

The background features a light gray, textured surface. Scattered across it are several sets of concentric circles. Some are thin white lines, while others are thicker pink lines. A pink line graph with several peaks and valleys is positioned horizontally across the lower half of the image. The peaks of the graph are marked with small pink circles.

# NINS

National Institutes of Natural Sciences  
SINCE 2004

**Inter-University Research Institute Corporation  
National Institutes of Natural Sciences**

**NINS**  
National Institutes of Natural Sciences

<http://www.nins.jp/>



# Message from the President Akio KOMORI

As an international Center of Excellence (COE), the National Institutes of Natural Sciences (NINS) promote cutting edge academic fundamental research in diverse fields such as astronomy and astrophysics, plasma physics and fusion energy, basic biology, physiology and molecular science, by carrying out joint use and joint research with universities and research institutes around the world. NINS consists of five 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, NINS has four research centers: the International Research Collaboration Center (IRCC), the Center for Novel Science Initiatives (CNSI), the Astrobiology Center (ABC), and the Exploratory Research Center on Life and Living Systems (ExCeLLS), as interdisciplinary organizations directly operated by NINS. A point to note is that NINS possesses some of the world's largest experimental equipment such as the Subaru Telescope of NAOJ, the Large Helical Device (LHD) of NIFS, and the Ultra Violet Synchrotron Orbital Radiation (UVSOR) of IMS. NINS makes these facilities available for joint use and joint research performed by researchers and graduate students from Japan and abroad to promote the most advanced research in the world.

In FY 2017, NINS welcomed 13,000 researchers and graduate students as joint users and collaborative researchers. Approximately 1,000 of them consist of researchers and graduate students from abroad. As an international COE, NINS implements several big international research projects and various international collaborative research programs. This enhances the exchange of human resources, and thus NINS functions as a hub to connect researchers and graduate students both in Japan and overseas. Moreover, NINS conducts postgraduate education, and accepts internship graduate students from abroad to guide their research.

Through these efforts, NINS promotes cutting edge research, and would like to create new fields which are suitable for the 21st century, and thus contribute to the international society.

小森章夫  
Akio Komori

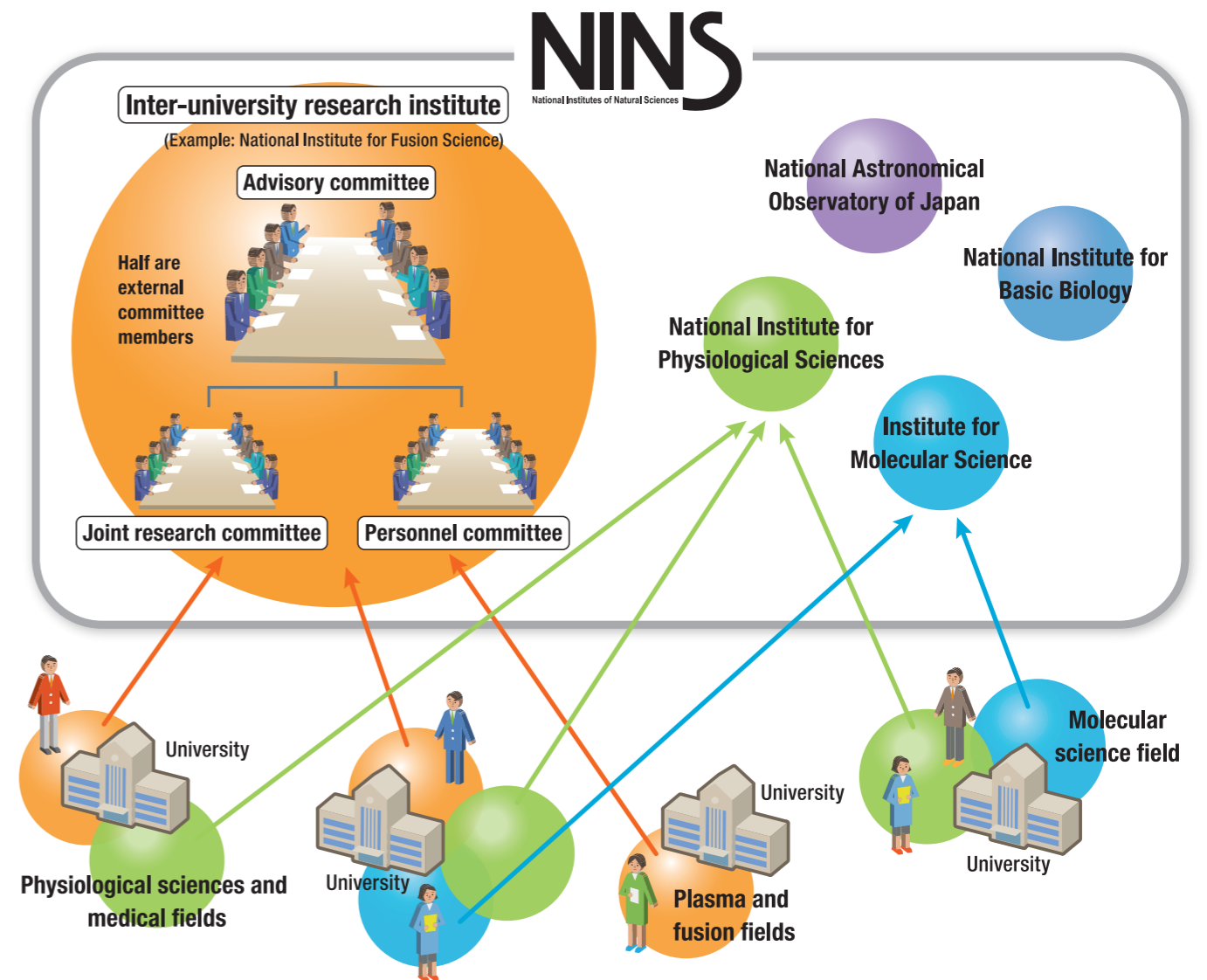
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# National Institutes of Natural Sciences (NINS)



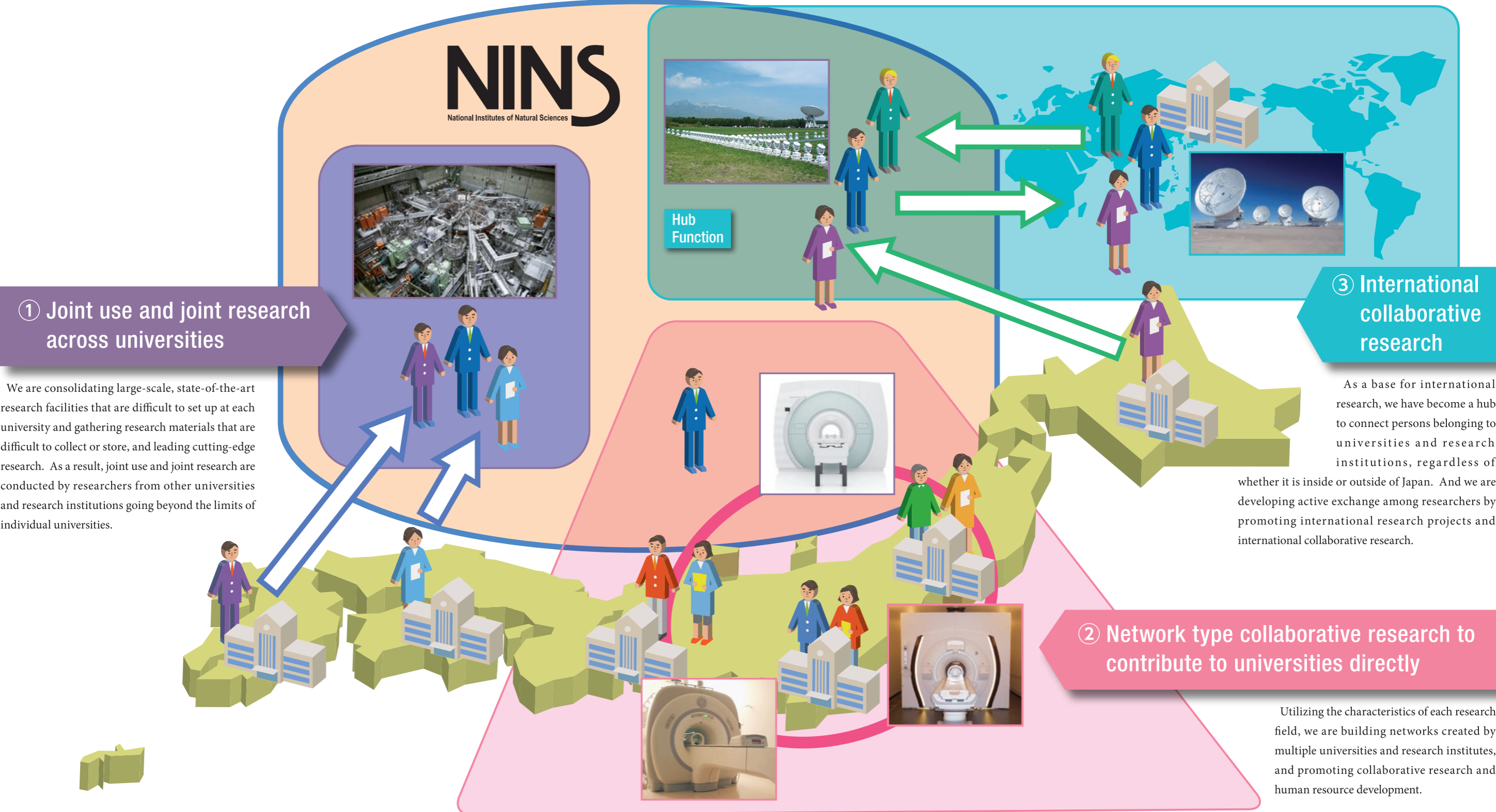
The National Institutes of Natural Sciences (NINS) consists of five inter-university research institutes: the National Astronomical Observatory of Japan (NAOJ), the National Institute for Fusion Sciences (NIFS), the National Institute for Basic Biology (NIBB), the National Institute for Physiological Sciences (NIPS), and the Institute for Molecular Science (IMS). As a global research center in the field of natural science promoting international and advanced research, we provide joint research and collaborative research for universities and other researchers all over the country. The result of our collaborative research contributes to strengthening Japanese research capabilities.

