Promote New Innovation and Industry

Tsukuba International Strategic Zone

http://www.tsukuba-sogotokku.jp/en/

Tsukuba International Strategic Zone

From Science City to a focal point of innovation

In December 2011, the Japanese Prime Minister offiically designated Tsukuba City and parts of Ibaraki Prefecture as a Comprehensive Special Zone. Today in the Tsukuba International Strategic Zone, leading research and development projects are being undertaken in order to create new industries with a global vision.

What are Comprehensive Special Zones?

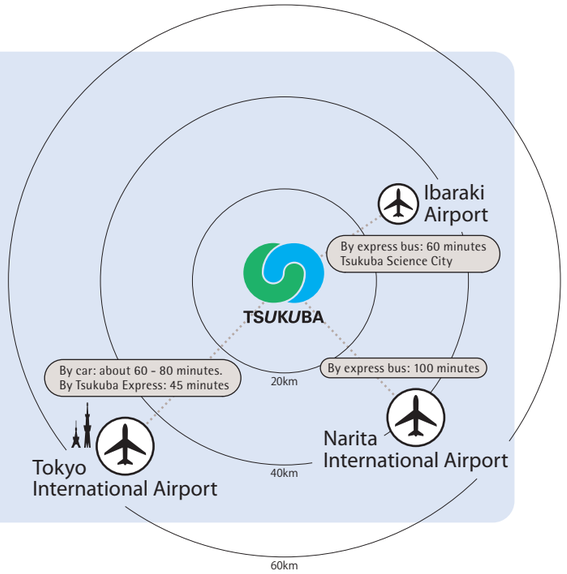
Comprehensive Special Zones are one of Japan's economic growth strategies that is particularly designed to strengthen Japan's industrial competitiveness in the global community. Tsukuba is currently one of 7 regions in Japan that have received such a designation. Research and development projects and related activities in special zones that have received approval may be given various types of assistance, special treatment, etc., such as government funding and relaxation of regulations that may impede their progress and materialization. Consequently, one of the advantages of special zones is that it is easier and quicker to make a project practical and commercially feasible there than in areas outside of such zones.

Construction of a new industry-government-academia collaboration system that is changing Tsukuba

Eight pioneering projects

Science City

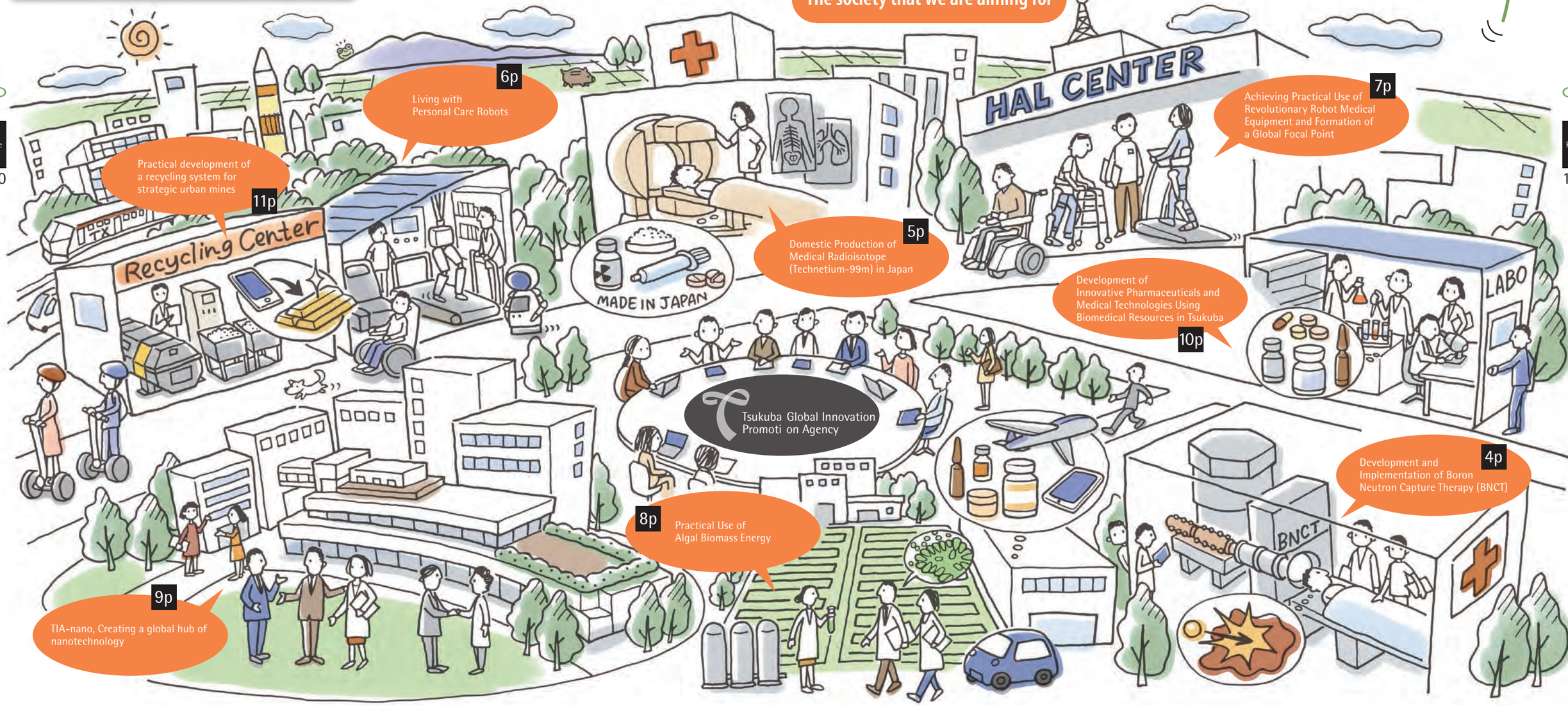
Tsukuba is Japan's largest science city.
In the 50 years since the Japanese Cabinet authorized the construction of Tsukuba Science City in 1963, the city has grown, and it is aiming for further growth.



