new interdisciplinary research center, the Okazaki Institute for Integrative Bioscience, was founded in 2000 in cooperation with the National Institute for Basic Biology and the Institute for Molecular Science. Recently, we established the "Center for Multidisciplinary Brain Research" to promote brain science as an interdisciplinary multidimensional science in Japan. With the key phrase "Elucidation of the Functioning of the Human Body," NIPS is performing cutting-edge research in multiple fields involving not only physiology but also biochemistry, molecular biology, cognitive science, and medical engineering. NIPS provides its facilities and expert staff to domestic and foreign scientists for collaborative studies.

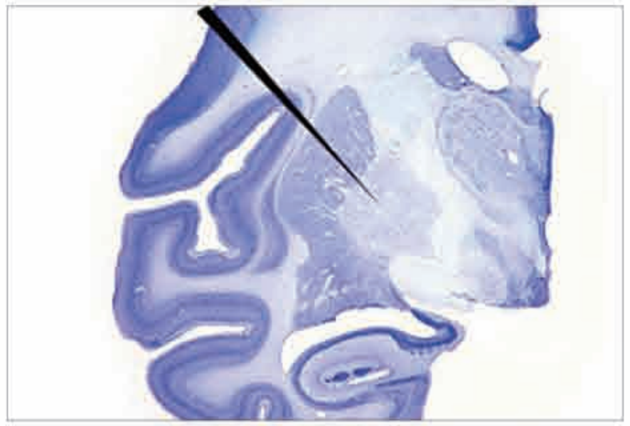
Exploring higher brain functions

One of NIPS' main research objectives is the exploration of higher brain functions in primates (including humans) such as perception, cognition, and motor control. To investigate the underlying mechanisms of higher brain functions, hemodynamic studies such as functional MRI (fMRI) and near-infrared spectroscopy (NIRS), and as well as electrophysiological studies such as single neuron recordings, magnetoencephalography (MEG), electroencephalography (EEG), and transcranial magnetic stimulation (TMS) are utilized, with the goal of attaining a comprehensive understanding in this area. NIPS has been evaluated as one of the best research centers not only in Japan, but also in the world in this particular research field.

Image of the recovery process in brain function following a spinal cord injury. In the early stage, both sides of the motor cortex become active simultaneously (left). In the later stage, a much larger area of the brain cooperated to restore damaged function (right).

Neuronal activity in living organisms

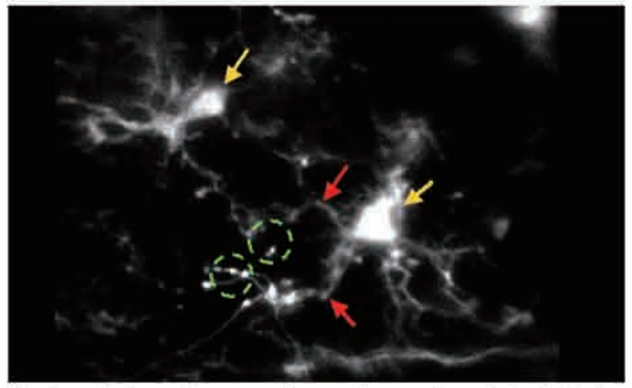
The recording of neuronal activity in vivo is a powerful technique to understand how neuronal circuitry functions in living organisms. This technique was originally applied to primates, but can also be applied to rodents, especially genetically modified animals. Utilizing a mouse model, NIPS research has discovered that the decreased activity of the basal ganglia, a part of the brain structure, is the main cause for the abnormal muscle contraction in dystonia.



Neuronal activity in the basal ganglia of living organisms can be recorded utilizing electrophysiological approach in vivo.