## Management of Institutes by a Community of Researchers

Each Institute constituting NINS conducts the management supported by the community by being a member representing each researcher community in universities, etc. to the advisory committee, joint research committee, faculty personnel committee, and other committees. In addition, all members of the conference for selecting the President of NINS consist of external committee members. Approximately half of the Management Council and Education Research Council consists of external committee members.

# Collaborative Research

NINS contributes to strengthening the research capabilities of Japanese universities as one of the inter-university research institutes. In order to contribute to strengthening the research capacity of Japanese universities, as an inter-university research institute, NINS is developing three types of collaborative researches while taking advantage of the characteristics of their academic field, as below.



## ① Joint use and joint research across universities

We are consolidating large-scale, state-of-the-art research facilities that are difficult to set up at each university and gathering research materials that are difficult to collect or store, and leading cutting-edge research. As a result, joint use and joint research are conducted by researchers from other universities and research institutions going beyond the limits of individual universities.



Hub Function

## ③ International collaborative research

As a base for international research, we have become a hub to connect persons belonging to universities and research institutions, regardless of whether it is inside or outside of Japan. And we are developing active exchange among researchers by promoting international research projects and international collaborative research.

## ② Network type collaborative research to contribute to universities directly

Utilizing the characteristics of each research field, we are building networks created by multiple universities and research institutes, and promoting collaborative research and human resource development.



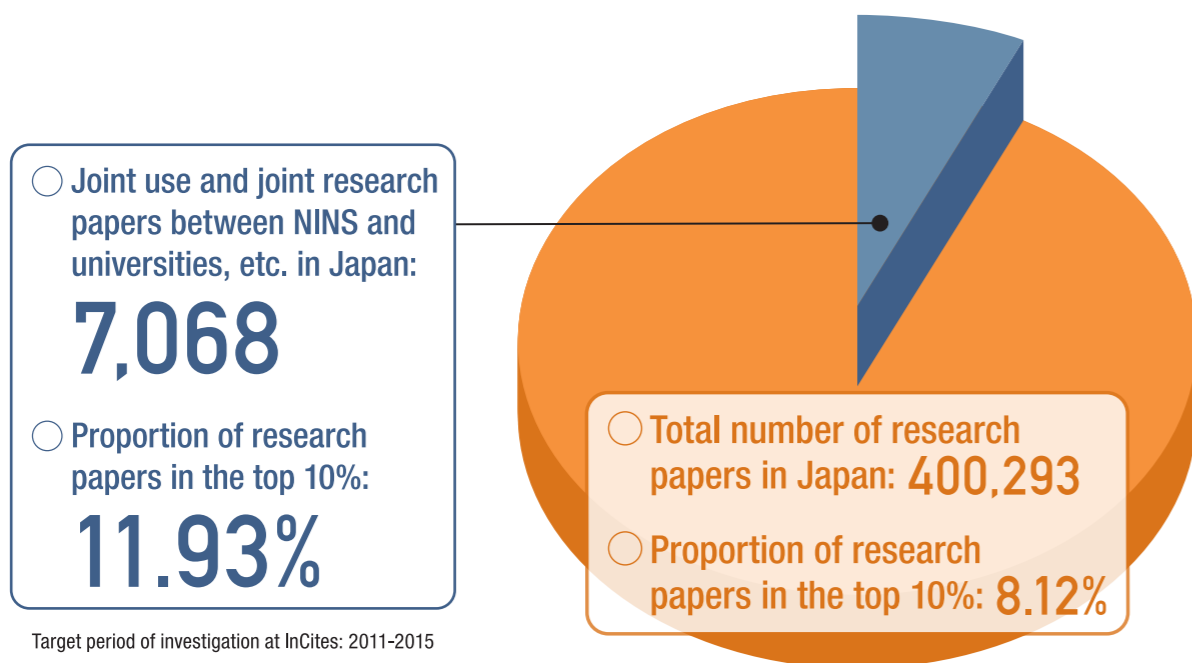
# What NINS aims for

## “On the Relationship with other Universities through Joint Use and Joint Research”

NINS actively accepts researchers from universities nationwide, and is promoting joint research. Moreover, we provide graduate school education as SOKENDAI (The Graduate University for Advanced Studies), and regardless of national, private and public universities, we accept graduate students from other universities as "special inter-university researchers" to instruct research. Supporting research activities of researchers belonging to other universities through these systems will result in strengthening the research capacity of universities in Japan.

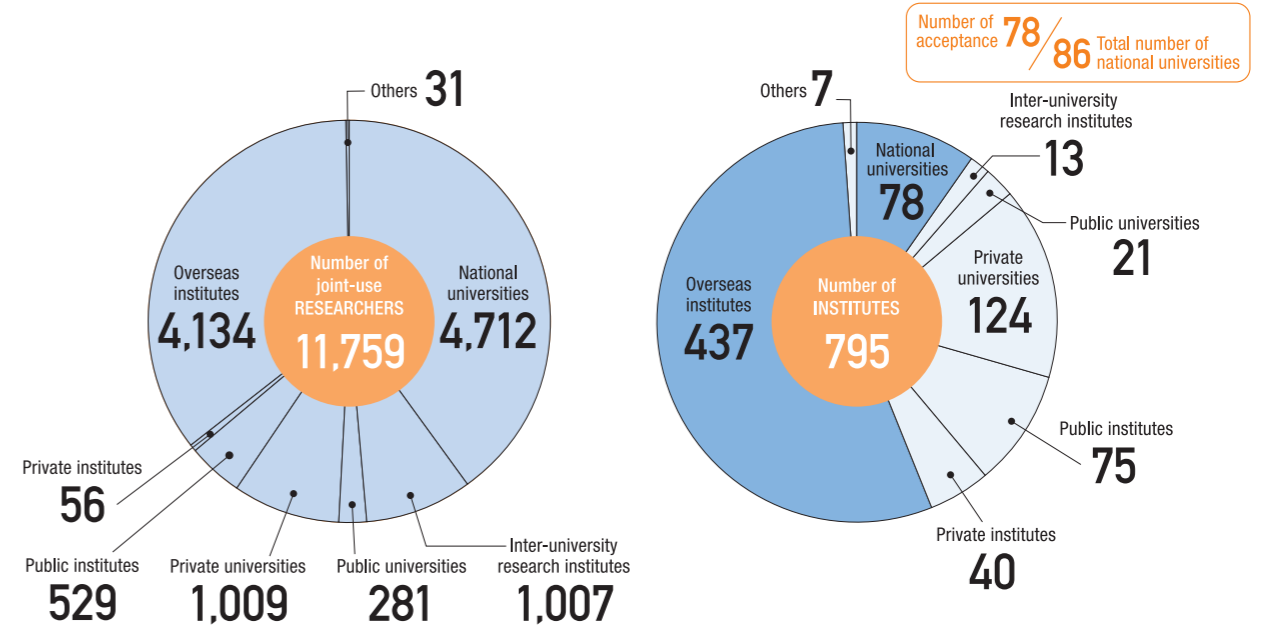
### Visualize the contribution to universities

In order to visualize the contribution to other universities and research institutions, we are analyzing the number of citations of research papers resulting from joint use and joint research. From the results of the collaborative research of NINS and other universities over the past five years, the proportion of articles, which were cited in articles with high impact falling within the top 10% of all research papers was 11.93%. This ratio is higher than that of all the articles published from Japan (8.12%) adopted in the papers located in the top 10% of the world's papers. It means that we are contributing to a certain extent to the strengthening of the research capacity of universities in Japan.



## Achievements of Collaborative Research (2016)

NINS accepts collaborative researchers from national, public, and private universities and research institutions regardless of national, private, and public universities. In particular, researchers from national universities accounted for 90%, and recently, researchers from public, private and overseas universities and research institutions are increasing.

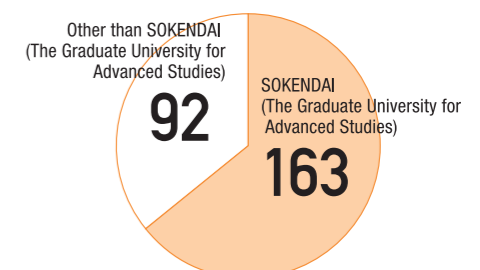


## Number of researchers accepted by each research institute (2016)

Name of research institute	Total researchers	Number of international researchers	Number of institutes
National Astronomical Observatory of Japan	6,008	328	433
National Institute for Fusion Science	1,491	166	237
National Institute for Basic Biology	756	24	120
National Institute for Physiological Sciences	908	47	164
Institute for Molecular Science	2,580	235	218

## Graduate Education

NINS conducts postgraduate education as the foundation of SOKENDAI (The Graduate University for Advanced Studies). In addition, as a special inter-university researcher, we accept graduate students from national, public, and private universities nationwide.





# What NINS aims for

- The number of research papers covers the total from 2011 to 2015 and it is counted based on the research papers reported by joint users and joint researchers and research papers from NINS researchers which were searched by In Cites, a research analysis tool of Clarivate Analytics.
- \*For institutes with no registration on In Cites, research papers are searched and counted with Scopus, a database of peer-reviewed literature by Elsevier.

## Relationship with universities through joint use and joint research

NINS accepts a wide range of researchers from public and private universities as well as national universities nationwide and promotes joint use and joint research. As a result of joint use and joint research, a great deal of findings has been published from each university.