Tsukuba Innovation City

FUTURE

The society that we are aiming for



6p Living with Personal Care Robots

7p Achieving Practical Use of Revolutionary Robot Medical Equipment and Formation of a Global Focal Point

11p Practical development of a recycling system for strategic urban mines

5p Domestic Production of Medical Radioisotope (Technetium-99m) in Japan

10p Development of Innovative Pharmaceuticals and Medical Technologies Using Biomedical Resources in Tsukuba

4p Development and Implementation of Boron Neutron Capture Therapy (BNCT)

8p Practical Use of Algal Biomass Energy

9p TIA-nano, Creating a global hub of nanotechnology

Tsukuba International Strategic Zone

A center where industry, government and academia collaborate to deliver innovations using scientific technologies clustered in Tsukuba and to turn the resultant new business and industries into international standards and models that drive the economic growth of Japan and help mitigate global issues

Tsukuba, an International City

Tsukuba has not only produced Nobel laureates, but is also a magnet for research organizations and is now one of the world's foremost science and technology cities. With its many world-class research facilities, Tsukuba is home to a multitude of researchers, students, and residents from foreign countries. As of September 1, 2015, there were 7,416 people from 133 countries living in the city. Tsukuba is creating various programs in response to its international character:

- International exchange fairs
- Classes for international understanding
- Social cooking classes
- Volunteer interpreters
- Foreign language classes

Tsukuba is home to 32 research institutes, of which one-third are national organizations, and more than 20,000 public and private researchers. World-class research facilities include Japan's biggest Super Clean Room for research (Advanced Industrial Science and Technology) and the B-Factory Accelerator (High Energy Accelerator Research Organization), forming the biggest R&D cluster in Japan.

More than 200 venture companies have been spawned so far, and have produced inventions such as the tunneling magneto resistance element which is now used in 98% of hard disks (530 million units in 2008) in personal computers and the world's first cyborg-type robot, "Robot Suit HAL®".

Comfortable living environment for business

A good living environment is essential to succeed in business. Tsukuba City offers excellent facilities for raising children, including top-class education in Japan. Other comprehensive facilities include medical clinics for peace of mind, good public cultural and education facilities, as well as parks and sports facilities. The city is also famous for its fresh agricultural products grown in nature.

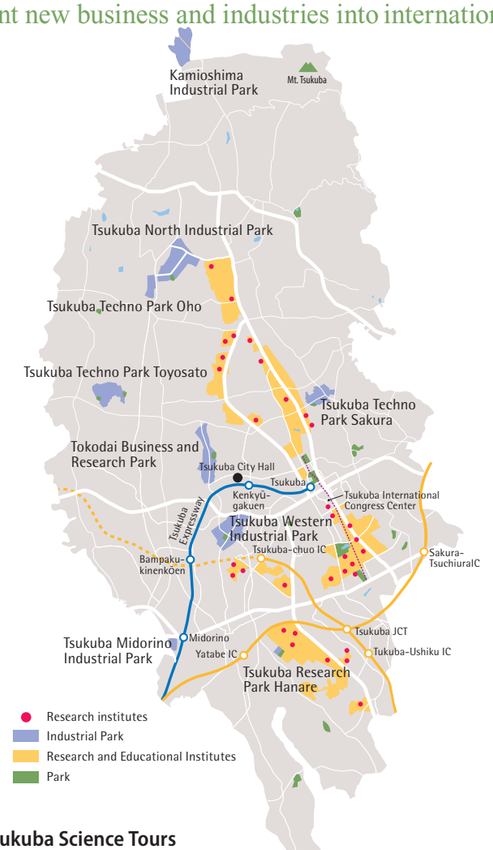
Housing for Foreign Researchers

Tsukuba Science City has housing for foreign researchers working at research institutes and universities, and their families. Such facilities also provide support for general daily life in Tsukuba, such as assistance with joining a school, advice on shopping, etc., and Japanese language classes and cultural exchange events.

Ninomiya House - International Residence for Researchers

Tsukuba International School

Tsukuba International School is an IB World School in Tsukuba established in 1992.
tis.ac.jp



Tsukuba Science Tours

Through the Tsukuba Science Tours, visitors can see the latest science and technology at public research institutes in Tsukuba Science City.
For those interested in visiting research institutes, the Tsukuba Science Tour Office provides information on where to visit and can suggest tour routes. Many people join a Tsukuba Science Tour, whether for sightseeing, school trip, or just something to do after a convention.

Tsukuba Science Tour Office.
(The Science and Technology Promotion Foundation of Ibaraki)
www.i-step.org/tour/

Tsukuba International Congress Center

Tsukuba International Congress Center (TICC) was built to encourage research exchanges, revitalize the regional economy, and hold conventions. Some 2.8 million people have visited it since it opened in June 1999.
In addition to the large hall with capacity for 1,258 people, there are also two medium-sized halls and conference rooms that can handle meetings for up to 2,500 people using video-conferencing. The latest equipment includes a 400-inch Hi-Vision Projector, a six-language simultaneous interpretation system, and a satellite teleconferencing system.
Among all international convention facilities in Japan (excluding universities, etc.), TICC held the second-most international conventions (48) in 2008. (Statistics from Japan National Tourism Organization)
www.epochal.or.jp

Area of Strategic Zone

- Entire Tsukuba City (all area)
- Tsukuba-no-sato Industrial Park in Ryugasaki City
- Tokai-mura Hospital, Japan Atomic Energy Agency and Ibaraki Neutron Medical Research Center in Tokai-mura, Naka-gun
- Ibaraki Prefectural University of Health Sciences and its University Hospital in Ami-machi, Inashiki-gun
- Part of Oarai-machi, Higashiibaraki-gun
- Part of Ibaraki-machi, Higashiibaraki-gun

* The area will be flexibly revised based on the progress of projects.

Excellent location for global business

As an R&D site with a world-class location, Tsukuba City has many similarities to Silicon Valley in the US, and is ideal for the headquarters of global companies in Asia.

- To central Tokyo by Tsukuba Express Line (45 min)
- To Narita International Airport by car (when the Ken-O Expressway opens, 50 min)
- To Ibaraki Airport by car (45 min)
- Various means of access including Ibaraki Port (Oarai, Hitachinaka and Hitachi ports), the Joban Expressway, and the Kita-Kanto Expressway, which are logistics arteries of east Kanto.

