Institute of Geoscience

The Institute of Geoscience is one of the core units of the Geological Survey of Japan, AIST, METI. It is responsible for geological, geophysical and geochemical research that provides geoscience information and expertise for the sustainable development of the nation and a better life for the people.

The Geological Survey of Japan (GSJ), established in 1882, has been responsible for national missions in the geoscience field. Japan is an industrialized country in a unique geological setting, that is, one of the most active island arc systems in the world. The GSJ has continuously provided systematic geologic information to society.

The need for geoscientific information is increasing for industrial development plans, preservation of the geological environment and mitigation of geologic hazards. We will maintain the GSJ’s basic research function in co-operation with related research institutes in AIST. We will strive for higher quality and easier access of geo-information for global standardization.

Institute for Geo-Resources and Environment

At the Institute for Geo-Resources and Environment, one of our missions is to contribute to national society and industries through field surveys and research on planning and evaluation of exploration, development and utilization of underground resources, such as geothermal and fuel resources and inorganic resources, for stable supply of basic energy and mineral resources of human life.

The other is to contribute sustenance of safety and environment through research on environmental forecast and assessment, environmental sustenance plan, and safety operation in relation to the development and utilization of underground spaces.

The institute makes above-mentioned broad research by combination specialties of earth science and engineering groups.
Institute for Marine Resources and Environment

The ocean, covering 70 percent of the earth’s surface, contains a vast amount of useful natural resources and plays an important role for the stabilization of the global environment. It is important to understand the nature of the ocean and to make use of its resources and energy with less environmental damage. This institute covers marine sciences including geological and environmental studies and a wide range of marine-related technologies, such as utilization of marine spaces, development of marine resources, environmental mitigation, protection against natural disasters etc.

Institute for Energy Utilization

Advanced technologies for reduction of greenhouse gas emission and energy security will become more important for the growth of industries and the comfort of society.

The Institute for Energy Utilization will be following these research topics:
1. Distributed energy system for the efficient utilization of power and heat to improve total energy efficiency.
2. Energy recovery technologies for organic wastes and unutilized exhaust heat.
3. Innovative technologies for energy transportation and storage.
5. Wind power generation, solar energy utilization technologies.
6. Efficient utilization technologies for biomass and super-heavy hydrocarbon resources.

R & D strategy of energy utilization technology
Institute for Environmental Management Technology

Our life consumes much energy and many resources, which results in various environmental issues. To realize a cleaner environment, technologies controlling environmental pollutants and preventing their diffusion to the environment, technologies purifying environmental pollutants, and technologies for environmental assessment as well as evaluation of energy utilization and environmental technologies shall be developed.

Measurements of Pollutants
Development of technologies to measure trace chemicals rapidly and precisely shall be performed. The measurement systems will be used to control emission sources and to diagnose the environment.

Evaluation and Prediction of Environmental Impacts
Models capable of assess the distribution, accumulation and circulation mechanisms of NOx, SPM, hazardous chemicals, CO2 and others in the environment will be developed.

Cleaning of the Environment
Energy- and resources-saving technologies that can suppress the emission of pollutants into the environment, as well as purify and/or remediate contaminated environments (air, water, soils, ocean) will be developed.

Research Institute for Green Technology

For human beings to survive in the 21st century, it is essential to convert the present mass-production and mass-consumption society into an environmental-friendly recycling-based sustainable society that harmonizes with the global environment. Under these circumstances, the Research Institute for Green Technology is doing research work to develop various environmentally benign technologies in order to realize an economical society, make an efficient use of natural resources while reducing/recycling wastes, control/minimize the risks of chemical substances, and reduce global environmental pollution. The Institute hopes to become a unique research center by doing research in a systematical way on environment-related technologies in the field of ecological materials, eco-processes and environmental catalysis.
Information Technology has pervaded our everyday life and has become one of the most important and influential technologies. We contribute to establishing the following generic information technologies which enable everyone to utilize digital information network conveniently and safely, anytime anywhere, in order to create and share enormous amount of information and knowledge freely at a very high speed:

**Information network technology**
The technology which enables us to execute various activities on the digital information network safely, without stress, anytime anywhere.