### Number of Researchers and Articles (National Universities: 78 Universities in Total)

University	Researchers (2016)	Papers
Hokkaido University	161	400
Hokkaido University of Education	1	7*
Muroran Institute of Technology	9	4
Otaru University of Commerce	0	-
Obihiro University of Agriculture and Veterinary Medicine	1	1
Kitami Institute of Technology	1	6
Asahikawa Medical University	2	2
Hirosaki University	24	33
Iwate University	6	19
Tohoku University	259	481
Miyagi University of Education	4	8*
Akita University	16	18
Yamagata University	50	57
Fukushima University	1	5
Ibaraki University	62	98
University of Tsukuba	131	292
Tsukuba University of Technology	2	3*
Utsunomiya University	10	24
Gunma University	33	68
Saitama University	31	74
Chiba University	92	114
The University of Tokyo	796	1,530
Tokyo Medical and Dental University	11	22
Tokyo University of Foreign Studies	0	-
Tokyo Gakugei University	8	29
Tokyo University of Agriculture and Technology	18	47
Tokyo University of the Arts	0	-
Tokyo Institute of Technology	178	320
Ochanomizu University	15	61
The University of Electro-Communications	29	79
Hitotsubashi University	1	15
Tokyo University of Marine Science and Technology	2	5
Yokohama National University	20	34
SOKENDAI (The Graduate University for Advanced Studies)	112	1,517
National Graduate Institute for Policy Studies	0	-
Niigata University	55	88
Nagaoka University of Technology	11	5
Joetsu University of Education	5	13*
University of Toyama	44	95
Kanazawa University	24	82
Japan Advanced Institute of Science and Technology	13	2
University of Fukui	64	58
University of Yamanashi	31	12

University	Researchers (2016)	Papers
Shinshu University	34	62
Gifu University	38	43
Shizuoka University	50	49
Hamamatsu University School of Medicine	5	21
Nagoya University	433	831
Aichi University of Education	12	6*
Nagoya Institute of Technology	83	48
Toyoashi University of Technology	18	14
Mie University	21	52
Shiga University	2	1
Shiga University of Medical Science	4	10
Kyoto University	434	1,051
Kyoto University of Education	1	-
Kyoto Institute of Technology	33	14
Osaka University	435	627
Osaka Kyoiku University	0	19
Kobe University	112	190
Hyogo University of Teacher Education	0	-
Nara University of Education	0	-
Nara Women's University	20	26
Nara Institute of Science and Technology	25	32
Wakayama University	6	6
Tottori University	30	46
Shimane University	22	25
Okayama University	61	73
Hiroshima University	99	290
Yamaguchi University	33	55
Tokushima University	16	25
Naruto University of Education	1	-
Kagawa University	10	15
Ehime University	60	150
Kochi University	5	22
University of Teacher Education Fukuoka	1	-
Kyushu University	149	368
Kyushu Institute of Technology	8	10
Saga University	5	11
Nagasaki University	16	8
Kumamoto University	28	53
Oita University	5	6
University of Miyazaki	4	11
Kagoshima University	44	118
National Institute of Fitness and Sports in Kanoya	0	-
University of the Ryukyus	16	22
<b>Total</b>	<b>4,712</b>	

### Number of Researchers and Articles (Public Universities: 21 Universities in Total)

University	Researchers (2016)	Papers
Akita Prefectural University	1	8
Fukushima Medical University	6	27
Tokyo Metropolitan University	21	65
Yokohama City University	18	25
Toyama Prefectural University	4	1*
Ishikawa Prefectural University	2	2*
Gifu Pharmaceutical University	1	1

University	Researchers (2016)	Papers
University of Shizuoka	6	31
Nagoya City University	28	101
The University of Shiga Prefecture	2	-
Kyoto Prefectural University	6	5
Kyoto Prefectural University of Medicine	15	22
Osaka City University	14	52
Osaka Prefecture University	88	95

University	Researchers (2016)	Papers
University of Hyogo	50	104
Nara Medical University	7	5
Wakayama Medical University	5	12
Hiroshima City University	3	-
Sanyo-Onoda City University	1	4*
Kochi University of Technology	2	9
Oita University of Nursing and Health Sciences	1	-
<b>Total</b>	<b>281</b>	

### Number of Researchers and Articles (Private Universities: 1,009 Universities in Total)

University	Researchers (2016)	Papers
Keio University	100	102
Waseda University	91	151
Tokyo University of Science	73	75
Nihon University	49	67
Ritsumeikan University	30	31
Doshisha University	28	31
Chuo University	27	36
Kitasato University	26	53
Kwansei Gakuin University	25	16
Meijo University	21	-
Toho University	19	29
Chubu University	19	41
Sophia University	17	26
Tokai University	16	48
Kindai University	16	34
Hosei University	15	30
Josai University	14	3
Chukyo University	14	1
Saitama Institute of Technology	13	-
Nagahama Institute of Bio-Science and Technology	12	14*
Jichi Medical University	11	36
Tamagawa University	11	8*
Japan Women's University	11	21
Rikkyo University	10	17
Tokyo University of Technology	10	7
Konan University	10	64
Gakushuin University	9	1
The Jikei University School of Medicine	9	8
Tokyo University of Pharmacy and Life Sciences	9	13
Kyoto Sangyo University	9	45*
Hoshi University	8	5
Meiji University	8	5
Fukuoka University	8	19
Aoyama Gakuin University	7	39
Tokyo City University	7	4
Kanagawa University	7	33
Osaka Sangyo University	7	10*
Tohoku Gakuin University	6	-
Kyorin University	6	5
Gokugakuin University	6	26

University	Researchers (2016)	Papers
Meisei University	6	19
Toyota Technological Institute	6	4
Osaka Institute of Technology	6	4
Showa Pharmaceutical University	5	-
Fujita Health University	5	67
Aichi Medical University	5	9
Kansai University	5	6
Chiba Institute of Technology	4	16
The Open University of Japan	4	-
International Christian University	4	3
Nippon Medical School	4	17
Azabu University	4	2
Matsumoto Dental University	4	-
Suwa University of Science	4	-
Toyohashi Sozo University	4	-
Meiji University of Integrative Medicine	4	-
Kansai Medical University	4	10
Hyogo College of Medicine	4	6
Kurume University	4	8
Fukuoka Institute of Technology	4	13*
Sojo University	4	3
Health Sciences University of Hokkaido	3	-
Nihon Pharmaceutical University	3	-
Edogawa University	3	-
Juntendo University	3	10
Showa University	3	3
Teikyo University	3	6
Tokyo Women's Medical University	3	15
Health Science University	3	-
Gifu Shotoku Gakuen University	3	-
Osaka Medical College	3	-
Aino University	3	-
Kobe Gakuin University	3	-
Okayama University of Science	3	11
Hokkaido University of Science	2	-
Iwate Medical University	2	7
Dokkyo Medical University	2	-
Toyo University	2	-
Sanno University	2	-
Shizuoka Institute of Science and Technology	2	-
Aichi Gakuin University	2	2

University	Researchers (2016)	Papers
Aichi Institute of Technology	2	4
Osaka Gakuin University	2	-
Osaka Electro-Communication University	2	3
Setsunan University	2	9
Kawasaki Medical School	2	2
University of Occupational and Environmental Health, Japan	2	13
The Hachinohe Institute of Technology	1	4*
Tokai University	1	-
Nippon Institute of Technology	1	-
Bunkyo University	1	-
Saitama Medical University	1	7
J. F. Oberlin University	1	-
Takachiho University	1	-
Tokyo Medical University	1	-
Tokyo Dental College	1	1
Tokyo Woman's Christian University	1	-
Tokyo University of Agriculture	1	2*
Nippon Veterinary and Life Science University	1	1*
Meiji Gakuin University	1	2*
St. Marianna University School of Medicine	1	1
Institute of Information Security	1	-
Niigata Institute of Technology	1	-
Niigata University of Health and Welfare	1	2*
Kanazawa Medical University	1	1
Fukui University of Technology	1	18*
Tokai Gakuin University	1	-
Gifu University of Medical Science	1	-
Tokoha University	1	-
The Graduate School for the Creation of New Photonics Industries	1	-
Daido University	1	-
Nagoya Women's University	1	-
Nagoya Bunri University	1	-
Japanese Red Cross Toyota College of Nursing	1	-
Kyoto Pharmaceutical University	1	1
Ryukoku University	1	6
Osaka University of Pharmaceutical Sciences	1	1
Tezukayama Gakuin University	1	-
Kawasaki University of Medical Welfare	1	-
Hiroshima Institute of Technology	1	2
Fukuyama University	1	-
Tokushima Bunri University	1	10
Okinawa Institute of Science and Technology Graduate University	1	16
<b>Total</b>	<b>1,009</b>	



# What NINS aims for

## Promotion of International Collaborative Research

NINS is carrying out the following four large international projects in the Promoting Large Scientific Frontier Projects of the Ministry of Education, Culture, Sports, Science and Technology. Maintaining and managing these state-of-the-art devices not only provides a base for research activities but also leads academic research around the world and functions as an international base.

### Large-scale international projects



**Subaru Telescope**

Large Optical Infrared Telescope. It can observe the universe with super high vision and super high resolution.



**ALMA Telescope**

Large Interferometer. It is operated by the National Astronomical Observatory of Japan (NAOJ) as an international project.



**TMT Project**

Thirty-meter class Optical Infrared Telescope.



**Large Helical Device**

The National Institute for Fusion Science (NIFS) leads the field of study of ultra-high temperature plasma in the world.

### Project related numerical data (FY 2016)

Project	Total Users	Foreign Users	Institutes	Countries
Subaru Telescope	1,065	224	58	11
ALMA Telescope	4,145	3,527	326	38
Large Helical Device	919	51	138	28

## Management of the Research University Consortium (Program for Promoting the Enhancement of Research Universities)

NINS is conducting various activities to contribute to the improvement of research capability of universities, with the support of the Program for Promoting the Enhancement of Research Universities of the Ministry of Education, Culture, Sports, Science and Technology (MEXT). As a part of these activities, NINS became an organizing institute of the "Research University Consortium" which is a group of universities that are taking a proactive stance for the enhancement of their research capability.