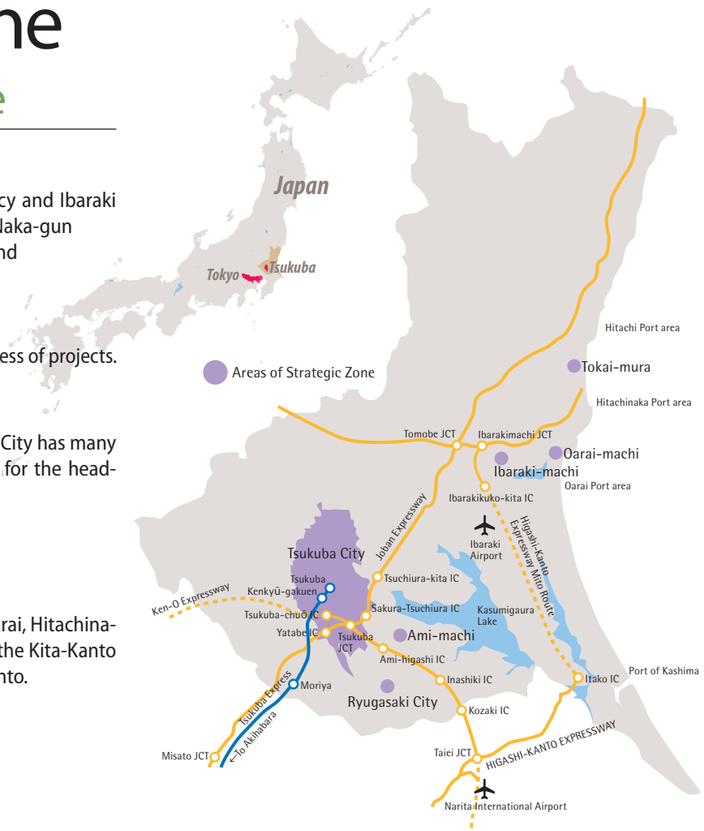
Initiatives in Tsukuba International Strategic Zone

1. Objectives

"A new system for industry-government-academia collaboration to change Tsukuba" is to be constructed by effectively using the preferential legal and tax measures that are available in the zone. The aim is to obtain tangible results from pioneering projects in order to help resolve the issues that we face in the fields of life and green innovation.

2. Construction of a new industry-government-academia collaboration system to change Tsukuba

- Establishing an organization for promoting global innovation in Tsukuba to serve as a core of the collaboration system
- Creating systems for enabling researchers to use leading-edge research facilities of other organizations, producing tangible results, publicizing study resources, and supporting projects on a common platform



3. Eight pioneering projects

Project 1 Life-Innovation
Development and Implementation of Boron Neutron Capture Therapy (BNCT)

Project 2 Life-Innovation
Living with Personal Care Robots

Project 3 Green-Innovation
Practical Use of Algal Biomass Energy

Project 4 Green-Innovation
TIA-nano, Creating a global hub of nanotechnology

Project 5 Life-Innovation
Development of Innovative Pharmaceuticals and Medical Technologies Using Biomedical Resources in Tsukuba

Project 6 Life-Innovation
Domestic Production of Medical Radioisotope (Technetium-99m) in Japan

Project 7 Life-Innovation
Creation of the global hub of innovative medical robots and medical devices

Project 8 Green-Innovation
Practical development of a recycling system for strategic urban mines

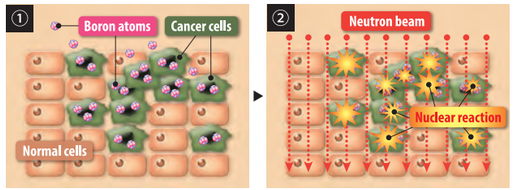
www.tsukuba-s ogotokku.jp/en/

Development and Implementation of Boron Neutron Capture Therapy (BNCT)

The outstanding medical engineering collaboration leads the world in treatment of refractory cancer

Boron Neutron Capture Therapy (BNCT) is a treatment which selectively attacks to tumors not damaging normal tissues significantly, and which is expected to be an effective treatment for invasive cancer, recurrent cancer, and refractory cancer. Since the 1980s, clinical studies on BNCT have been conducted at the University of Tsukuba which involve use of a nuclear reactor. Using the experience, the project is developing a safe and small-sized treatment apparatus that substitutes the nuclear reactor and that can be attached to the hospital, as well as peripheral devices such as radiotherapy planning apparatus. A global cutting-edge package of cancer therapy is being created in Tsukuba, which is an intellectual cluster of experts on medicine, physical engineering, accelerator development and pharmacy.

Principles of BNCT



A boron-containing drug that accumulates only in cancer cells is administered.

Energy-controlled neutrons are irradiated at the focal point.

The nuclear reaction between neutrons and boron atoms emits alpha particles and lithium ions.

Both alpha particles and lithium ions penetrate only as far as the diameter of one cell (10 μm), enabling cell-level therapy.

Remedial example

Head and neck cancer

Photo courtesy of Osaka University

Before BNCT

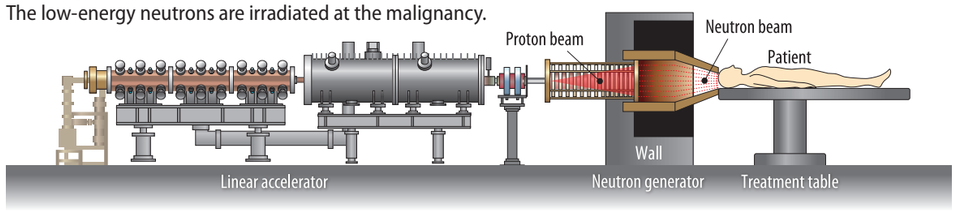
After BNCT

Characteristics of BNCT

- Effective also against refractory cancers (invasive cancer, multiple cancer, cancer not treatable by surgery, etc.)
- Reduced physical burden to the patient and high quality of life (QOL)
- Pinpoint targeting at individual cells

Schematic diagram of a therapeutic device

Accelerated proton beams from the linear accelerator react with beryllium in the neutron generator and emit neutrons. The low-energy neutrons are irradiated at the malignancy.



Main institutes involved:

University of Tsukuba Hospital /
High Energy Accelerator Research Organization (KEK) /
Japan Atomic Energy Agency /
Mitsubishi Heavy Industries, Ltd. /
Hokkaido University / Ibaraki Prefecture

Overview of activities

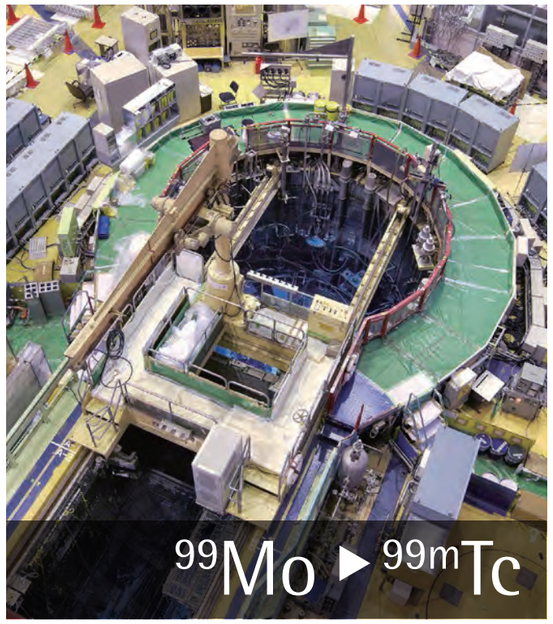
[Results obtained so far]
- Development of versatile medical equipment, etc., for hospitals and clinics (since FY 2010)
- Development of the Ibaraki Neutron Medical Research Center as a focal point of joint research (FY 2011-2012)
- Acceleration of proton beams up to a set energy level and transmission to an irradiation chamber (FY 2014)
- Development of a medical treatment planning system, equipment for controlling patients' posture, equipment for automatically synthesizing chemicals for PET diagnoses, comprehensive control system, etc. (up to FY 2015)