Clarifying the mechanisms underlying neural development

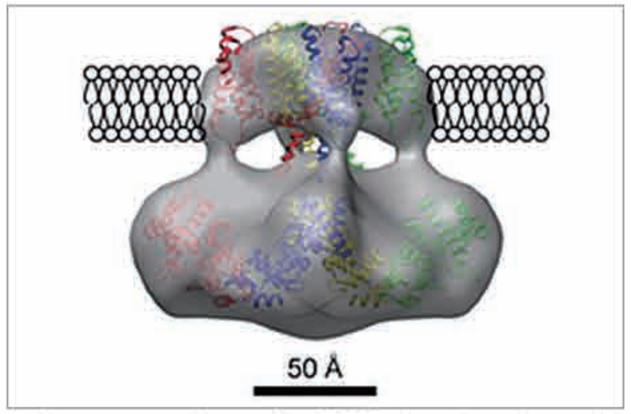
NIPS is studying the development of neural systems and body homeostasis. For example, NIPS found that microglial cells in the brain play an important role in surveying synapses between neurons. Once the neural circuit is damaged, microglial cells promote its remodeling. NIPS has also successfully observed this remodeling process utilizing the two-photon laser microscopy in vivo.



The two-photon microscopy image shows microglial cells in the brain (yellow) reaching their processes (red) out to synapses (green).

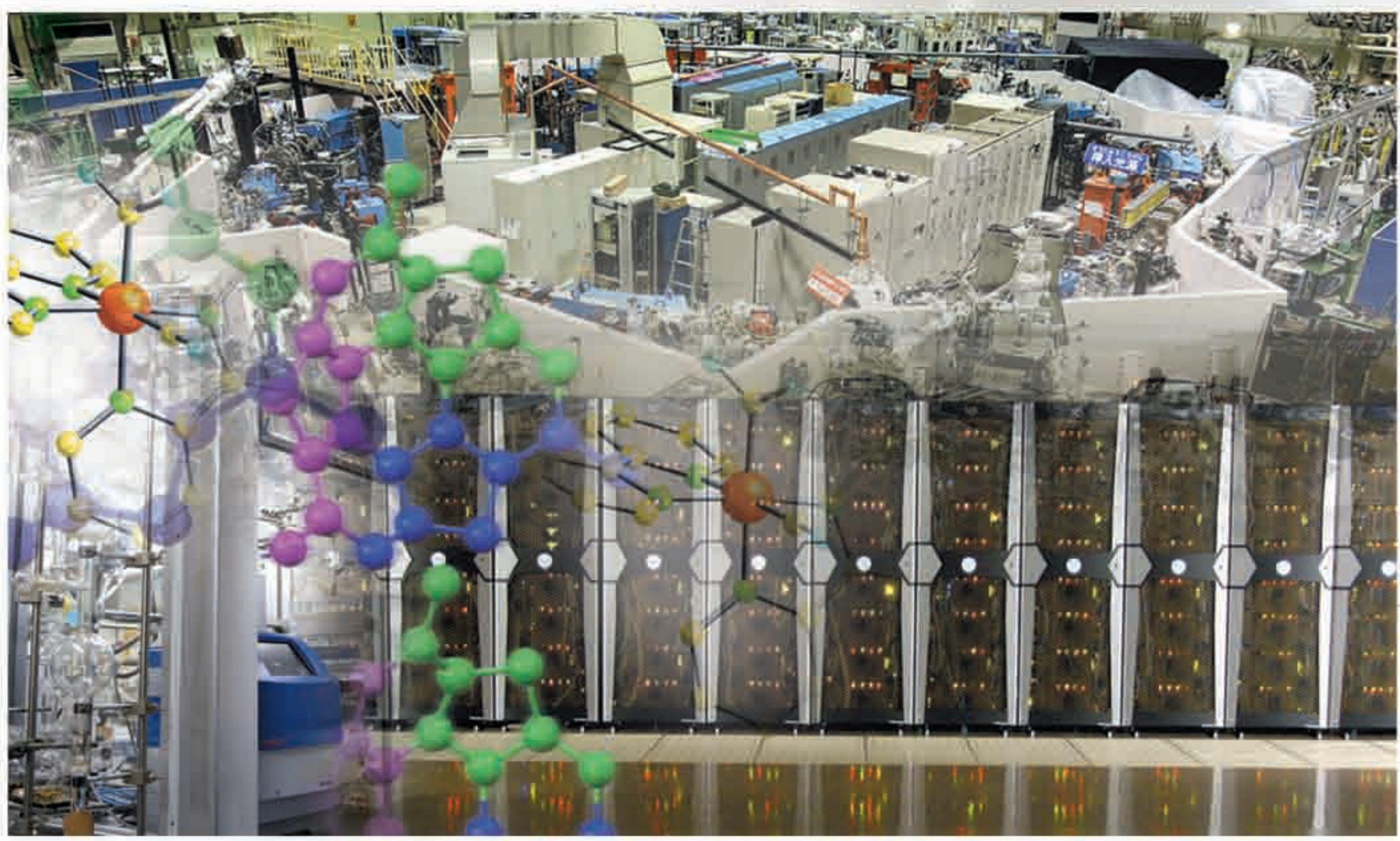
Visualizing functional structures on the nanometer scale

