

What is an Inter-university Research Institute?

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National Institutes of Natural Sciences

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. The 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 such as academic materials” were later added to the original concept, and 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 founded. Going through such a process of development, inter-university research institutes now share the responsibilities given below, as important research centers engaged in academic research at the highest international level.

- Promote unique and cutting-edge academic research, and contribute to academic progress in its role as an institute for advanced studies of the university research community throughout Japan.
- Establish/operate large-scale facilities that cannot be kept by individual universities, promote pioneering research, and provide facilities for use by researchers across Japan.
- Implement the organizational survey, study, collection, sorting and offering of organized academic materials and information, and contribute to improving the intellectual foundation of Japan.

The institutes serve the above functions while maintaining their uniqueness and diversity, and each makes a great contribution in the development of academic research in Japan as a Center of Excellence (COE) in each research field. Together, they also serve as an international core base to promote cooperation and exchange with research institutes and researchers abroad.

Five institutes under the National Institutes of Natural Science, which are inter-university

research institutes, are engaged in unique extramural usage and joint research in each academic field as follows.

(1) National Astronomical Observatory of Japan (NAOJ)

National Astronomical Observatory of Japan (NAOJ) contributes to promote astronomy and related fields as the central research institute of astronomy in Japan and possesses cutting-edge observational facilities in the world. Our research facilities include supercomputers and large telescopes (such as Subaru Telescope in Hawaii, a 45m radio telescope and Nobeyama Radioheliograph in the Nobeyama Radio Observatory, an optical and infrared telescope in the Okayama Astrophysical Observatory, four 20m antenna in the VERA observatory, and so on) which would be difficult to be constructed and operated by a university. We have been developing, constructing, and operating these facilities to offer open-use research means to astronomers in universities as well as to promote our own research. NAOJ arranges a flexible team called as a Project Office that has clear purposes, plans, and members for each of our main facilities. In this way, we are making best efforts to push studies and open-use, and joint research activities further. (The Projects are grouped into three classes, A, B, and C according to their stages.)

In addition, as a collaboration project with domestic universities, NAOJ established the Very Long Baseline Interferometry (VLBI) network, a network of radio telescopes in the universities, and is promoting the joint research activities. We are also engaged on other collaborations for the promotion of astronomy based on agreements with various universities.

By aiming at the development and construction of newer large facilities for open-use, we participate in international cooperative projects such as the Atacama Large Millimeter/submillimeter Array Project (a collaboration between, Europe, North America, and Japan) and the East-Asia VLBI network. These observational facilities are going to be utilized for the open-use in the international framework.

(2) National Institute for Fusion Science (NIFS)

In order to realize the Sun on the Earth – that is, controlled fusion, which is a new, safe and eco-friendly energy source, the National Institute for Fusion Science (NIFS) conducts experiments to make and confine high-temperature, high-density plasma as well as other research like plasma physics simulation. What we are pursuing are the elucidation of the fusion plasma mechanism, the solution of any scientific and engineering problems standing in the way of a real fusion reactor use, and the systematization of fusion science as an academic base. Characterized by its own

large-scale facilities like the Large Helical Device (LHD) and super computers, NIFS offers the facilities to domestic and international scientists for research, and promotes three main collaboration schemes as follows: “General Coordinated Research” invites external scientists to projects at NIFS in order to jointly study them using the research resources. “LHD Coordinated Research” is a scheme to support academic activities at universities or other institutes for the ultimate purpose of applying their outcomes to the LHD experiment, no matter whether theoretical or experimental, or no matter how mature they are. “Interactive Coordinated Research” forms a community made up of NIFS and four other university centers so as to facilitate the flow of its staff members aimed at a more active sharing of their devices. The members are (1) the Plasma Research Center, the University of Tsukuba, (2) the Laboratory for Complex Energy Processes, the Institute of Advanced Energy, Kyoto University, (3) the Institute of Laser Engineering, Osaka University, and (4) the Advanced Fusion Research Center, the Research Institute for Applied Mechanics, Kyushu University. Thanks to the community scheme, we are now able to take much more effective approaches in cooperation toward significant fusion challenges.

Along with these collaborative activities, NIFS offers interactive opportunities and environments to researchers across the nation. We hold a number of study meetings targeting an extensive area from fusion science, plasma physics to reactor engineering, while having successfully put a large network of fusion research database into operation. Meanwhile, NIFS promotes various international programs under bilateral agreements with the US, China, South Korea, Russia, Australia or the EU, under multinational agreements concerning the Stellarator, TEXTOR, or Spherical Tori projects and under other institute-level agreements. We also host international conventions including the annual International Toki Conference.

