Full Research in Society, for Society

The National Institute of Advanced Industrial Science and Technology (AIST) is a research institute established through integration and reorganization of 15 research institutes of the Agency of Industrial Science and Technology and the Weights and Measures Training Institute. With the concept, “Full Research in Society, for Society,” we promote continuous research related to industry from basic research, application research to practical realization, for the realization of a sustainable society.

As a world’s top-level research institute that responds to the requests of the country and society, we have a 5-year medium- to long-term plan which starts in 2020. Under this plan, we actively tackle the creation of innovation that contributes to enhancing economic growth and strengthening industrial competitiveness and to solving social issues ahead of other countries.

With AIST Tsukuba, our largest research base, at the center, we have 11 research bases, and have maintained a research organization with 7 research domains. In the new medium- to long-term plan, we will further promote research and development by fusion of domains applying AIST’s comprehensive strengths, and will contribute to the following:

- Creation of innovation
- Enhancement of research and development capabilities of the country
- Establishment of open innovation and construction of ecosystems

Employees and Budget

**Employees (as of June 1, 2019)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researchers</td>
<td>2,338</td>
</tr>
<tr>
<td>Administrative employees</td>
<td>703</td>
</tr>
<tr>
<td>Total number of employees</td>
<td>3,041</td>
</tr>
<tr>
<td>Executives (full time)</td>
<td>13</td>
</tr>
<tr>
<td>Visiting researchers</td>
<td>237</td>
</tr>
<tr>
<td>Postdoctoral researchers</td>
<td>240</td>
</tr>
<tr>
<td>Technical staff</td>
<td>1,550</td>
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**Composition of researchers by domain (as of June 1, 2019)**

<table>
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<th>Domain</th>
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<tr>
<td>Energy and Environment</td>
<td>343 (17%)</td>
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<td>Information Technology and Human Factors</td>
<td>294 (14%)</td>
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<td>206 (10%)</td>
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<td>National Metrology Institute of Japan</td>
<td>278 (13%)</td>
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</table>

**Financial results for FY 2018 (Units: million yen)**

- **Revenue Total 112,405**
- **Expenditure Total 114,619**

### Employees

- Researchers: 2,338
- Administrative employees: 703
- Total number of employees: 3,041
- Executives (full time): 13
- Visiting researchers: 237
- Postdoctoral researchers: 240
- Technical staff: 1,550

### Composition of researchers by domain

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**Revenue Total 112,405**

- Subsidy: 62,850
- Joint research revenue: 7,167
- Intellectual property revenue: 489

**Expenditure Total 114,619**

- Energy and Environment: 16,905
- Life Science and Biotechnology: 8,658
- Information Technology and Human Factors: 20,249
- Materials and Chemistry: 11,733
- Electronics and Manufacturing: 15,330
- Geological Survey of Japan: 8,080
- National Metrology Institute of Japan: 8,317
- Other management costs: 7,725
- Facility management costs: 8,511
- Indirect costs: 9,111
Research domains

**Department of Energy and Environment**
- Energy Process Research Institute
- Research Institute of Electrochemical Energy
- Research Institute for Energy Conservation
- Environmental Management Research Institute
- Research Institute of Science for Safety and Sustainability
- Renewable Energy Research Center
- Advanced Power Electronics Research Center
- Global Zero Emission Research Center

**Department of Life Science and Biotechnology**
- Health and Medical Research Institute
- Cellular and Molecular Biotechnology Research Institute
- Biomedical Research Institute
- Bioproduction Research Institute

**Department of Information Technology and Human Factors**
- Human Informatics and Interaction Research Institute
- Artificial Intelligence Research Center
- Cyber Physical Security Research Center
- Human Augmentation Research Center
- Industrial Cyber-Physical Systems Research Center
- Human-Centered Mobility Research Center
- Digital Architecture Promotion Center

**Department of Materials and Chemistry**
- Research Institute for Sustainable Chemistry
- Research Institute for Chemical Process Technology
- Nanomaterials Research Institute
- Innovative Functional Materials Research Institute
- Multi-Material Research Institute
- Interdisciplinary Research Center for Catalytic Chemistry
- CNT-Application Research Center
- Research Center for Computational Design of Advanced Functional Materials
- Magnetic Powder Metallurgy Research Center

**Department of Electronics and Manufacturing**
- Device Technology Research Institute
- Research Institute for Advanced Electronics and Photonics
- Advanced Manufacturing Research Institute
- Spintronics Research Center
- Advanced Coating Technology Research Center
- Sensing System Research Center