For the "Research University Consortium", executive directors for research from 33 universities are serving as constituent members, at present and discussing common issues (such as the utilization of highly professional human resources like URAs, analysis of research capability, and delivering information to the world) along with sharing best practices, through the website, symposium, and task forces of experts.

### Institutes

- Hokkaido University
- Tohoku University
- University of Tsukuba
- Chiba University
- The University of Tokyo
- Tokyo Medical and Dental University
- Tokyo University of Agriculture and Technology
- Tokyo Institute of Technology
- The University of Electro-Communications
- Niigata University
- Kanazawa University
- University of Fukui
- Shinshu University
- Nagoya University
- Nagoya Institute of Technology
- Toyohashi University of Technology
- Kyoto University
- Osaka University
- Kobe University
- Okayama University
- Hiroshima University
- Yamaguchi University
- Kyushu University
- Kyushu Institute of Technology
- Kumamoto University
- Nara Institute of Science and Technology
- Tokyo Metropolitan University
- Waseda University
- Keio University
- Tokyo Women's Medical University
- National Institutes of Natural Sciences
- High Energy Accelerator Research Organization
- Research Organization of Information and Systems

### Three Task Forces

#### Task Force 1: Utilization of highly professional human resources and research administrators

NINS is gathering best practices and evidences, communicating and discussing necessary measures, in order to establish the utilization of highly professional human resources and research administrators such as URAs in actual research sites in Japan.

#### Task Force 2: Research Analysis

In order to keep track of the features of research capability at each university from multiple perspectives, NINS is gathering and sharing best practices and evidences with regard to research capability analysis, research IR (Institutional Research) and strategies, by utilizing a research capability analysis index.

#### Task Force 3: Delivering Information to the World

In order to improve the ability to deliver information to the world of each university, along with sorting out tasks, NINS is enhancing its ability to deliver information by utilizing international information transmission platforms such as EurekAlert! of AAAS.

### Symposium

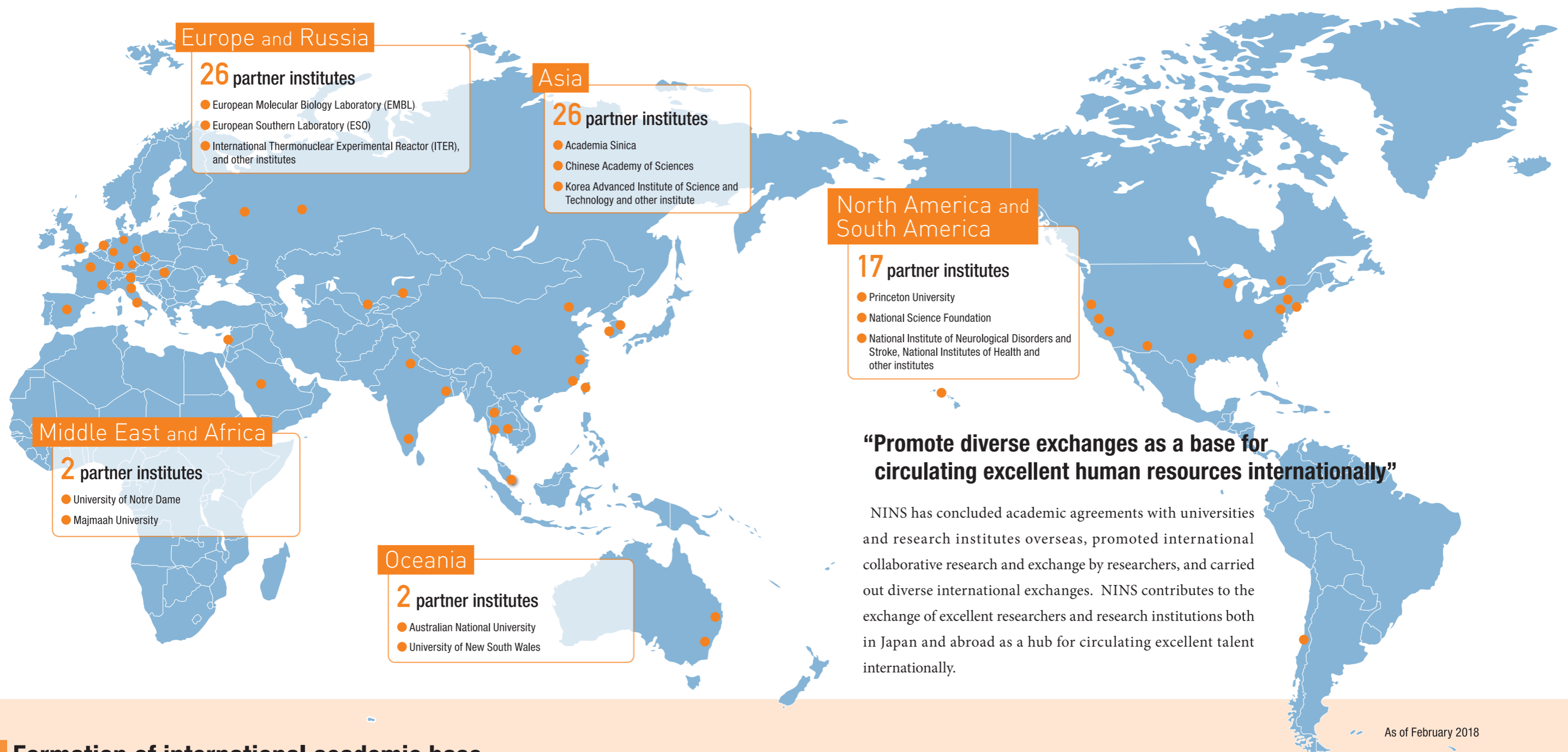
All universities participating in the Research University Consortium converge and hold the symposium once a year. They discuss common issues about measures and systems on research capability enhancement which confront all RUC members, including sharing leading initiatives and best practices in a cross sectoral manner.





# What NINS aims for

## Promotion of International Collaborative Research



### Formation of international academic base

#### International collaboration with Princeton University.

NINS and Princeton University signed an academic exchange agreement in March 2010. Based on this agreement, various exchanges are carried out by participating in mutual support for joint research, educational activities support, conference, and symposium. In order to strengthen the framework for promoting international joint projects, NINS North America base was installed in the university and staffed with an overseas URA in 2015.



Princeton University  
NINS President receiving a courtesy call from P. Debenedetti

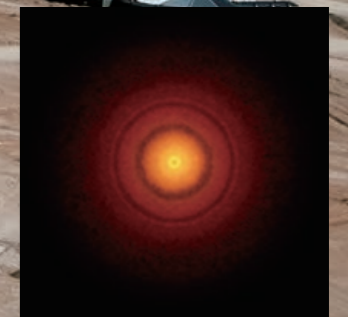
#### International collaboration with the European Molecular Biology Laboratory (EMBL)

EMBL is a European-led research institution funded and operated by 19 countries with headquarters in Heidelberg, Germany. NINS and EMBL extended the agreement in 2014 after concluding an academic exchange agreement in July 2005. NINS has adopted exchanges on 3 fronts such as academic exchanges, personnel exchanges, and technical exchanges, and collaborative research is being promoted mainly by the National Institute for Basic Biology (NIBB).



# National Astronomical Observatory of Japan

Astronomy is one of the oldest and yet most active sciences. This means that human beings possess the fundamental desire to seek our origin and the reason for our existence through an understanding of the Universe. NAOJ utilizes our full strength to play a key role in establishing a new paradigm for understanding the Universe, the Earth, and life as a whole. For this purpose, we observe various objects, from the Earth to the Universe itself, and we consider the fundamental theoretical laws behind the observed phenomena. We also develop new technology to support these activities.



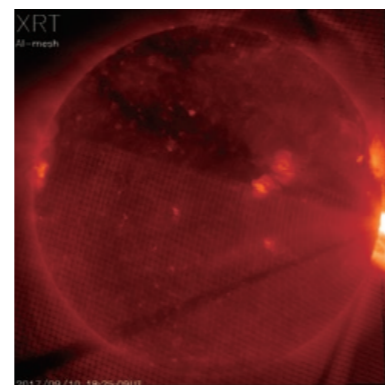
Ultra-high resolution ALMA image of the dust disk around TW Hya.  
(S. Andrews (Harvard-Smithsonian CfA);  
B. Saxton (NRAO/AUI/NSF); ALMA (ESO/NAOJ/NRAO))

ALMA Telescope  
(Clem & Adri Bacri-Normier (wingstorscience.com)/ESO)

## Topics of Research

### 01 X-ray image of the Sun taken with “Hinode”

The Solar Observing Satellite Hinode has observed solar activity for more than ten years since its launch in 2006. The Sun is a typical star, but as our parent star it dominates the Solar System and facilitates life on the Earth. The Sun influences all of our surroundings and activities. The images and data obtained with Hinode are released as soon as they are acquired and are used by solar and space weather researchers all over the world.



A huge solar flare (right edge) imaged by Hinode on September 11, 2017 (JST).  
(NAOJ/JAXA/MSU)

### 02 Gravitational lens phenomena the “Eye of Horus”

The Subaru Telescope is undertaking a massive survey with Hyper Suprime-Cam to image a large area of the sky at an unprecedented depth. The Eye of Horus was discovered in images taken as part of this survey. A close inspection reveals two distinct arcs/rings of light with different colors. This strongly suggests that two distinct background galaxies are being lensed by the foreground galaxy. This extremely rare lens system offers a unique opportunity to probe the fundamental physics of galaxies and add to our understanding of cosmology.



Eye of Horus (false color image) discovered by Subaru Telescope.  
(NAOJ)



# National Institute for Fusion Science

One of the world's top priorities is undoubtedly to obtain an energy source that is eco-friendly and inexhaustible. If we can achieve on Earth the nuclear fusion that has powered the sun and the stars, human beings will gain that never-ending energy. Deuterium and tritium are currently expected to be the most favorable fuels for fusion. Deuterium and the lithium that is necessary for tritium production are found in seawater.