(3) National Institute for Basic Biology (NIBB)

By incorporating the ideas of molecular biology which quantitatively explain the universal mechanisms of biological phenomena, the National Institute for Basic Biology (NIBB) aims to better understand important phenomena that are the basis of biological processes. NIBB has also striven to transform zoology and plant biology, which were mainly descriptive studies at the time NIBB was established, into new biological sciences by sharing the techniques and ideas of molecular biology with leading researchers in those fields. In addition to providing the Okazaki Large Spectrograph as a large-scale facility for joint usage, NIBB also regards the joint usage of software as important, because NIBB sets molecular biology, which does not require large-scale facilities, as the basis for its methodology. Promoting the joint usage of software includes holding workshops and providing resources for the development and diffusion of the most advanced methodologies of molecular biology and new model organisms (small aquatic

animals such as Medaka, *Arabidopsis thaliana*, *Physcomitrella patens*, etc.), training and diffusion of experimental techniques through training courses, and allowing access to databases of these techniques and information through the internet. NIBB also serves as a hub of the research community through supporting the individual joint research projects being carried out in each division of the institute.

Modern molecular biology has enabled an analytical understanding of the structure and function of living organisms. However NIBB continues its effort to explore the most challenging problems, which are difficult to solve if relying solely on knowledge obtained by analytical methods. In order to create a new perspective and enable breakthroughs in biological research NIBB continues to be engaged in improving its research organization, the exploration of promising and creative research fields, and the formation of researchers' communities in these fields. Through activities such as holding the Okazaki Biology Conferences (OBC) in fields which we believe will form the heart of future revolutions in biology, NIBB aspires to become an inter-university research institute that ventures to explore new academic fields. NIBB also serves a central role in the joint research undertaken between the National Institutes of Natural Sciences (NINS) and the European Molecular Biology Laboratory (EMBL), particularly through installing and maintaining facilities for joint research, with an emphasis on bioimaging.

(4) National Institute for Physiological Sciences (NIPS)

The aim of the National Institute for Physiological Sciences (NIPS) is to clarify the “mechanism of normal functions of the human body,” which is the basis for medical science, and to clarify the “mechanism of pathophysiology” of various illnesses, which can be considered as a disorder of the said functions. Therefore, it is engaged in comprehensive and precise joint research in close cooperation with research communities mainly in the fields of medical science and physiology.

“General Cooperative Research” is implemented by accepting and selecting joint research projects from the public, covering a wide range of research fields without specifying a theme. It implements over 30 research projects every year. “Planned Cooperative Research” specifies a theme that matches the demands of the times, and will be implemented by choosing joint researchers under the theme from the public. It is now implementing about 30 joint research projects under five themes.

As for large-scale facilities, it has a magnetic resonance imaging (fMRI) device, a magnetoencephalogram (MEG) device and an ultra-high voltage microscope, which are offered as “Facility Usage” for use by researchers in the community of related fields. Around 40 joint research projects under this “Facility Usage” are also implemented every year.

Furthermore, as an effective measure to carry out more in-depth discussion concerning certain issues in the related fields, and to seek further new developments, the “NIPS

Study Group,” a workshop based on suggestions from external research, is held around 25 times every year. Also, as a COE research institute in the related fields, it promotes cooperation with researchers abroad and serves the role of an mediator. It invites ten or more foreign researchers every year and holds an international research assembly (NIPS International Symposium).

(5) Institute for Molecular Science (IMS)

The aims of Institute for Molecular Science (IMS) are to investigate experimentally and theoretically the structures and functions of molecules and molecular assemblies that are the basic elements of all substances, to establish fundamental and common knowledge and disciplines for various branches of sciences, and to contribute to the creation of new materials and to the energy and environmental problems. IMS also quests a new approach to life science in close collaboration with Okazaki institute for integrated bioscience.

As for large-scale facilities, IMS maintains and operates the UVSOR Facility (vacuum ultraviolet synchrotron radiation facility) and the Research Center for Computational Science (one of the Okazaki Research Facilities and is mainly operated by IMS), and offers them for joint use and various joint research programs by researchers in the community of related fields. In research centers and experimental facilities such as the Laser Research Center for Molecular Science, the Research Center for Molecular-scale Nanoscience, and Instrument Center, IMS offers advanced equipments for joint usage, developments of new experimental techniques and new material synthesis methods. IMS supports “Special Programs,” in which joint research is carried out in collaboration with researchers of the related fields. Furthermore, IMS sets these centers and research resources free for extramural use, and implements “Cooperative Research” in which Joint Studies Programs are conducted for the individual needs of researchers.

In addition to these joint usages mainly for hardware services, IMS holds “Research Symposia” several times every year, which are workshops suggested by external researchers in order to get deeper insights concerning certain topics in the related fields. Also, as a COE research institute in the field of molecular science, IMS promotes cooperation with researchers from abroad, serving the interfacial role among the researchers, and also holds international research meetings. Particular focuses are put on cooperation with Asian countries and regions such as China, South Korea, and Taiwan for educating and fostering young researchers in the rising generation, who are to bear the future of molecular science.

IMS is also playing a leading role in implementing national core programs such as Next Generation Integrated Nanoscience Simulation Software Development for advanced high-performance supercomputer, Photon Frontier Network, and Inter-University Network for Efficient Utilization of Chemical Research Equipments.