TRPV4 is one of the TRP channels activated by various stimuli including temperature. NIPS reconstructed the TRPV4 structure on the nanometer scale. The upper small and lower large components are thought to correspond to transmembrane and cytosolic segments, respectively. We discovered that these components have structures similar to those of the transmembrane segment of the potassium ion channel (MlotiK1) and the ankyrin repeat domain of TRPV1.



A 3D-reconstructed image of the TRPV4 channel protein revealed by a new electron microscope developed by NIPS

IMS
Institute for Molecular Science

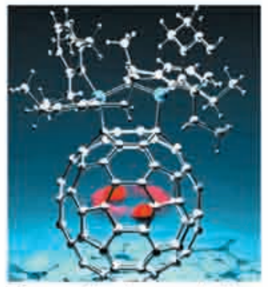


Director-General
Iwao OHMINE

Almost all substances—including water, air, and living bodies—are made up of molecules, and their natures are closely related to the structures and functions of molecules constituting the materials. Molecular science is a fundamental discipline that gains, via experimental and theoretical investigations, deeper insights into the interactions between molecules and into chemical reactions that cause transformation of molecules. By finding novel characteristics of molecules and molecular assemblies, and by synthesizing new materials with desired properties and functionalities, molecular science provides invaluable clues to resolving future energy and environmental crises. By doing so, the research field will contribute to building new scientific and technological tools which are indispensable for realizing a sustainable society. As a Center of Excellence in molecular science, on which a wide range of research fields are based, the IMS encourages concepts and methodologies to be uniformly applied in a variety of scientific fields. IMS' main research areas are theoretical and computational molecular science, photo-molecular science, materials molecular science, and life and coordination-complex molecular science. In each area, the frontiers of science are being explored by independent research groups led by professors or associate professors who take full initiative in original research activities. The IMS has also been continuing efforts to further promote molecular science all over the world by supporting various collaborative research programs in which many researchers in Japan and abroad fully utilize IMS' state-of-the-art facilities and by constructing a solid cooperative network with research centers in East Asia.

Drawing vivid figures of molecules by theory and computation

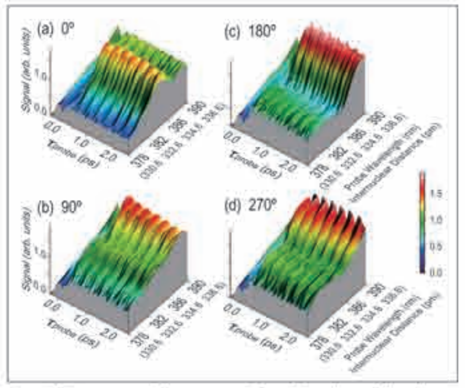
Behaviors of molecules and molecular assemblies are governed by the fundamental laws of physics, i.e., quantum mechanics and statistical mechanics. In the area of theoretical and computational molecular science, new theories and concepts are constructed on the basis of these fundamentals in physics. Large-scale calculations are carried out utilizing high-performance computers to achieve truly microscopic descriptions of various phenomena appearing in the real world and to predict the novel properties and functionalities of materials. In particular, since 2006, IMS has been contributing to the national project on Development & Application of Advanced High-Performance Supercomputer of the Ministry of Education, Culture, Sports, Science and Technology, as the core center in nano-science to elucidate the microscopic mechanisms of self-organization and functionalities in bio-molecules and nano-scale assemblies.