**Advanced computing technology**
The technology for fast analyzing, processing, accumulating and searching of enormous amount of information.

**Human interface technology**
The technology for making the smooth and comfortable interaction between information network and humans.

In particular, considering our technical advantage and the role as a public research institute, we concentrate on the following research subjects: Global information processing technology, High-end computing technology, Advanced media technology, Information security technology.

We strategically promote the research with three research groups, global information technology group, high-end computing group, and media-interaction group.
Light can transmit, distribute and process digital information in high volumes and quickly. Moreover, it plays an important role for precise measurement, fine processing and diagnosis by interacting with various materials.

The Photonics Research Institute promotes research and development of photonic technology aimed at the future industrial and human technologies by taking advantage of many advanced aspects of light or photons. The research filed is composed of three major fields i.e. “Soft Photonics” where photonic communication and information processing technology is the main objective, “Amenity Photonics” where comfortable and ecologically acceptable optical human interface is the main objective, and “Hard Photonics” where development of novel light (or photon) source with superior properties and its measurement and application are the main objectives.

The synergetic effects among these fields would also open a new filed on the basis of various potentials of light and photon.

Photonic technology is not only a key technology for the photonic industries in the field of the information communication and processing but also gives wide basis of other technological fields. The institute promotes collaborative researches with other domestic and foreign institutes and industries.

Institute for Human Science and Biomedical Engineering

Major problems facing this rapidly aging society often require solutions based on human science and biomedical engineering. Such problems are frequently concerned with industrial products, information and behavioral environments incompatible with human characteristics, and increasing numbers of aged, diseased or disabled people requiring long-term and costly care. In order to deal with these and related problems, we carry out cooperative research in three fields: (1) human life technology pursuing user-friendliness, (2) assistive technology pursuing independence for the disabled, and (3) biomedical engineering pursuing good health.
Research Institute of Biological Resources

Tens to hundreds of millions of biological species are thought to exist on this planet. Many are known to benefit mankind. For instance, microorganisms have been utilized for long time to produce sake (rice wine), soy source, miso, natto and other food products in Japan. Enzymes and antibiotics, for example, are also the products of microorganisms. In addition, microorganisms are currently used for environmental technology such as wastewater treatment and garbage disposal. These useful biological functions of microorganisms and other biological species are expressed based on the genetic information written in their genomes. Recent analyses exploiting molecular biological approaches have revealed that more than 99.9% of microorganisms on the earth are unknown. We expect there are many, which have such useful characteristics as the ability to produce useful materials or to preserve the environment.

In this institute, we carry out the research from basics to applications, focusing on the research subjects important from the points of view of advancing the exploration of biological resources, functional analyses of genes, utilization of biological and genetic resources in the post genome-sequencing era.

Through the studies, we expect to discover new biological resources and to elucidate novel genetic functions, and to develop the production technology of useful materials, a production process in harmony with environments, and environment protection technology.

Visualization of target microbes in microbial communities using fluorescence in situ hybridization A, syntrophic microbes (red) associated with methanogens (green); B, novel microbes (red) covering the surface of granular methanogenic sludge (green, methanogens); C, Protozoa cell harboring endosymbiotic methanogens (red) and bacteria (green); D, Filamentous bacteria causing bulking in activated sludge

Neuroscience Research Institute

Research in the field of neuroscience has immense scientific value, and its social and economic impacts are extensive. The unraveling of the function and structure of the brain, where the source of all human behavior originates, will lead us to understand our existence, and further promote the fundamental principles for new industrial technologies. Our country is embarking on a mission to realize a “nation built by the promotion of science and technology” and taking active part in supporting neuroscience research as one of its main scientific themes. Neuroscience is still at an early stage of its research, and has unresolved technical elements to be developed. However, we are expecting and already experiencing rapid progress in this field.
The R&D on materials and reaction processes is being carried out to develop advanced technologies as well as to improve and/or establish basic and fundamental technologies for the purpose of strengthening industrial competitiveness, creating a new industry, and realizing a sustainable society.