[Future topics]
- Generation of neutron beams
- Start of plant and animal experiments, clinical research (treatment of patients)

Domestic Production of Medical Radioisotope (Technetium-99m) in Japan

For stable supply of the essential tracer for detailed examination

The tracer used in nuclear medicine examinations, such as bone scintigraphy and SPECT, is made by combining an agent that characteristically accumulates in lesion areas and radioisotopes (RI). By visualizing the gamma rays emitted from the radioisotopes, it helps diagnoses of various diseases. Technetium-99m is most widely used for the diagnoses of cancers and for the blood flow examination in brain, bones and myocardia. Technetium-99m is generated from molybdenum-99 (^{99}Mo). Although Japan is the third largest consumer of ^{99}Mo, it depends on imports for the entire supply of ^{99}Mo. Also, its supply shortage could be caused if any troubles take place at the foreign nuclear reactors producing the materials, or its transportation is disrupted due to disasters such as volcanic eruptions. In order to ensure the stable supply, it is highly desirable to produce ^{99}Mo in Japan as soon as possible. We aim to develop the necessary technologies for practical use using the Japan Material Testing Reactor (JMTR) of the Oarai Research & Development Center of the Japan Atomic Energy Agency. We are sure that such technologies will also reinforce the international competitiveness of Japan's medical industry.

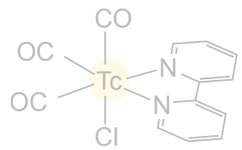


Preparation method of ^{99}Mo

Currently molybdenum-99 (^{99}Mo) is mainly produced via nuclear fission of uranium, and it is difficult to avoid diffusion of fissionable materials and to maintain safety while using and disposing it. In this project, ^{99}Mo will be prepared via activation without using uranium. However, it is difficult to generate ^{99}Mo which has high specific activity with the neutron activation method compared with the nuclear fission method. Therefore, practical production technologies are now being developed.

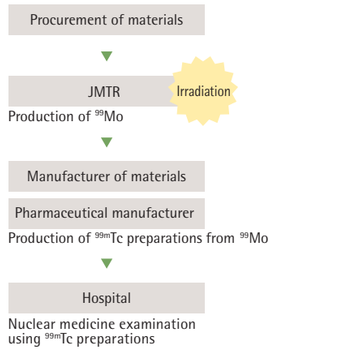
Neutron activation method ((n,γ) method)

- Smaller amount of radioactive waste
- Reduced production cost



Schematic flow from development to supply of ^{99}Mo

A consistent system for the entire process from the material production to the product supply is being constructed.



Overview of activities

[Results obtained so far]
- Neutron irradiation tests with the research and test reactor (since FY 2013)
- Separation, extraction, and condensation tests of technetium-99m (since FY 2013)
- Construction of a clean room inside a hot cell (FY 2014)

[Future topics]
- Confirmation of the quality of technetium-99m solution
- Animal tests and clinical research
- Technical feasibility for practical applications

Main institutes involved:

Japan Atomic Energy Agency/
Chiyoda Technol Corporation/University of Tsukuba

Living with Personal Care Robots

Robots developed in Tsukuba are setting international standards

Personal Care Robots are robots that are designed to assist people with physical motions and mobility in their lives. As Japan's society ages, expectations are growing for a variety of uses of these robots, and numerous research organizations and companies are conducting research and development in this field. The Robot Safety Center acts as the focus for ascertaining the technical safety of such robots and is also verifying effects and issues through corroborative experiments, since it is necessary to evaluate the safety in order to promote full-scale practical use. With a goal of full-scale introduction of personal care robots both in Japan and overseas, the Center is creating a seamless system covering everything from robot development to safety approval.

Robot Safety Center

The Robot Safety Center is equipped with various types of testing apparatus to conduct safety tests of robots developed by research organizations and companies. It also conducts all sorts of tests requested by other organizations.

Main institutes involved:

National Institute of Advanced Industrial Science and Technology (AIST), Japan Automobile Research Institute (JARI), and other related companies; University of Tsukuba, Tsukuba City, Ibaraki Prefecture

Corroborative experiments in various fields

In Tsukuba there is a specially designated area where boarding-type mobility robots can be tested on public pathways. Corroborative experiments are also conducted in care facilities, hospitals, etc., to determine the effectiveness and safety of such robots in actual use scenarios.

RT.1 is a robot that is designed to assist elderly people and others with walking. Corroborative experiments are currently being conducted to introduce these robots in care facilities in Ibaraki Prefecture.

Corroborative experiment at the Ibaraki Prefectural University of Health Sciences.
Corroborating the restorative effects of physical functions and safety of users.

The safety, etc., of users and the areas around them are being verified.

Overview of activities

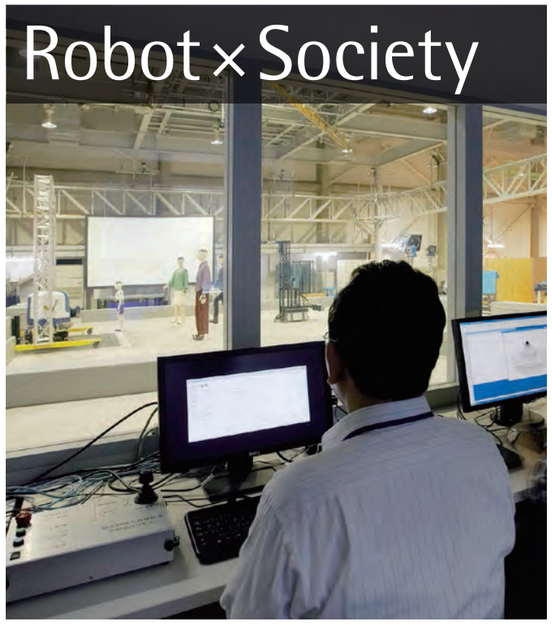
- [Results obtained so far]
- Start-up of the Robot Safety Center (since FY 2010)
- Implementation of corroborative experiments designed to bring Personal Care Robots into practical use (FY 2010 - 2012)
- Corroborative experiments conducted in public pathways in the "Tsukuba Mobility Robot Experiment Zone" (FY 2012 - 2015)
- Project for the development and introduction of Personal Care Robots and related equipment (since FY 2013)
- Establishment of safety evaluation standards and proposal and issue of the ISO13482 international standard (FY 2013)

* Six Personal Care Robots were certified including the original prototype.