Theoretically predicting the motion of metal atoms inside a molecular cage made of carbon atoms

Using light to capture lively figures of molecules

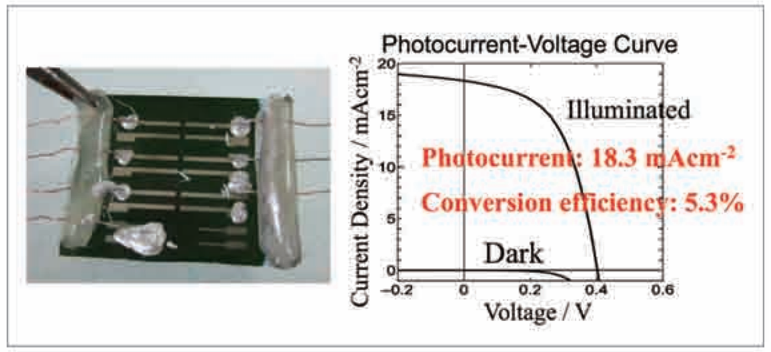
Light is one of the most valuable tools for detailed experimental examination of the characters of molecules and molecular assemblies. No field—from material science to bioscience—can proceed without utilizing light. In the area of photo-molecular science, highly active investigations are performed to develop light sources with unsurpassed performance such as the synchrotron radiation facility, which generates intense light in a wide frequency region from X-ray to terahertz, and microchip lasers, which are quite compact but still have surprisingly high output. These light sources are utilized for studies on the properties, functionalities, and reactivities of materials. This research area establishes the foundation for a wide range of fields in science through cutting-edge research on photo-molecular science, including the real-time probing of ultrafast structural changes of molecules, direct optical microscopic imaging of nanometer-scale assemblies, and precise quantum control of molecular motion and reactions.



Spatiotemporal images of molecular vibration, actively tailored by precisely controlled ultra-fast laser pulses

Designing molecules at nanometer scale

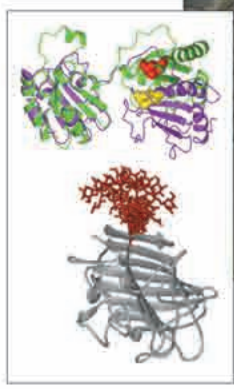
For synthesizing valuable compounds without undesirable by-products and creating new materials with novel functionalities, it is necessary to take precise control of molecules and molecular assemblies. In the area of material molecular science, active researches are in progress to develop synthetic technologies for various chemical compounds with atomic-scale precision and to construct methods for well-designed molecular assemblies. These researches are expected to lead to findings of heretofore undiscovered chemical and physical phenomena at the nanometer scale and contribute to other fields in science and technology such as information, communication, and energy-conversion processes. In addition, the Nanotechnology Support Project is underway to support various collaborative researches in the fields of nano-scale measurement and analyses, ultra-precision material processing, and advanced syntheses of molecules and materials.



An organic solar cell with the highest light-to-current conversion efficiency

Learning from biological functionalities to develop waste-free chemical reactions

Various biological functionalities in living bodies are closely correlated to the behavior of molecules. In the area of life and coordination-complex molecular science, various advanced methods of research have been developed in the field of molecular science, e.g., state-of-the-art thermometric and spectroscopic measurements including nuclear magnetic resonance (NMR). These methods are extensively applied in conjunction with molecular biologic technologies such as genetic modification to studies on the structure and functionalities of proteins, which play an important role in living bodies. Active research is also underway on the development of efficient light-energy conversion to chemical energy and innovative organic synthesis free from unwanted byproducts.



The molecular structure of protein is unveiled by measurements using an ultra-high magnetic field NMR apparatus.