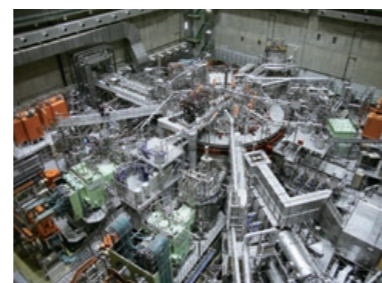
Aiming at the early achievement of fusion energy, the National Institute for Fusion Science (NIFS) is advancing its research activities in fusion plasma and other targets in fields of experimental research using the Large Helical Device (LHD), theory and simulation, and fusion engineering. NIFS is also playing an active role in mutual cooperation with universities and research organizations in Japan and abroad, and is producing excellent researchers.

The inside of the LHD plasma vacuum vessel.

## Topics of Research

### 01 Research for high-temperature steady-state plasma in the LHD

The Large Helical Device (LHD) is the world's largest class of superconducting experiment devices for confining plasma. Using deuterium gas, the LHD achieves the ion temperature of more than 120 million degrees that is necessary for the fusion reaction. Helical devices have the advantages of controllability and steady state operation. The LHD project is advancing research in the physics of high-temperature steady-state plasma for achieving the future fusion reactor and in related fields of science and engineering. In addition to fusion research, the plasma generated by the LHD provides a platform for research in many fields from astrophysics to industrial applications.



The LHD as seen from above. The LHD is 13.5m in diameter and 9.1m high. Many plasma heating systems and plasma measurement devices are attached to the LHD.

### 02 Computer simulation of plasma

A fusion plasma is a typical complex system controlled by multi-physics and multi-time/space nonlinear processes, from macroscopic phenomena, such as plasma transport, to microscopic electron dynamics. In order to understand and systematize physical mechanisms in fusion plasmas, large-scale numerical simulation research has been carried out by utilizing the full capabilities of supercomputers. Based on this research and development, we promote large-scale simulation science, aiming at the ultimate realization of a helical numerical test reactor, which will be based on an integrated predictive model for plasma behavior over the whole machine range.



Simulation of the hydrogen diffusion behavior inside the divertor material receiving heat flux and particles from plasma.



# National Institute for Basic Biology

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. The National Institute for Basic Biology promotes research to find the basic principles common to all creatures, and the mechanisms that enable diversity and allow life to adapt to changing environments.

Various organisms to be studied at NIBB

## Topics of Research

### 01 Exploring the environmental adaptation strategies of living things

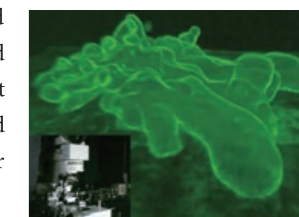
Living organisms have flexibly adapted to various environments on Earth and have acquired various forms and abilities. Therefore, NIBB conducts research to ascertain the environmental adaptation strategies used by animals and plants, such as the mechanism of photosynthesis regulation that corresponds to constantly changing light intensity dependent on the weather, adaptation mechanisms for seasonal changes in living organisms and evolutionary mechanisms utilized by carnivorous plants in order to adapt to environments lacking nutritional sustenance. In addition to this, we also work on the development of new model organisms to decipher unknown phenomena such as the establishment of symbiotic relations among living organisms.



Environmental control system for plants

### 02 Promotion of integrated bioimaging

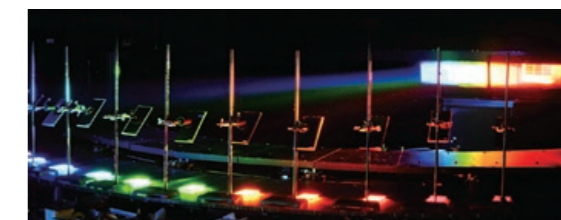
At NIBB, we advance observation technology via the use of cutting edge microscopes such as light sheet fluorescence microscopes, multiphoton excitation fluorescence microscopes and IR-LEGO, as well as develop new technologies for image processing and statistical processing to analyze acquired images. We also conduct activities to support experimental design, image acquisition and data analysis in an integrated manner for researchers through collaborative research.



Amoeba's movement captured by light sheet fluorescence microscopy

### 03 Exploring the relationship between light and living organism using the Okazaki Large Spectrograph

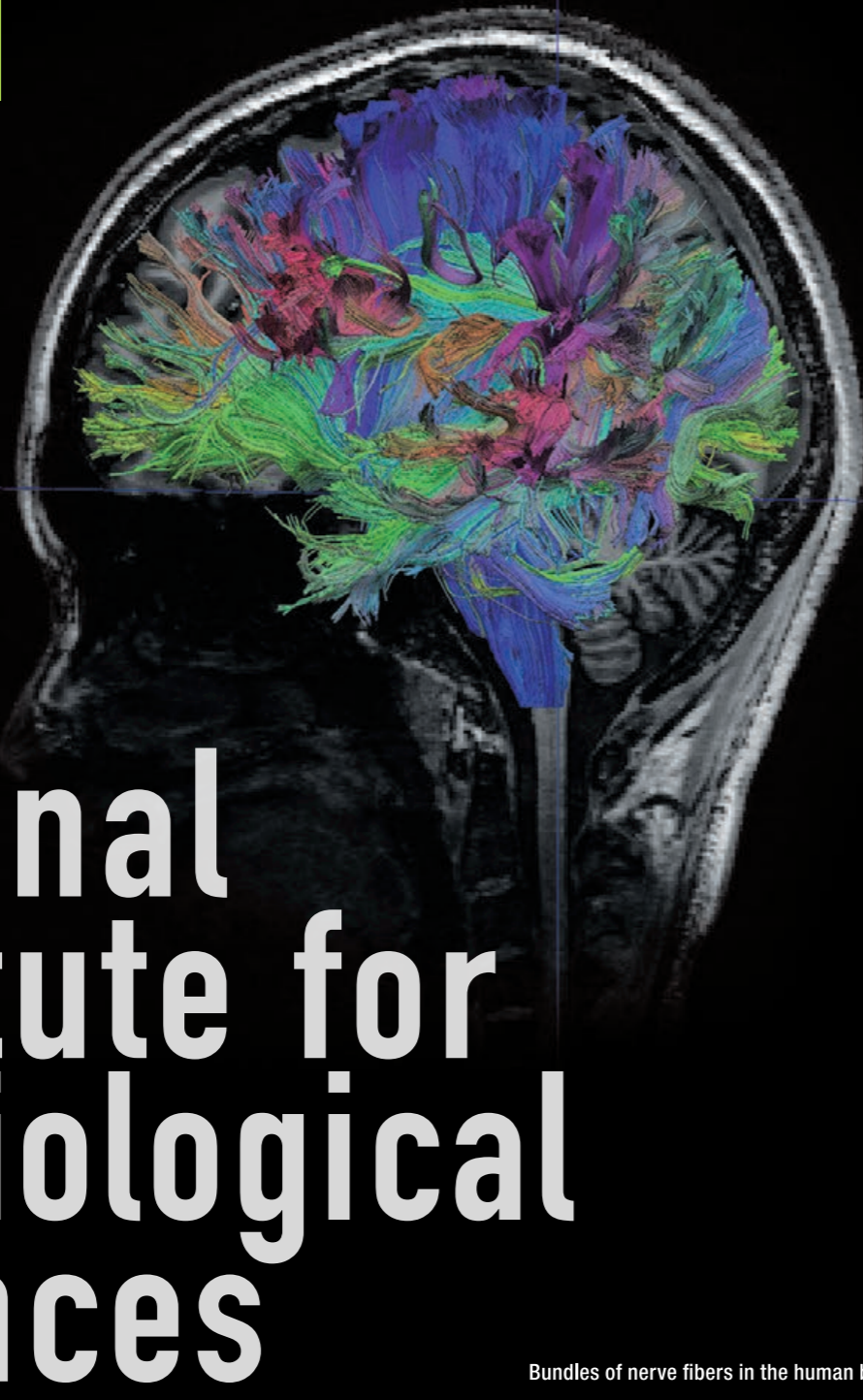
The Okazaki Large Spectrograph projects a wavelength spectrum ranging from 250 nm (ultraviolet) to 1,000 nm (infrared) onto its 10 m focal curve with an intensity of monochromatic light at each wavelength which is more than twice as much as that of the corresponding monochromatic component of tropical sunlight at noon. The spectrograph is designed for action spectra analyses of various light-controlled biological processes.