- Start-up of safety approval facility and certification for various robots (since FY 2014)

[Future topics]

- Full-scale market entry of safety-certified robots



Contribute to establishment of international safety standards

In February 2014, ISO13482 was officially issued as the international safety standard for personal care robots. It incorporates results from safety testing technologies and verification methods used at the Robot Safety Center and was created based on proposals submitted from Japan. As it acquires more data and results, the Robot Safety Center is aiming to serve as an international robot certification organization.

ISO13482 certified products of participating companies in the project

February 2013 - "HAL® for social welfare equipment" (ISO/DIS13482) Cyberdyne Inc.
February 2014 - "Rishone®" Panasonic Corporation
- "Area Management System" Daifuku Co., Ltd.
November 2014 - "HAL® for task support (back load reduction)" Cyberdyne Inc.
- "HAL® for care support (back load reduction)" Cyberdyne Inc.
July 2015 - "Robot Assist Walker RT.1" RT. Works Co., Ltd.

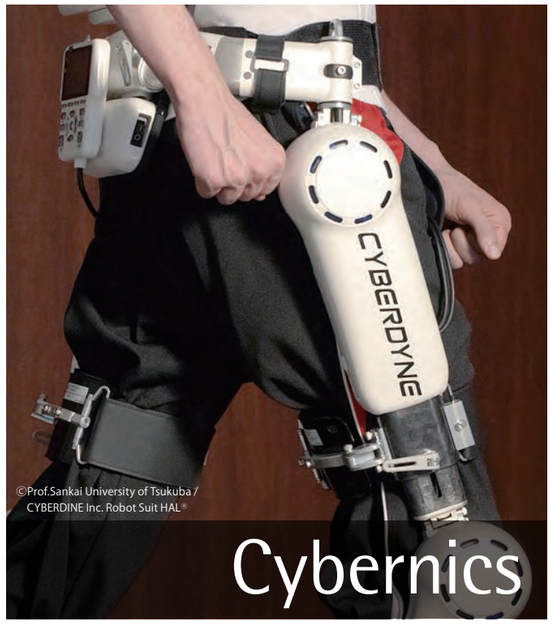
Achieving Practical Use of Revolutionary Robot Medical Equipment and Formation of a Global Focal Point

Global development of revolutionary HAL® robot medical equipment

Efforts are being made to put HAL® robot medical equipment, which has received approval in Europe, to practical use in Japan. In addition, The International Center for Medical Cybernics (tentative name) is being established in Tsukuba to provide an environment for the creation of not only new compound medical treatments consisting of combinations of pharmaceutical products, regenerative medicine, etc., and HAL®, but also for the R&D of new medical equipment and treatment techniques that utilize cybernics technology, conducting clinical trials and social implementation, and nurturing human resources in an integrated manner. The Center is aiming to become an international frontrunner that can continue to create revolutionary robot-based medical equipment and medical technologies.

Main institutes involved:

University of Tsukuba (University of Tsukuba Hospital), Ibaraki Prefectural University of Health Sciences, National Hospital Organization Niigata National Hospital, Karolinska Institutet- Dandreyd Hospital (Sweden), Bergmannsheil Hospital (BG Group, Germany), Swedish Neuroscience Institute (USA), TÜV (Germany), UL (USA)



Overview of activities

[Results obtained so far]

- Successive clinical research and trials for Robot Suit HAL® have been commenced (since FY 2013)

* Clinical trials of a HAL for lower limbs was concluded and an application for pharmaceutical approval was submitted in March 2015.

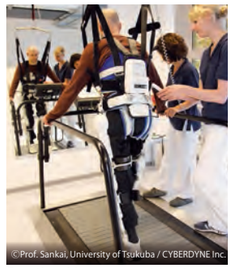
[Future topics]

- Establishment of the International Center for Medical Cybernics
- Acquisition of pharmaceutical approval of HAL® and production as medical equipment
- Development of compound therapy with pharmaceutical products and regenerative medicines using HAL®
- Development of a health care system using cutting-edge medical care sensing technology
- Development of communication devices for patients with neuromuscular diseases such as ALS

Robot Suit HAL®, the world's first cyborg-type robot

Following the intentions of its wearer, Robot Suit HAL® is a wearable robot that can assist with autonomous motions such as leg movement. When a person moves, commands are transmitted from the brain to muscles via the spinal cord, motor neurons, etc. At such times, extremely weak bio-electric signals are leaked to the surface of the skin. HAL® uses sensors to read these bio-electric signals to activate motors to respond to the intentions of the wearer to move in unison with joints. This helps to improve, supplement, expand, and reproduce physical functions.

Acquisition of medical equipment certification, application for pharmaceutical approval, and development of state-of-the-art equipment



Functional improvement treatment at CCR in Germany

Medical care system for examining, diagnosing, and preventing circulatory diseases

Clinical research and evaluations are being used to corroborate the efficacy of treatments for improving the functionality of patients with brain, nerve, and muscle disorders including spinal damage and apoplexy. Already, CE marking certification (CE0197) has been acquired throughout Europe as the world's first robot medical equipment. In Japan, clinical tests on patient with nerve and muscle disorders have ended, and a pharmaceutical application for medical equipment has been submitted to the Pharmaceuticals and Medical Devices Agency (PMDA). This application is being given preferential examination. Furthermore, R&D for cutting-edge medical equipment is being conducted, and work has been completed for palm-sized prototypes of arteriosclerosis and electrocardiographic meters.

The International Center for Medical Cybernics (Tsukuba Medix) (tentative name)

The tentatively named International Center for Medical Cybernics (Tsukuba Medix) is being built to serve as a focal point for the global development of innovative technologies for robot medical equipment and medical treatment. The center will be engaged in R&D of not only compound medical treatments consisting of pharmaceutical products, regenerative medicine, etc., and HAL®, but also new medical equipment and treatment technologies. The center will also be using the results of R&D to conduct clinical trials and social implementation, and nurture human resources in an integrated manner.

Practical Use of Algal Biomass Energy

Algal oil to help solve energy problems

Microalgae are widely known as a source for alternative biofuel for its high production capacity of biomass that does not compete with food production. The aim of this project is to develop techniques for microalgae oil production to help solve the global energy problems. Moreover, to built a momentum to create a new algal industry, by discovering more function and inventing applied technology for a commercial use of microalgae.

Oil production capacity of microalgae

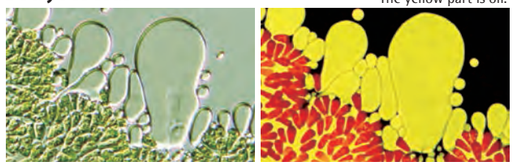
Microalgae have a high potential for producing biofuels. Their production capacity is tens to several hundreds times greater than that of terrestrial oil crops.