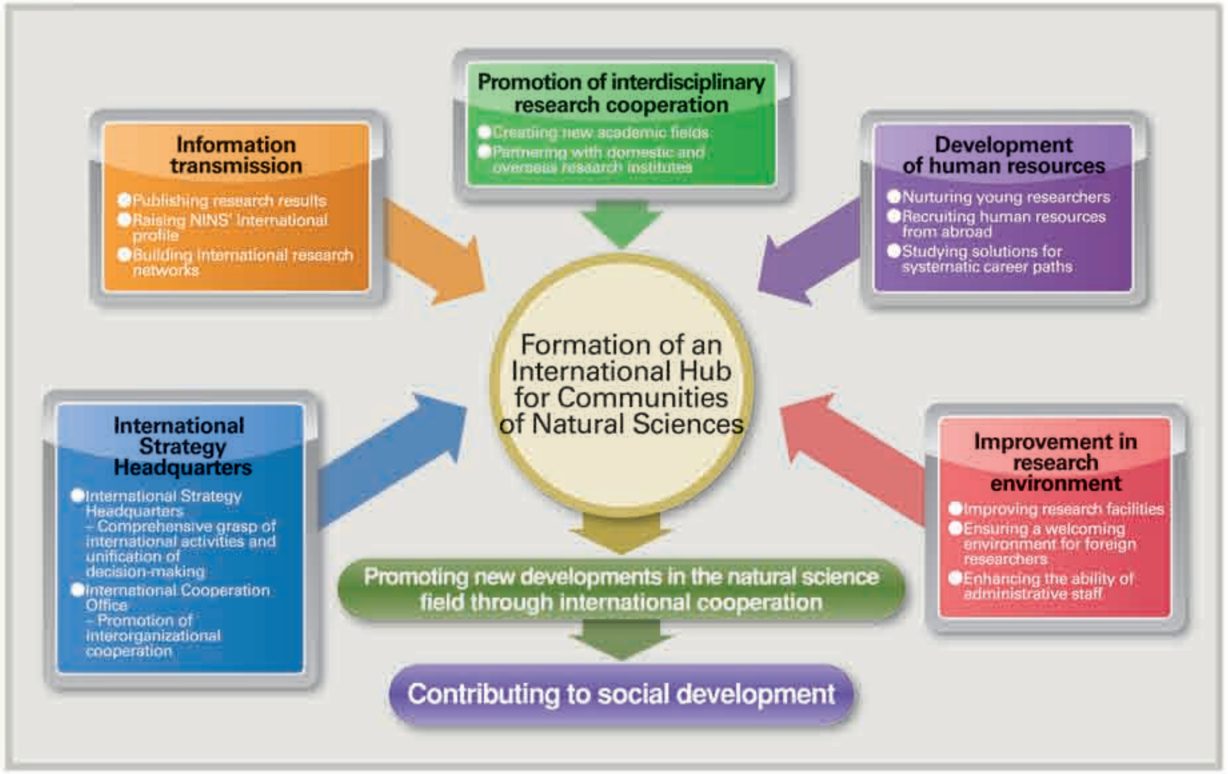
International Strategy

In response to diversification of research and accelerated scientific progress, it is getting more essential to promote research through international academic cooperation that crosses national borders and academic fields. NINS consists of the five institutes : NAOJ, NIFS, NIBB, NIPS, and IMS. We support their international activities aimed at the autonomous formation of the hubs for research communities. NINS has also been strategically promoting the formation of the bases for international, interdisciplinary research hubs.

To further accelerate to this process, we established the International Strategy Headquarters, which established international strategies aimed at the "Formation of International Hubs for the Natural Sciences Research Communities".

To apply these strategies, we manage the inter-organizational and international activities in an organized way, and promote new approaches for the further development of the natural sciences, with support and corporation from the research community.