**Geological Survey of Japan**
- Research Institute of Earthquake and Volcano Geology
- Research Institute for Geo-Resources and Environment
- Research Institute of Geology and Geoinformation
- Geoinformation Service Center

**National Metrology Institute of Japan**
- Research Institute for Engineering Measurement
- Research Institute for Physical Measurement
- Research Institute for Material and Chemical Measurement
- Research Institute for Measurement and Analytical Instrumentation
- Center for Quality Management of Metrology
Department of Energy and Environment
Tackling energy and environmental issues

In order to promote green innovation the Department of Energy and Environment pursues development of technology aiming at accelerating introduction of new energy including renewable energy and energy savings, storing energy with high efficiency, efficient use of energy resources, and reduction of environmental risks.

**Advanced power electronics**
We are developing power electronics technology that brings innovation to control of electric power using new materials.

**Recycling technology for high-purity recovery of rare metals**
We are developing technology to efficiently recover rare metals from disposed electric and electronic devices (urban mines).
Fluorescence observation of pectin polysaccharides inside a plant stalk

We succeeded in highly-efficient production of useful proteins in eggs for the first time in the world.

Genetically modified chickens by genome editing

We are trying to elucidate developing mechanisms of neurological disorders and new life phenomena by analyzing in detail intracellular molecular dynamics.

Observation technology for biological samples using super resolution microscope

We succeeded in highly-efficient production of useful proteins in eggs for the first time in the world.

Fluorescence observation of pectin polysaccharides inside a plant stalk
At the Department of Information Technology and Human Factors, we conduct research and development on informatics, human factors, and their synergies: empowering industrial competitiveness and promoting societal well-being. We push cutting-edge research in artificial intelligence to create value from big-data, cyber-physical system technology for advanced industry and society, human instrumentation and evaluation technology for safety and wellness of life, and robotics to support various industry and daily activities.

Human Augmentation Technology

We conduct research to change and augment human functions to support the active life of people through technologies that intervene in human vision and motor functions integrated with real-world feedback.

AI Bridging Cloud Infrastructure (ABCI)

This is one of the first large-scale open AI computing infrastructure, with the world’s top-level computational power. ABCI accelerates business and research activities by providing knowledge on large-scale computation and the cloud services necessary for implementing AI.
Department of Materials and Chemistry

R&D for providing additional value to functional chemicals and application of new materials

The Department of Materials and Chemistry conducts research and development to create additional value of functional chemicals and to develop technologies of practical application for new materials. We thus offer stronger value chains of materials and products by integrating material science and chemistry. We provide innovative materials used for competitive end products and contribute to material and chemical industries.

Highly efficient synthesis of silicon basic raw materials

We develop a methodology to directly produce silicon basic raw materials (tetraalkoxysilanes) using inexpensive silicon sources, such as sand, without converting general silicon sources to metallic silicons.

Computer simulation of electrochemical reactions

We develop computational simulations to predict various electrochemical interfaces for high-performance devices.
The Department of Electronics and Manufacturing develops world-leading devices for realizing significant energy reduction and high performance in IT equipment. We also develop on-demand manufacturing technology with power, resource, and cost savings. Toward the era of Internet of Things (IoT) in which all things connect to the internet, we develop advanced sensing systems creating high value-added service and realizing highly-efficient production systems.

Innovative optical input and output device based on silicon photonics

A surface coupled optical input and output device was fabricated by bending tips of silicon optical waveguides with ion-implantation-induced stress.

Low-power vibration sensor employing piezoelectric thin film

This is a low-power and highly sensitive vibration sensor with integrated multiple piezoelectric MEMS resonators corresponding to different frequencies.
Geological Survey of Japan

Geological information supporting a safe and comfortable society

Geological information is essential for keeping our society safe and secure, and is particularly required in Japan, which is located on an active tectonic belt. With its abundant knowledge and experience in earth science, the Geological Survey of Japan (GSJ) pursues R&D on a wide range of areas: mitigation of geological disaster, protection of environment, sustainable utilization of natural resources and energies, and others. GSJ aims to realize an earth-friendly and sustainable society through its research and survey to conserve and utilize our geoenvironment.

Bird’s eye view of Geological Map of Fuji Volcano (2nd ed.)

Geological Map of Fuji Volcano was completely revised for the first time in about 50 years.

Advanced Integrated Sensors Towing system (AISTs)

GSJ conducts marine geological surveys at the vast sea area surrounding Japan. A deep-towed high-resolution survey package is being developed to accelerate marine use.