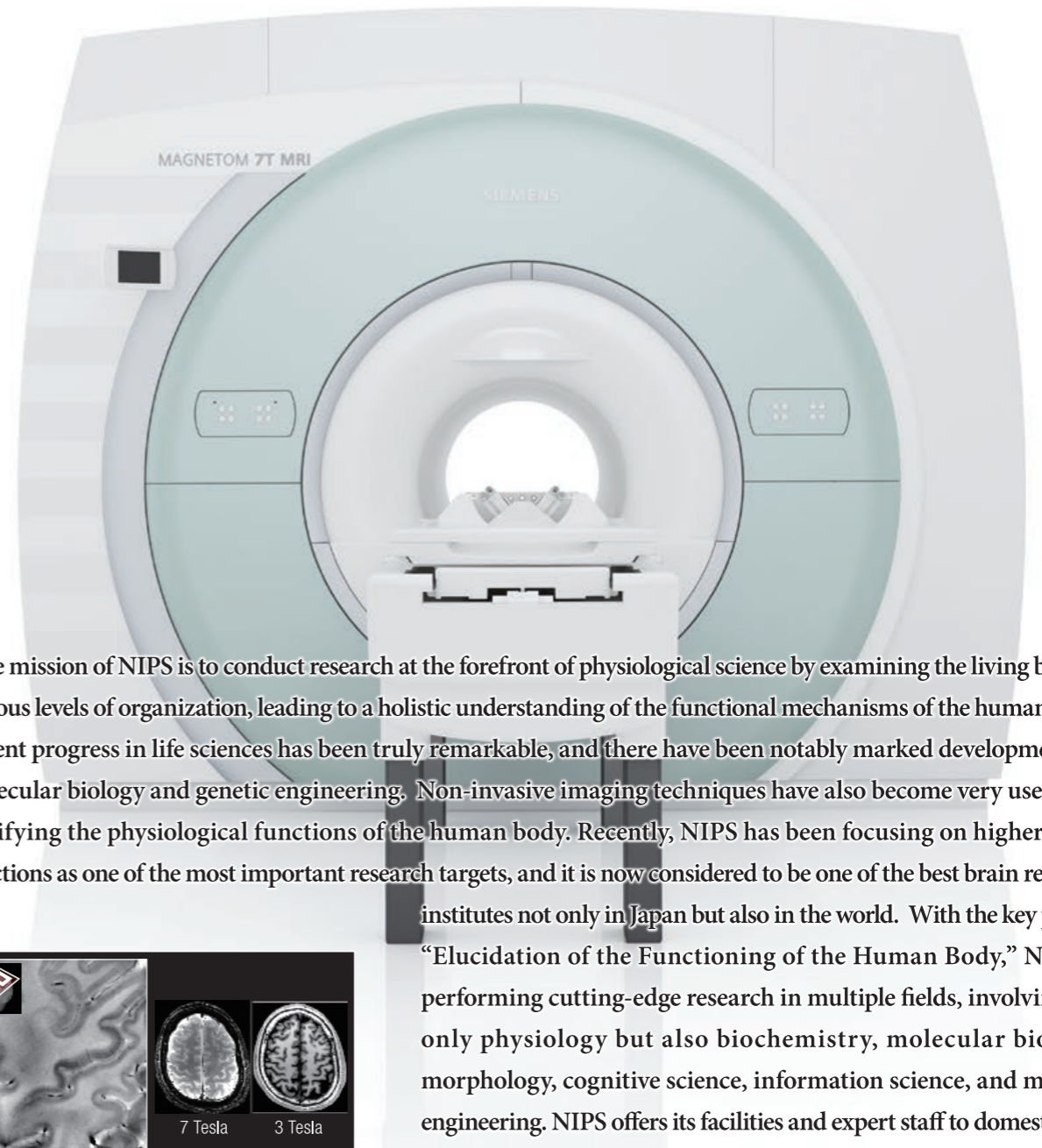
Okazaki Large Spectrograph



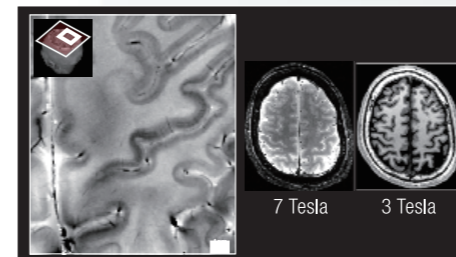
# National Institute for Physiological Sciences



Bundles of nerve fibers in the human brain.



The mission of NIPS is to conduct research at the forefront of physiological science by examining the living body at various levels of organization, leading to a holistic understanding of the functional mechanisms of the human body. Recent progress in life sciences has been truly remarkable, and there have been notably marked developments 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 focusing on higher brain functions as one of the most important research targets, and it is now considered to be one of the best brain research institutes not only in Japan but also in the world. 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, morphology, cognitive science, information science, and medical engineering. NIPS offers its facilities and expert staff to domestic and foreign scientists for collaborative studies.



Cross-sectional view of human brain imaged with 7T MRI. Vessels and nerves are depicted in units of 100 micrometers.

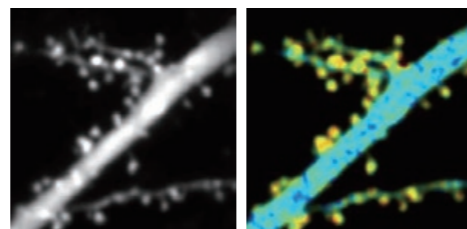
Ultra-high-field 7-Tesla Magnetic Resonance Imaging (MRI) system.

## Topics of Research

### 01 2-photon fluorescence lifetime imaging microscopy

Two-photon fluorescence lifetime imaging microscopy (2pFLIM) can be used to measure and image the fluorophore-fluorophore interaction. This method enables us to monitor protein-protein interactions in tiny subcellular compartments of living cells in deep tissues, such as in brain slices.

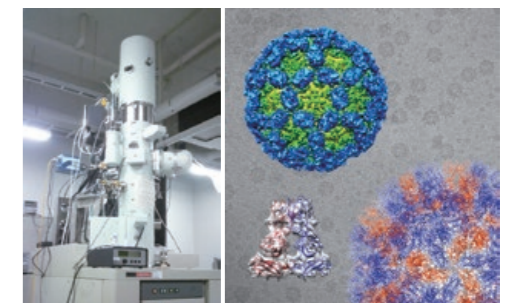
The right image is a fluorescence lifetime image of GFP-actin in a neuron of cultured hippocampal slices. GFP-actin and YFP mutant (YFPm) fused to actin were expressed and imaged by 2pFLIM. In the image, warmer color indicates actin polymerization. This data clearly shows that actin is highly polymerized in the dendritic spines, but not in the dendritic shaft.



(Left) 2-photon fluorescence image.  
(Right) 2-photon fluorescence lifetime image.

### 02 200kV Phase Contrast Electron Cryomicroscope

Phase contrast electron cryomicroscopy is an electron microscope developed for observing close-to-life-state biological samples with a combination of rapid freezing and ice embedding sample preparation methods. Biological specimens up to 200 nm thicknesses can be observed with high-resolution and high-contrast. Ultrastructure analyses of protein molecules, viruses, bacteria, cultured cells and frozen tissue sections are performed with this microscopic system.



Phase Contrast Electron Cryomicroscope and image of Saporivirus capsid.



# Institute for Molecular Science

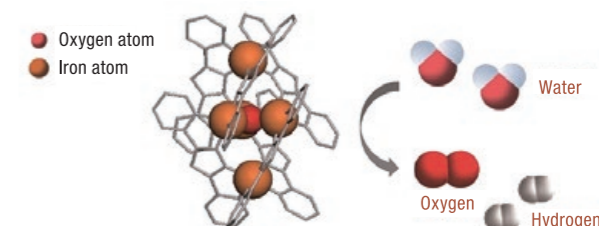
Molecular science is a field of science that aims at elucidating the essentials of intermolecular interactions and chemical reactions in which molecules change their shapes from both theoretical and experimental standpoints. The Institute for Molecular Science continues to provide opportunities of joint researches, in which the most advanced technology and instruments are accessible, for the researchers all over the world. To update our system continuously, we have established the Research Center of Integrative Molecular Systems and the Center for Mesoscopic Sciences, in addition to the four core departments of Theoretical and Computational, Photo, Materials, Life and Coordination-Complex Molecular Sciences. Collaborating with the 72 national university corporations all over Japan, we organize the Inter-University Network for Common Utilization of Research Equipments. In the network, researchers in universities, public research institutes and private enterprises can share the research equipment in participating institutions at reasonable cost.

The UVSOR synchrotron facility.

## Topics of Research

### 01 Creating novel molecular systems with analyzing logic which connects “molecules” and “molecular systems”

The Research Center of Integrative Molecular Systems (CIMoS) is dedicated to the important and interdisciplinary subject of “how the characteristics of each molecule are integrated into excellent functions of the molecular systems with higher-order structures.” We learn the interlayer logic that links “individuals” and “assemblies” from life systems. We then aim at elucidating the principle of how the molecular systems develop their functions such as energy conversion, material conversion and life activities by exchanging energy or information in a concerted manner. CIMoS has a mission to be a base of common utilization of facilities and joint researches to create “molecular systems having flexible, robust and excellent functions.” With the mission, CIMoS contributes to the society and advancement of science.



Pentanuclear iron complex  
Creation of catalysts having higher activity than that of native enzymes.

### 02 Capturing the behavior of molecules with light

The unique functions of molecules are realized in such a condition as a variety of molecules, not as single molecules, exist with the manner that molecular characteristics and macroscopic features of assemblies interact with each other. The Center for Mesoscopic Sciences has been founded on April 2017. In the center, novel mesoscopic measurement methods have been developed and applied to various systems. This is indispensable in understanding, controlling and developing the functions in the mesoscopic space-time domain in which microscopic and macroscopic natures interact with each other. We work to aim at providing foundations of basic researches on theoretical analysis, development of light sources and novel measurement methods and their applications.

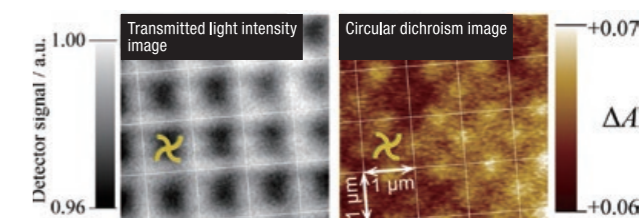


Image of chiral gold nano-structured samples by a newly developed high-precision circular dichroism microscope. (Achieving the apparent resolution over the diffraction limit.)



## Center for Novel Science Initiatives (CNSI)

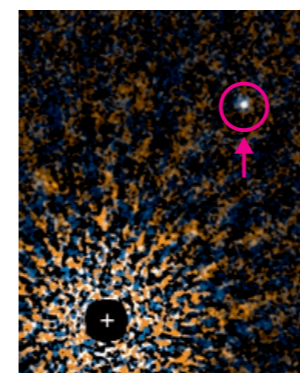
In the fields of natural science, the development of new techniques and productive interaction among different genres of research fields not only leads to further development of the own research fields, but also promotes to create novel research fields. The Center for Novel Science Initiatives (CNSI) has promoted the three research fields of "Brain Science", "Imaging Science", and "Astrobiology". In FY2018, we have launched the two new fields of "Advanced Optical Science" and "Plasma Bio Science". The former searches for wider use and application of the cutting-edge optical science, and the latter, which is a fused field of plasma science and life science, aims to elucidate the molecular and cellular mechanisms of interesting effects of plasma on living organisms. In addition, the "Office of Novel Science Exploration" of CNSI watches and studies current world-wide trends of natural sciences to discover seeds that may evolve to a new research field of the next generation.