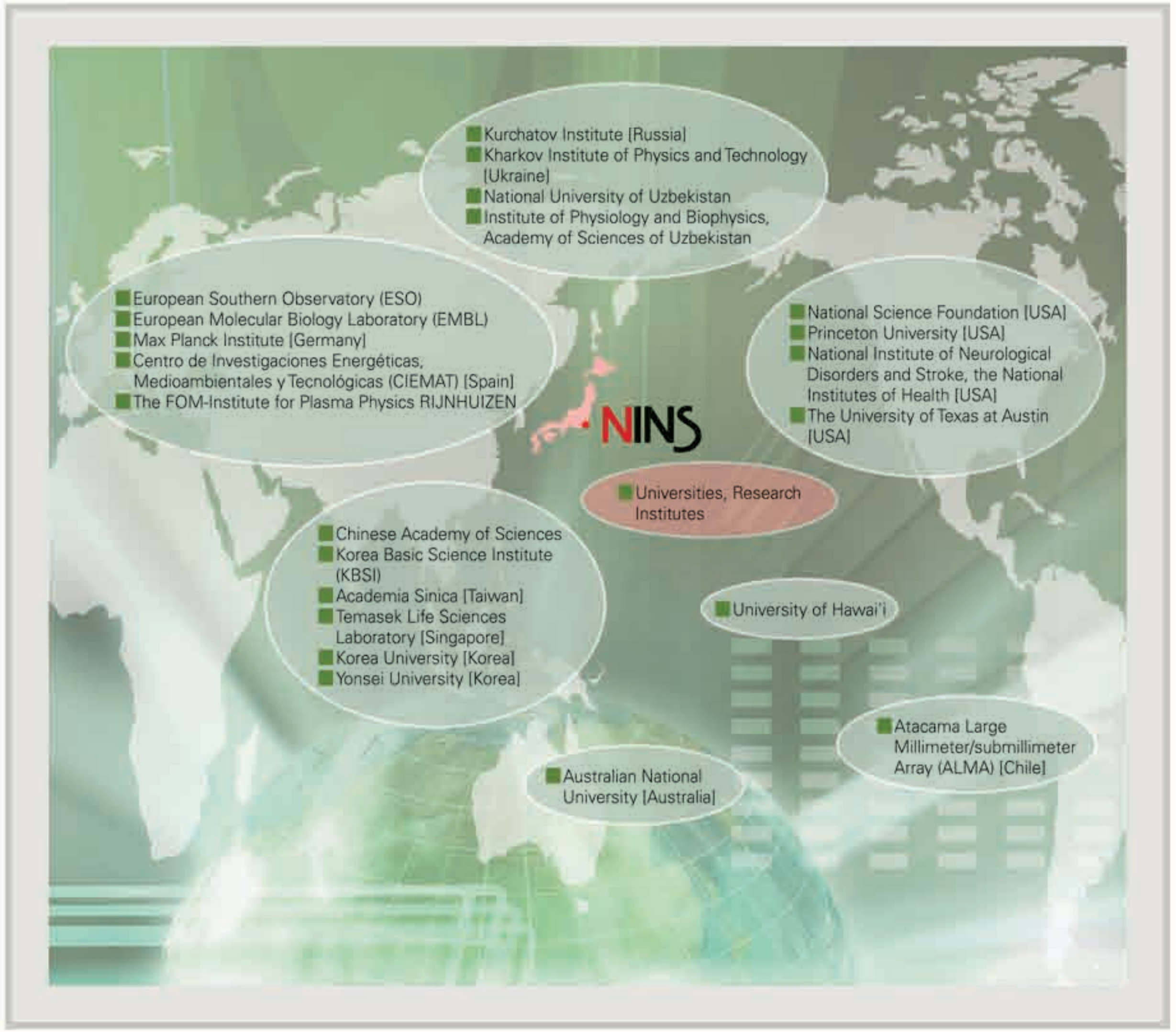
NINS' International Strategies



Conclusion of the agreement between NIFS and the FOM-Institute for Plasma Physics RIJNHUIZEN

Conclusion of the agreement among NIPS and the College of Medicine of Korea University, the College of Medicine of Yonsei University, and the College of Dentistry of Yonsei University

Main contracting research institutions with NINS



Research Cooperation

NAOJ, NIFS, NIBB, NIPS, and IMS are Japan's Centers of Excellence in academic research in their respective fields. Since its inception, NINS has aimed at forming new research fields through the coordination of the inter-disciplinary activities among these five research institutes and promotion of collaborations with universities for the formation of new research communities.

NINS inaugurated the Center for Novel Science Initiatives (CNSI) in 2009, and has been facilitated the expansion of two new creative research communities, Imaging Science, created from collaborative activities among the five institutions, and Brain Science, for the promotion of a national inter-university network in the field of brain science. NINS has been extending the community of creative researchers, and continues to support the promotion of research that facilitates the further development of academic field with CNSI at the core.

Furthermore, under the leadership of the president, NINS is working on the Program for Cross-disciplinary Study by young researchers aimed at the fostering of young researchers, strengthening of international cooperation, and promotion of various academic disciplines.