Field survey of alternating sand and mud layers at a sea cliff
National Metrology Institute of Japan

Measurement standards support the spectrum from daily life to advanced industry

Development of the measurement standards such as length, time, and mass is a mission of AIST. The National Metrology Institute of Japan (NMIJ) develops and maintains measurement standards of the seven base units of the International System of Units (SI) and numerous combinations of these base units, and disseminate these standards to society. NMIJ strives to advance measurement technologies associated with the measurement standards, and undertakes the development of infrastructure underpinning cutting-edge manufacturing as well as the safety and security of our society. Furthermore, we disseminate measurement standards, conduct legal metrology services, and provide training for metrology experts.

Reference materials support safety and security

We develop and supply various reference materials necessary to ensure reliability of analytical results.

Redefinition of the International System of Units (SI)

This is the silicon sphere used in the measurement for the redefinition of the unit of mass (kilogram).
Regional research bases operated throughout the country

AIST has regional research bases that respond to regional needs and collaborate with companies in the regions.

**AIST Hokkaido** Research theme: bio-manufacturing
We promote research and development of new bioproduction technology using the abilities of living organisms such as developing a substance production platform using plants and microorganisms.

**AIST Tohoku** Research theme: chemical-manufacturing
AIST Tohoku, merging technologies related to chemical reactions, processes, and materials, is leading in innovation by promoting research in chemical-manufacturing of the world’s highest level.

**Fukushima Renewable Energy Institute, AIST (FREA)** Research theme: renewable energy
From Fukushima, we promote R&D of renewable energy internationally and contribute to reconstruction through developing new industrial clusters in this area.

**AIST Kashiwa** Research theme: AI and ergonomics
We work toward social implementation of services that help people maintain and enhance their capabilities by human augmentation technologies that boost human abilities using AI and sensing technologies.

**AIST Tokyo Waterfront** Research theme: integration of AI and life science and manufacturing technologies
We promote open innovation toward social implementation of AI technologies and realization of healthy and safe living through drug discovery.

**AIST Chubu** Research theme: functional materials
We promote research and development of various industrial components targeting inorganic new materials such as ceramics and metals relating to automotive, aircraft, industrial tools, and energy industries.

**AIST Kansai** Research theme: battery and medical technologies
We transfer our research achievements of batteries, medical care, materials, and information fields, for development of industries and a better life for people.

**AIST Chugoku** Research theme: materials evaluation technology
We promote research and development emphasizing chemical, bio, and materials evaluation technologies to produce basic fundamental and functional chemicals with high efficiency and low environmental impact.

**AIST Shikoku** Research theme: health care
We promote research and development of technologies for measurement and visualization of health conditions, removal of health risk factors from living environments, and functionality assessment of food ingredients for promotion of health.

**AIST Kyushu** Research theme: sensing for smart manufacturing
We endorse research and development of various sensing technologies to contribute to the realization of smart manufacturing, sensor network technologies, and collected data usage technologies.
In addition to the latest research achievements and announcements, various kinds of information can be found on these websites.

**General inquiries**

**Collaboration and technical consultation**

**Research achievements**
- [https://www.aist.go.jp/aiest_e/list/us_latest_research.html](https://www.aist.go.jp/aiest_e/list/us_latest_research.html)

**Facility tours**
- [https://www.aist.go.jp/aiest_e/exhibitions/](https://www.aist.go.jp/aiest_e/exhibitions/)
- Science Square Tsukuba
- Geological Museum
- Life Technology Studio

**Employment**
- [https://www.aist.go.jp/aiest_e/humanres/](https://www.aist.go.jp/aiest_e/humanres/)
Development and succession of human resources that create innovation

AIST has a personnel system that allows human resources of every line of work and age to flourish.

Cross-appointment system
In order to build a research system that extends beyond the boundaries of an organization, AIST, as a core institution that links research and industry, has a system for researchers who can have appointments at multiple institutions and are able to play active roles in research, development, and education in any institution.

Technical training
AIST accepts researchers and engineers from universities, companies, and public testing and research institutions for defined periods, and enables trainees to absorb technology under the instruction of AIST researchers. For students, we offer a broad range of support from internships to research guidance for degrees in the framework of the technical training program.

Research assistant program (RA)
AIST hires graduate students of high ability so that they can focus on research for their degrees with less financial worries. RAs can participate in R&D projects that AIST conducts and may use the results in their theses.