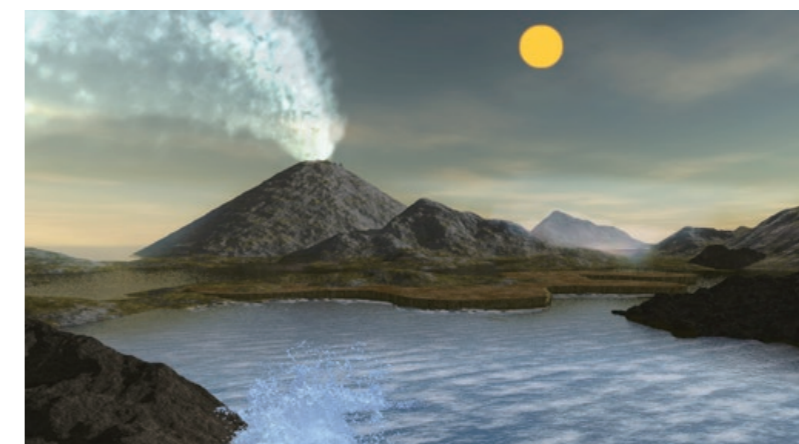
Low-temperature atmospheric pressure helium plasma jet that can be directly irradiated to the living body.

## Astrobiology Center (ABC)

As a result of developments in extrasolar planet observations, astrobiology research to explore "life in the Universe" and uncover its mysteries has become a pressing subject. Astrobiology Center (ABC), established in 2015, advances this field by combining disciplines, promotes research into extrasolar planets and life both outside and within the Solar System, and develops observational instruments for these purposes.



Direct image of a super-Jupiter exoplanet GJ504b (upper-right)



Artist's illustration of an exoplanet with ocean around a low mass star

## Exploratory Research Center on Life and Living Systems (ExCELLS)

**Our research spans from the observation to the creation of living systems in order to elucidate what life is.**

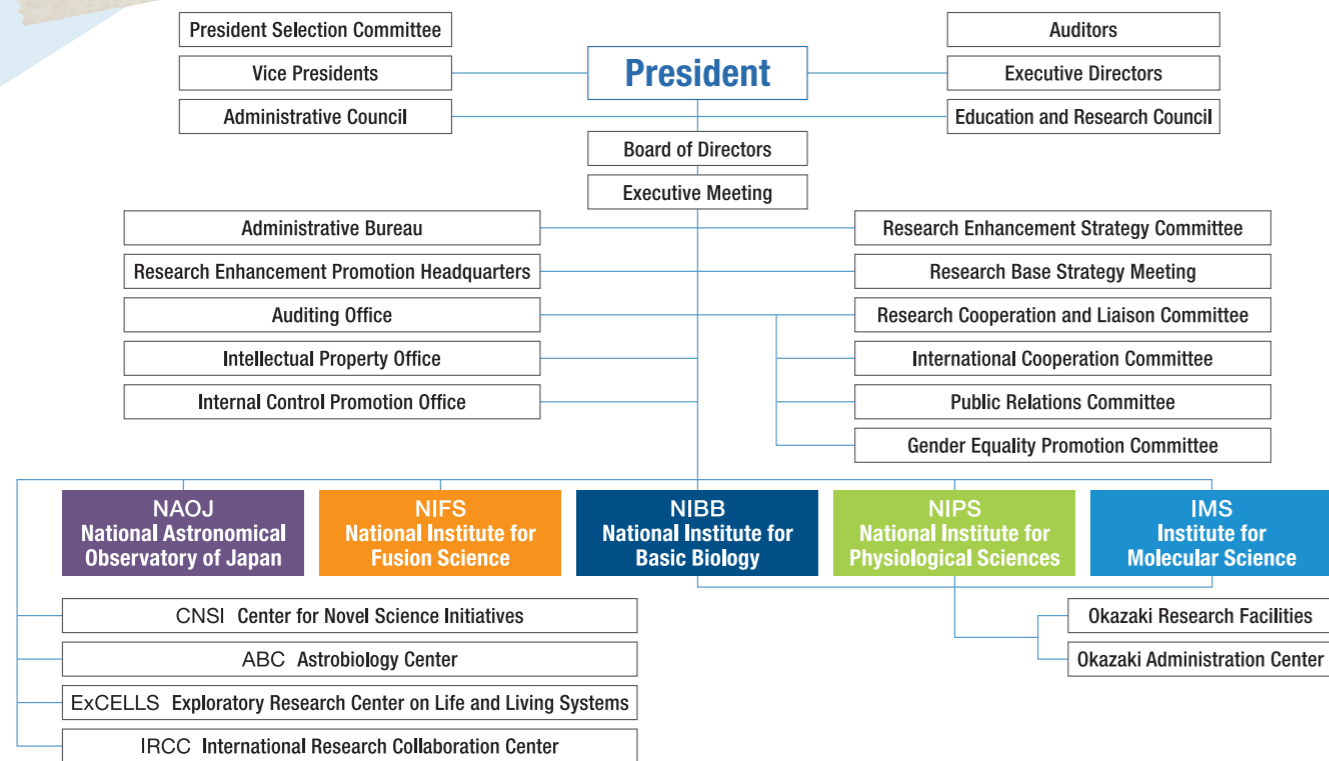
What is life? The Exploratory Research Center on Life and Living Systems (ExCELLS) was established in April 2018 to address this fundamental question. ExCELLS develops novel approaches for observing biological entities, deciphering hidden information, and creating living systems to improve our understanding of their nature. Moreover, ExCELLS promotes collaborative, interdisciplinary research involving investigators exploring organisms living in extreme environments.

## International Research Collaboration Center (IRCC)

The five NINS Institutes are actively conducting international exchange activities in their respective research fields. Based on these activities, the IRCC was established in August 2018 to strengthen international exchange activities, particularly across the boundaries of research fields and institutions, and through organizational collaboration with overseas research institutes. In October 2018, the "Research Unit for Astro-fusion Plasma Physics", (AFP) which is the integrated research field of astrophysics and fusion science, was established in IRCC. The division conducts the research project of the three-party collaborations among NINS, Max-Planck Institutes in Germany, and Princeton University in the USA, and further progress of the international collaborations is anticipated.



# Organization Chart



# List

April 1, 2018

## President

Name	Job Title
Akio KOMORI	President

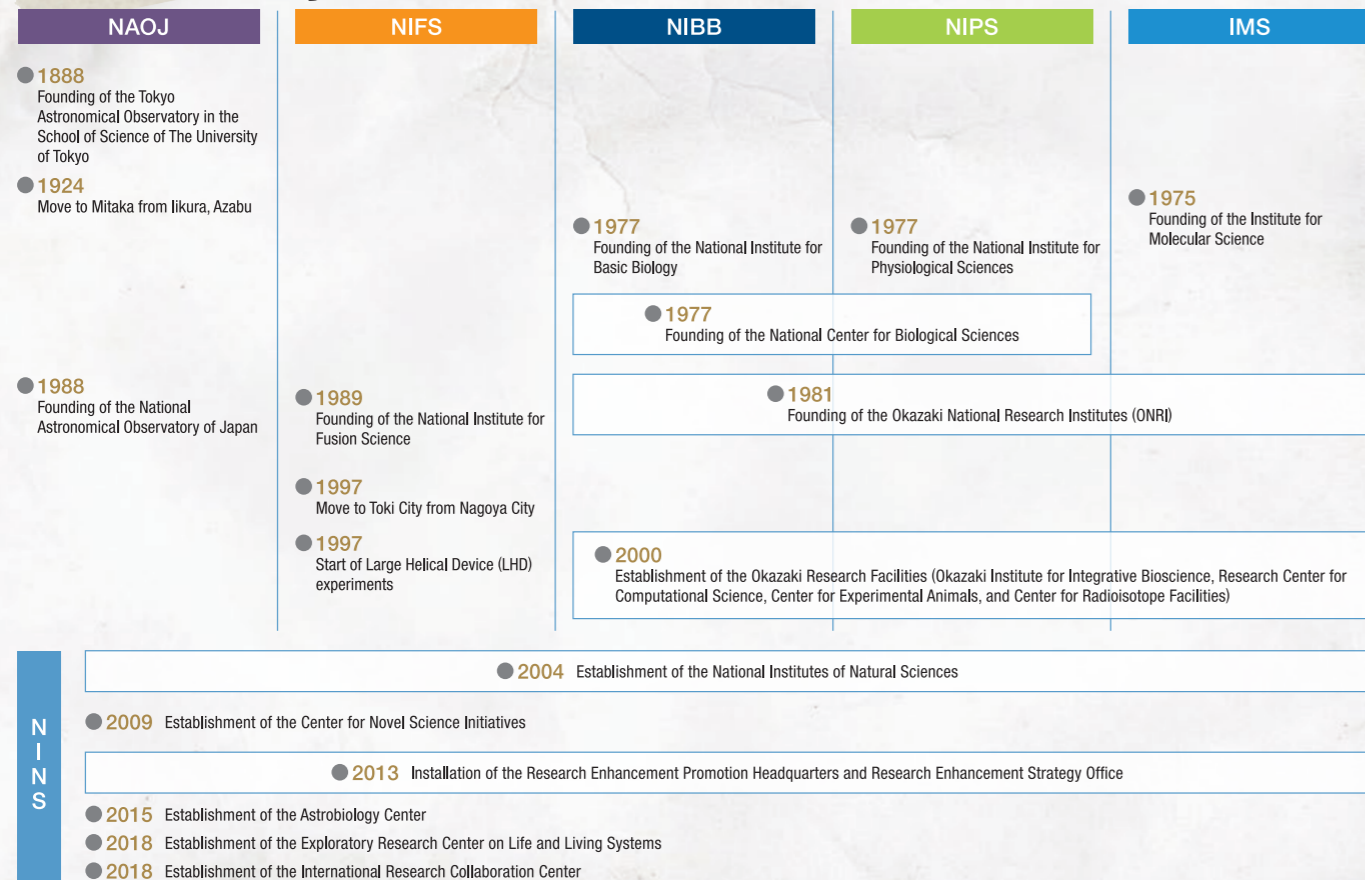
## Auditors

Name	Job Title
Hirosa NINOMIYA	Auditor
Koichi TAKEMATA	Auditor

## Executive Directors / Vice Presidents

Name	Job Title
Tsugio TOKUTA	Executive Director and Secretary General
Osamu KANEKO	Executive Director
Yasuhiko TAKEIRI	Executive Director, Vice President, and Director General of NIFS
Masayuki YAMAMOTO	Executive Director, Vice President, and Director General of NIBB
Keiji IMOTO	Executive Director, Vice President, and Director General of NIPS
Saku TSUNETA	Vice President and Director General of NAOJ
Maki KAWAI	Vice President and Director General of IMS