Types of crops	Corn	Soybeans	Safflower	Sunflower	Rapeseed oil	Palm oil	Microalgae
Annual production volume per hectare of cultivated land (t)	0.2	0.5	0.8	1.0	1.2	6.0	47 - 140

Hydrocarbon producing algae

Botryococcus

* The yellow part is oil.



- Freshwater photosynthetic green alga
- Fixes carbon dioxide
- Accumulates hydrocarbon oil in its cell and colony (20 - 75 % of dry cell weight)

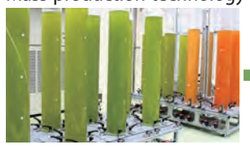
Aurantiochytrium

* The yellow part is oil.

- Marine and brackish-water heterotrophic alga
- Grows using organic matter and oxygen and produces hydrocarbon called squalene
- Contains hydrocarbon in the cell (20 - 30 % of dry cell weight)

Development of large-scale production technology of algal oil

Mass production technology



Indoor Laboratory Culture (1 – 2,000 L)

Outdoor Pool Culture (10 – 50 kL)

Outdoor farmland plant for mass culture demonstration experiments (100 kL -)

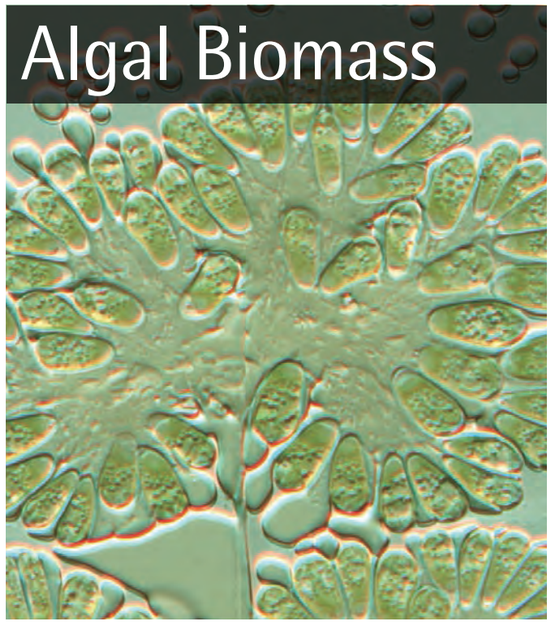
Overview of activities

[Results obtained so far]

- Construction of an outdoor demonstration plant for mass culture technology (FY 2013)
- Test operation of an official vehicle fueled with composite fuel containing algal biomass energy (since FY 2013)
- Joint development and commercialization of functional products with private companies (since FY 2014)
- Establishment of the Algal Biomass Energy R&D Center of the University of Tsukuba

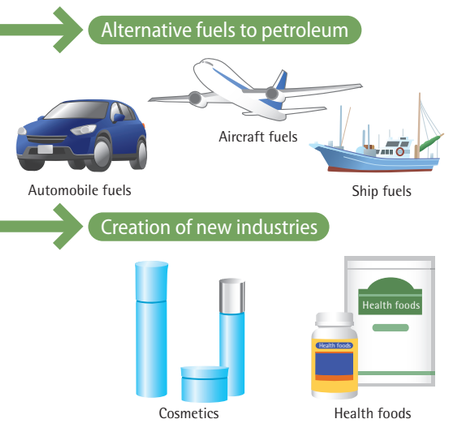
[Future topics]

- Promoting the creation of an algal biomass industry through R&D conducted at the Algal Biomass Energy R&D Center of the University of Tsukuba



Main institutes involved:

University of Tsukuba/ Tsukuba City/ Ibaraki Prefecture/ Sobio Technologies Inc.



TIA-nano, Creating a global hub of nanotechnology

Open innovation platform for renovating Japan's innovation system

In Tsukuba where world-class advanced nanotechnology research facilities and human resources gather, TIA-nano (Tsukuba Innovation Arena for Nanotechnology) strives to build a global nanotechnology research and education center, with the support of the Cabinet Office, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Economy, Trade and Industry (METI). TIA-nano has been led by the National Institute of Advanced Industrial Science and Technology (AIST), the National Institute for Materials Science (NIMS), and the University of Tsukuba as the core institutes, together with industries.

Open Innovation Platform

TIA-nano is constructing an open innovation research platform in the fields of nanoelectronics, power electronics, N-MEMS, nano-green, carbon nanotubes, and measurement techniques by using the world-class advanced research facilities in Tsukuba, such as Super Clean Room (SCR) in AIST and Photon Factory (PF) in KEK, open advanced equipment used in nanotechnology platform projects, and knowledge accumulated in core institutes about the facilities and equipment.
By integrating the funds and human resources of the government, academia and industry, TIA-nano promotes human resource development and improving the usability and appeal of the platform by enhancing its management, such as a one-stop service for using the facilities and equipment and joint project planning by the core institutes.

Main projects using the centers

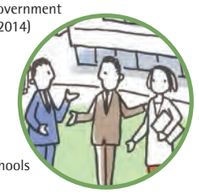
- Cabinet Office's Cross-Ministerial Strategic Innovation Promotion Program (SIP) (2 projects)
- Cabinet Office's Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST Program (5 projects) completed in FY2013)
- MEXT's Funds for the Development of Human Resources in Science and Technology (Nanotech Career-up Alliance (Nanotech CUPAL))

About 30 other national projects are also being promoted including projects by MEXT, METI and NEDO.

Overview of activities

[Results obtained so far]

- Progress with R&D based on the Open Innovation Model (since FY 2012)
- Promotion of the TIA Alliance among graduate schools (since FY 2011)
- Over 1,000 nanotechnology researchers have used equipment at Tsukuba facilities.
- Cumulative project funding industry-academia-government collaboration: At least 100 billion JPY (FY 2010 - 2014)
- Enterprises participating in industry-academia collaboration: At least 260 (FY 2010 - 2014)



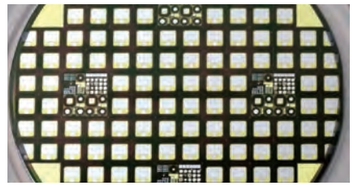
[Future topics]

- Promotion of industry-academia-government collaboration and further promotion of human resources development by associated graduate schools

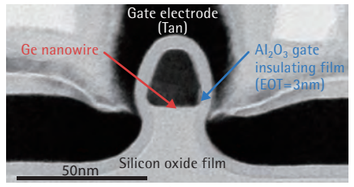
Main institutes involved:

National Institute of Advanced Industrial Science and Technology (AIST) / National Institute for Materials Science (NIMS) / University of Tsukuba / High Energy Accelerator Research Organization (KEK)

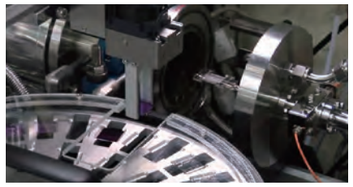
From "Tsukuba" to future industries - Research and development aimed at industrialization



We are promoting the development of energy-saving equipment using SiC (silicon carbide) which greatly reduces electric losses.