Innovation School
The Innovation School was started in 2008 to develop young research talent, and over 400 trainees have completed the course. Through the 2 courses that meet the needs of postdoctoral fellows and graduate students, while deepening their scientific and technological knowledge, the school aims to develop human resources with broader perspective and communication and cooperative skills to work with specialists of different fields.

Nanotech Career-up Alliance (Nanotech CUPAL)
Nanotech Career-up Alliance (Nanotech CUPAL) was established based on the subsidized project by MEXT “The Consortium Structuring Project to Foster Science and Technology Personnel” in FY 2014. We aim to advance the careers of young researchers in Japan and to improve their career mobility.

AIST Design School
At the AIST Design School, one can learn methods such as design thinking, system thinking, and foresight and others. The school provides a place to learn with researchers of AIST and companies, and aims to foster human resources that can co-create with stakeholders and pursue projects for society with views of the future.
Highlights of Research Achievements

Starting as the Geological Survey of Japan in 1882, followed by the era of its forerunner, the Agency of Industrial Science and Technology, and up until now, AIST has achieved numerous instances of breakthrough research and development that have left their mark in the annals of science history. Here we introduce prime achievements spanning over 130 years from the 1880s until today.

Geological map of Japan (1:3,000,000)
The first complete geological map of Japan was published in 1889, a mere seven years after founding of the Geological Survey of Japan. Its history is closely linked to the development of geology, industry and mining in Japan, which began with instruction by foreign nationals at the beginning of the Meiji Period.

1880s

1920s

TIEL method of ammonia synthesis
The Provisional Laboratory of Nitrogen developed the first national ammonia synthesis technology using its original robust catalyst. It is the result of Japan’s first large-scale project and is recognized worldwide as the “TIEL method of ammonia synthesis.”

1950s

Transistor computer Mark-IV
The Electrotechnical Laboratory completed Japan’s first transistor computer, the ETL Mark-III, in 1956. It was then enhanced to create the Mark-IV and Mark-IVA, leading the way for commercialization of computers in Japan.

1960s

PAN based carbon fiber
In 1959, the Government Industrial Research Institute, Osaka, was the first in the world to develop lightweight and high-strength carbon fiber from polyacrylonitrile (PAN) fiber, which came to be used in clothing and other products. Research aimed at its practical application was launched in the 1960s, and the material is now widely used in a multitude of products from fishing rods to airplanes.

Production process for glucose isomerase used to make soft drink sweetener
The Fermentation Research Institute developed a method for producing super sweet fructose by using glucose isomerase from glucose. It later signed license agreements with numerous companies in Japan, the US, and other countries, which resulted in its use all over the world.

1980s

Catalytic action of gold nanoparticles
Gold was considered to have no catalytic function, but in 1982 the Government Industrial Research Institute, Osaka discovered specifically high catalytic activity of gold nanoparticles (3–4 nm) carried on metal oxide surfaces. The activity was outstanding even at low temperatures, and opened doors to commercial applications like deodorizing catalysts, detoxification of carbon monoxide, and gas sensors.

Anode alloys as the foundation for nickel metal hydride batteries
Research on the nickel metal hydride batteries used in hybrid cars began at the Government Industrial Research Institute, Osaka, in the 1970s. Around 1990, the first nickel metal hydride battery that had the same performance as lead batteries at half the weight was created. It is also garnering interest for use as a large stationary battery.

A breakthrough in single-walled carbon nanotube synthesis
A revolutionary synthetic technology for single-walled carbon nanotubes (SWCNTs) called the “super growth method,” was developed, and a synthetic efficiency 1,000 times higher than previous methods was realized. Furthermore, the synthesized SWCNTs possess various outstanding properties, such as high purity, compared to those synthesized by previous methods. Industrial mass production has been realized.

High-performance MTJ device for HDD magnetic heads
We developed high-performance magnetic tunnel junction (MTJ) devices with crystal line magnesium oxide (MgO) tunnel barrier for HDD read heads, which have more than doubled the recording density of HDD than before. Such high-performance MgO/TMR read heads are used in all HDDs manufactured today.

Production for transparent conductive film
The Government Industrial Research Institute, Osaka, was the first in the world to develop technology for industrial production of indium tin oxide (ITO) transparent conductive film, which is indispensable to liquid crystal displays and solar cells. This film also aided in the industrialization of liquid crystal calculators and is now the source of a huge market.

1990s

PAN based carbon fiber

2000s

photo courtesy of Fujitsu Limited

INTEGRATION FOR INNOVATION