# History



## Nobel Prize and Monument of Professor Emeritus Yoshinori OHSUMI

NINS Professor Emeritus Yoshinori Ohsumi, the Honorary Professor of NINS, won a Nobel Prize in Physiology or Medicine in 2016 for his findings on “autophagy” including research lasting 13 years in the National Institute for Basic Biology (NIBB). As a memorial of his achievement, the monument is installed in NIBB in the motif of “autophagy in yeast cells”.

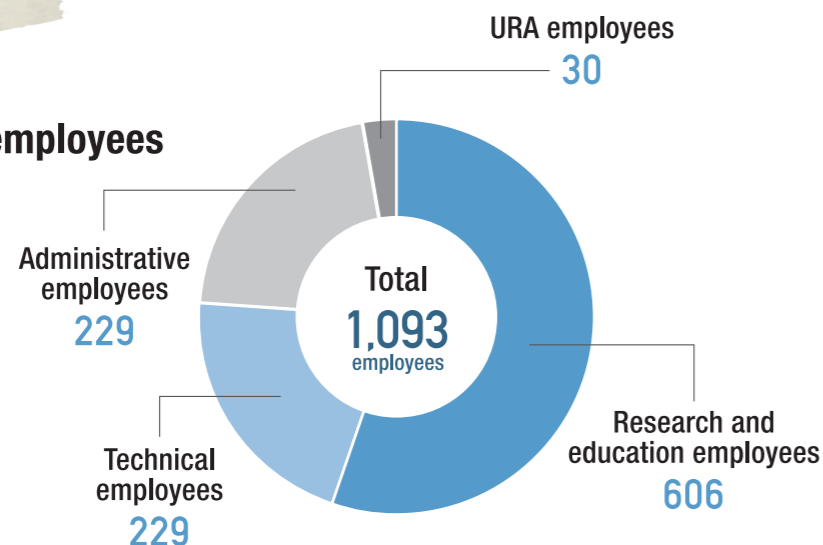




# Data

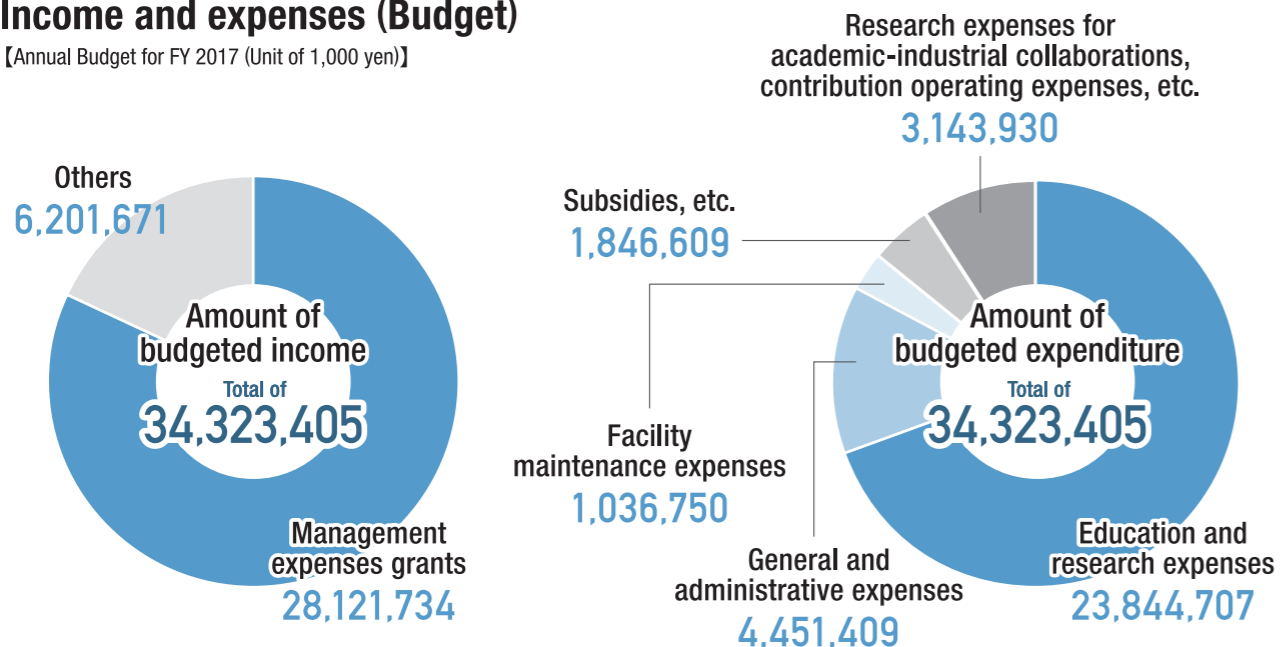
## Number of employees

As of March 1, 2018



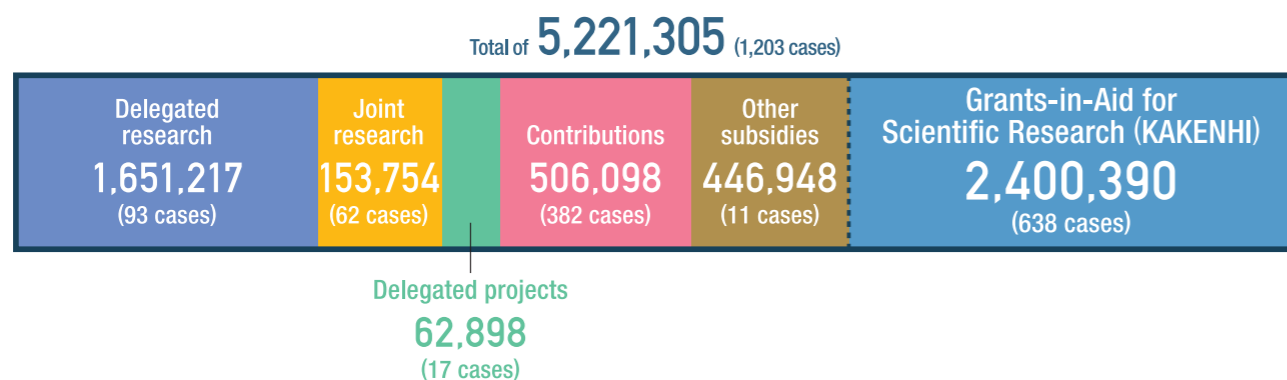
## Income and expenses (Budget)

【Annual Budget for FY 2017 (Unit of 1,000 yen)】



## Breakdown of external funds

【Annual closing of accounts for FY 2016 (Unit of 1,000 yen)】



## Facilities

### National Institutes of Natural Sciences (NINS)

2F 4-3-13 Toranomon, Minato-ku, Tokyo 105-0001, Japan  
 Phone +81-3-5425-1300 FAX +81-3-5425-2049  
 URL <http://www.nins.jp/english/>

### National Astronomical Observatory of Japan (NAOJ)

2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan  
 Phone +81-422-34-3600 FAX +81-422-34-3690  
 URL <http://www.nao.ac.jp/en/>

### National Institute for Fusion Science (NIFS)

322-6 Oroshi-cho, Toki, Gifu 509-5292,  
 Japan Phone +81-572-58-2222 FAX +81-572-58-2601  
 URL <http://www.nifs.ac.jp/en/>

### National Institute for Basic Biology (NIBB)

38 Nishigonaka, Myodaiji, Okazaki, Aichi 444-8585, Japan  
 Phone +81-564-55-7652 FAX +81-564-53-7400  
 URL <http://www.nibb.ac.jp/en/>

### National Institute for Physiological Sciences (NIPS)

38 Nishigonaka, Myodaiji, Okazaki, Aichi 444-8585, Japan  
 Phone +81-564-55-7700 FAX +81-564-52-7913  
 URL <http://www.nips.ac.jp/eng/>

### Institute for Molecular Science (IMS)

38 Nishigonaka, Myodaiji, Okazaki, Aichi 444-8585, Japan  
 Phone +81-564-55-7418 FAX +81-564-54-2254  
 URL <http://www.ims.ac.jp/en/>

## Japan

- ① Department of Helical Plasma Research Rokkasho Research Center, NIFS
- ② Mizusawa VLBI Observatory, NAOJ
- ③ National Institutes of Natural Sciences (NINS)
- ④ Center for Novel Science Initiatives
- ⑤ National Astronomical Observatory of Japan (NAOJ)
- ⑥ Astrobiology Center
- ⑦ Nobeyama Radio Observatory, NAOJ
- ⑧ National Institute for Fusion Science
- ⑨ National Institute for Basic Biology
- ⑩ National Institute for Physiological Sciences
- ⑪ Institute for Molecular Science
- ⑫ Okazaki Research Facilities
- ⑬ Exploratory Research Center on Life and Living Systems
- ⑭ International Research Collaboration Center