LSI (large-scale integration) is being actively researched and developed to dramatically reduce power consumption.



We have successfully developed technologies for mass-production of carbon nanotubes (CNT), which is a new material that will sustain green innovation. Further research on its application is now under way.

shared use of advanced nanotechnology

AIST
Super Clean Room (SCR)

KEK
Photon Factory (PF)

Database of Open Research Facilities in Tsukuba

http://oft.tsukuba-sogotokku.jp/ (only Japanese)

This is a database and search system that compiles information related to joint-use facilities and equipment owned and operated by research organizations in Tsukuba.

Development of Innovative Pharmaceuticals and Medical Technologies Using Biomedical Resources in Tsukuba

Utilization of a world-class repository of biomedical resources

Research institutes and pharmaceutical companies in Tsukuba are closely cooperating to develop innovative pharmaceuticals and medical technologies related to cancer, infectious diseases, and cell therapy, etc. by making use of world-largest biomedical resources in Tsukuba and are developing and aiming to market functional foods for preventing lifestyle diseases and having anti-aging effects.

Seeds of drug discovery meeting the needs of society

• Against cancer

- We are developing a novel anti-cancer agent with a little side effects by utilizing a recombinant bifidobacterium modified to produce an active anticancer substance and selectively propagate actively in cancer tissue.
- We are developing humanized antibodies against antigens that are specifically expressed in cancer cells into an anti-cancer agent that is effective against refractory cancers by fully utilizing tissues removed by surgical operation.
- We are developing "autovaccine against cancer" that fights hidden cancers in the patient by using cancerous tissue removed by surgical operation from the patient himself or herself.
- We are developing a new treatment that prevents cancer from recurring and metastasizing by fusing radiation therapy that pinpoints cancers and systemic immunotherapy.

• Against infectious diseases

- We are developing an anti-influenza drug that targets at a highly conserved domain on the viral protein that is necessary for the virus to propagate. The product is expected to control emergence of drug-resistant strains.
- We are developing a detection drug for influenza infection that is 1,000 times more sensitive than conventional ones by using surface plasmon resonance of gold thin film.

• Cell therapy and regenerative medicine

- We are developing a novel therapy for treating rare intractable diseases by using fat cells of the patients themselves. We will also elaborate it in terms of safety to deploy it for general chronic diseases.
- We are developing a therapy for treating diabetes using nerve cells of the patient himself or herself. The therapy is expected to be an effective early treatment that does not require long-term administration of expensive insulin.

• Functional foods and healthcare products

- We are developing functional foods and healthcare products for preventing lifestyle diseases or having an anti-aging effect by using biomedical resources in Tsukuba and food and drug resources in Northern Africa and Mediterranean Area as well as characteristic food resources of Ibaraki, such as Hitachi-oguro beans, Okukuji and Sashima tea, and taro.

Collaboration systems for early implementation of results

• Close cooperation with Clinical Trial & Research Network IBARAKI

Formed from 18 hospitals and 41 clinics in Ibaraki Prefecture, and having 7,011 beds in total, Clinical Trial & Research Network IBARAKI is one of the largest networks in Japan. With its secretariat in the University of Tsukuba Hospital, the network covers all kinds of diseases including lifestyle diseases and rare diseases, and is capable of performing clinical trials at all phases.

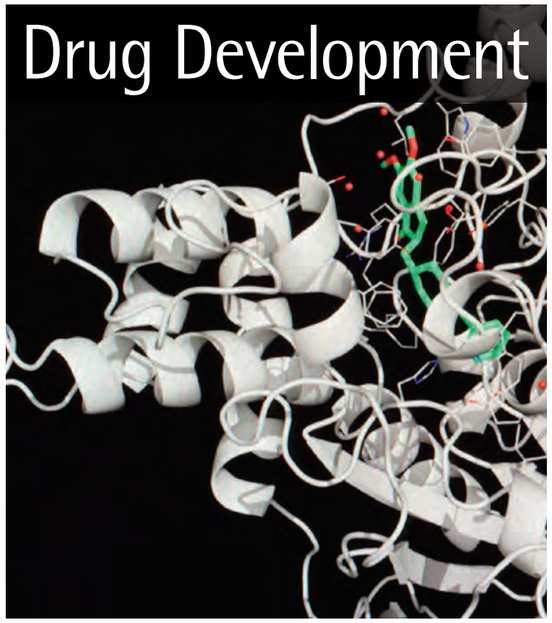
• Tsukuba Life Science Promotion Association

The Association was founded in April 2012 by pharmaceutical companies and academic research institutes located in the Tsukuba area, and presently (as of July 2015) consists of 23 organizations. It is creating drug development projects mainly through industry-academia collaboration, constructing systems for promoting the use of the world-class biomedical resources in Tsukuba, and working to start a graduate degree program (Life Science Innovation Academic Program), for which the Association will act as the parent organization.
A project titled "Development of Innovative Pharmaceuticals and Medical Technologies Using the Biomedical Resources in Tsukuba" is being carried out by a component organization of the "Tsukuba Biomedical Resources Consortium," which is a subgroup of the Association.

World-class repository of biomedical resources in Tsukuba

Biomedical resources (bio resources) are indispensable for life science, as exemplified by the saying "No research without resources." The many kinds of biomedical resources in Tsukuba include human specimens, experimental plants, cell materials, gene stocks, and microbes. Tsukuba has one of the world's largest repositories of biomedical resources, a big advantage in life science research.

- **NIAS (National Institute of Agrobiological Sciences) Genebank**
- **RIKEN BioResource Center**
- **Tsukuba Human Tissue Biobank Center (THB)**
- **Research Center for Medical Plant Resources, National Institute of Biomedical Innovation**



Tsukuba Bio Resource Cross Search System
Cross Search Tsukuba Biomedical Resource(XS-TBR)
http://xs-tbr.tsukuba-sogotokku.jp/
Biomedical resources in the institutes in Tsukuba can be searched in one stop.

Overview of activities

[Results obtained so far]
- Construction of a joint-use platform for biomedical resources (FY 2012~2013)
- Establishment of the Tsukuba Biomedical Resources Consortium (since FY 2013)
- Clinical research, promotion of R&D

[Future topics]
- Commence clinical trials for revolutionary pharmaceuticals and apply for pharmaceutical approval
- Quickly commercialize functional foods, etc.