Under this idea, we have conducted the R&D at the wide spectra from fundamental to advanced chemical technologies, promoting technical innovation in cooperation with each spectrum. Concretely, our effort is focused on the R&D of technical subjects such as new chemical conversion processes, the conversion of small inert molecules, the preparation of novel polymers, advanced inorganic materials, molecular materials, and biomimetic substances, and material safety evaluation.

Ceramic industries of Japan have high competitive power and are supplying various kinds of parts and components to the world. However, its market scale is small, and the related fundamental technology such as standards and design techniques are not sufficiently developed. Materials research has been conducted aiming only to the high performance without harmonization with natural environment.

The purpose of research in our institute is to construct the infrastructures as follows:
1. Reconstruction of technology systems taking the impact on the environment into consideration.
2. Development of material integrating various functions.
3. Establishment of material design technology and of standardization of evaluation procedures.

The subjects, which are highly delicate and common in ceramics, will be systematically studied in the institute, and strong attention will be paid to the hybridization with polymers and metals. The institute will contribute to the sustainable development of both society and economy.
Institute for Structural and Engineering Materials

Overview

The prime objective of our institute is to improve technologies concerned with manufacturing, that can be environment-conscious.

Stress will also be laid on developing composites and nano-materials with highly sophisticated multiple functions that are realized by controlling their bulk and surface structures at the nanometer level through macroscopic scales.

With this research, we will contribute to the advancement of industry and aim at establishing fundamental technologies that contribute to developing a recycling-based sustainable society.

Structure and Research Activities

Our institute has over 130 researchers with the bases located at Tohoku, Chubu, Chugoku, and Kyushu Centers. At these centers we carry out the following four comprehensive researches:

1. Recyclable Materials Technology.

In addition to conducting the research activities, our institute also encourages cooperative studies with academia and industry.
Everyday life is supported by advanced science and technology in many aspects, such as home electric appliances, energy, housing environment, information-communication apparatus, medical equipment and so on. Computational sciences provide the generic technology for all of them and play important roles in the area of industry in order to make our living environment safe and to save natural resources and energy. We are engaged in developing new methods in computational sciences and applying them to scientific and industrial problems.

**Computational Sciences**

Scientific processes of analysis, prediction and design are needed to make a step farther in the advancement of technology. In order to realize such processes, many sophisticated experimental techniques have been developed. However, microscopic phenomena are not necessarily accessible to laboratory experiments. Moreover, complex origins are difficult to resolve by experiments. Therefore, computer simulations as experiments in virtual reality have acquired greater importance in many fields.

**Information technology industry**

Today’s compact mobile phones of light weight with multiple functions were made possible by semiconductors developed in 1980’s. Personal computers are changing the way of communications. Nevertheless, a more advanced LSI technique is required to realize computers with higher performance and larger memory. In 21st century, manipulation of individual atoms and molecules is required to perform atomic scale design in these technology fields and computer simulations are expected to play roles in nano-scale processing.

**Chemical industry**

Variety of materials such as plastics, polymers, liquid crystals and so on are products of chemical industry. It is required to minimize the consumption of natural resources and energy in the process of producing these materials. Computational science approach is becoming indispensable to the control of chemical reactions and materials structures.

**Life science and engineering**

It is believed that 21st century is the age of life science. As the basic technique for gene analysis has been established, one of the next targets of life science is to analyze the structure and function of protein. New industrial activities for manufacture of artificial skin, artificial blood vessel, artificial organs, which are closely linked with medical care, are emerging. Computational sciences will contribute to these activities.

**Automobile and construction industry**

Although a wind-tunnel test used to be a standard method for designing cars and aircrafts for reducing air drag and for safety design, it is nowadays replaced with computer simulations. Computational sciences have established their positions as generic technology and yet are expected to make further contributions to the prediction and design of complex objects possessing desired functions.

Research Institute for Computational Sciences consists of five groups covering studies from microscopic to macroscopic objects and is engaged in research and development of computer simulation techniques as generic technology of industrial activities.