Main institutes involved:

University of Tsukuba / National Institute of Advanced Industrial Science and Technology (AIST) / Eisai CO., Ltd. / Riken BioResource Center (BRC) / National Institute of Biomedical Innovation / Cell-Medicine, Inc.

Practical development of a recycling system for strategic urban mines

Aiming for the materialization of a recycling society based on the concept of strategic urban mines

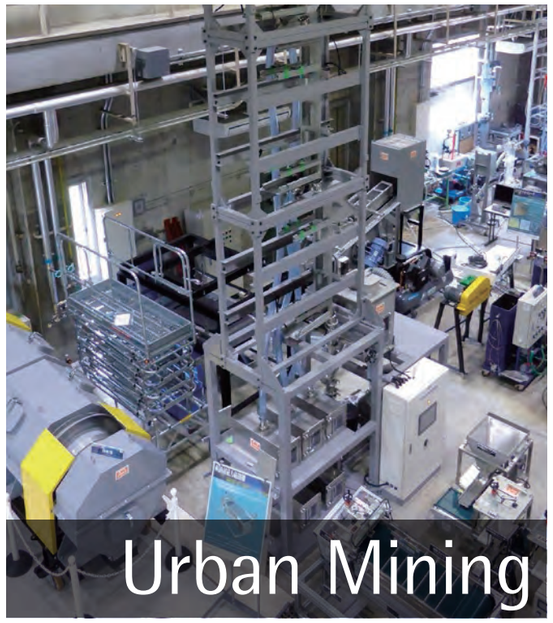
Urban mines, which contain small home appliances and other discarded electronic and electrical devices that may be recycled for their metals, are mostly undeveloped or buried under the ground. Therefore, efforts are being made to lead the world in integrating the development of revolutionary recycling technologies with educating the public about their potential, the environment, etc., to help ensure a stable supply of various necessary metals for manufacturing, promote the development of recycling industries, and materialize a recycling society that is based on the concept of strategic urban mines.

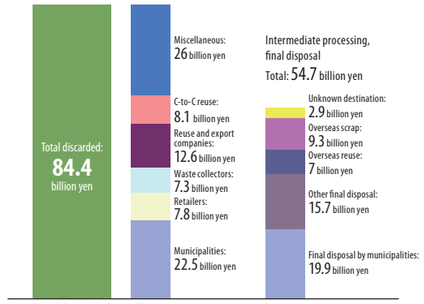
Development of revolutionary recycling technologies

New technologies and techniques for economically and effectively recovering rare metals and other useful metals from discarded appliances include

(1) the development of equipment and systems for automatically disassembling home appliances, etc., and sorting substrates, work which has hitherto been done by hand

(2) the development of systems for sorting useful metals, etc., into single materials that can be easily recycled.





Annual value of useful metals contained in small discarded home appliances
(based on materials presented by the Central Environment Council, 2011)

Outlooks, economic effects, etc.

- Economic effect of about 5.2 billion yen: Expectations for about 4 plants to be built in Japan
- Market scale of about 18 billion yen: Estimated from the recovery target of 140,000 tons based on Act on Promotion of Recycling of Small Waste Electrical and Electronic Equipment (about 20% of the total annual amount produced in Japan)

Discarded home electronics ① Disassembling/crushing ② Sorting metals into single materials

Educating the public to help materialize a recycling society

Efforts are being made to enlighten the public and provide environmental education in order to effectively promote Act on Promotion of Recycling of Small Waste Electrical and Electronic Equipment.

- Associating with the SURE Consortium including manufacturers, resource industries, etc., and examining social systems based on the concept of strategic urban mines.
- Meeting places, research groups, etc., are being established in municipalities to investigate ways to improve the recovery rate from discarded products, and public relations campaigns are being undertaken to educate the public.

Development of systems for automatically disassembling and sorting discarded products

Equipment and systems are being developed for safely disassembling discarded products such as home appliances, etc., down to parts units without destroying their shape, work which has hitherto been done by hand.

- Development of products which can be crushed while maintaining the shape of such things as secondary batteries, and crushing machines for disassembly.
- Development of systems for automatically sorting secondary batteries, etc., after disassembly by creating and utilizing databases.

Development of systems for high-grade sorting

Development of systems for sorting useful metals, etc., into single materials that can be easily recycled

- Development of systems that can remove metals from mixed plastic-metal materials and sorting according to the way the plastic is used
- Development of a "fine-particle sorting system" that can sort substrates, mixed metals, and other composite materials into single materials

Development of a liberation crusher (conceptual image)
Development of a "fine-particle sorting system" (conceptual image)
Recovery by type of metal (copper, precious metal, rare metal, etc.)

Overview of activities

[Results obtained so far]
- Establishment of the SURE (Strategic Urban Mining Research Base) at AIST (FY 2013)
- Establishment of the SURE Consortium at AIST (FY 2014)

[Future topics]
- Development of systems for automatically disassembling and sorting discarded products and systems for high-grade sorting
- Educating the public to help materialize a recycling society

Main institutes involved:

National Institute of Advanced Industrial Science and Technology (AIST)/ Re-Tem Corporation/ Ibaraki Prefecture

Special exceptions and supports in Tsukuba International Strategic Zone

National Support Systems

(1) Preferential legal measures

- Preferential legal measures are prescribed in advance concerning the relaxation of regulations on industrial land use (special measures of the Building Standards Act) and on green land areas in factory sites (special measures of the Factory Location Act and the Act on Formation and Development of Regional Industrial Clusters through Promotion of Establishment of New Business Facilities, etc.).
- Preferential measures to promote projects in the comprehensive special zones are successively added by national and local councils, which discuss the matter together and then revise the law, government ordinance, ministerial ordinance or notification based on the regulations.

(2) Financial support measures

Budgets of related ministries and agencies will be preferentially utilized, and flexibly topped up from the reserve fund for promoting comprehensive special zones.

(3) Tax support measures (International Strategic Zones)

The following measures are selectively applied:

- Investment tax credit or special depreciation

For projects in Tsukuba International Strategic Zone, an investmen tax credit or special depreciation can be applied to machines and facilities (20 million yen or more), apparatus and equipment for R&D (10 million yen or more), and/or buildings, annexes and other structures (100 million yen or more).

- Ratio of investment tax credit:
  15 % of acquisition cost (8 % for buildings, etc.)
- Ratio of special depreciation:
  50 % of acquisition cost (25 % for buildings, etc.)

(Deadlines for designating business establishment and acquiring facilities, etc.: March 31, 2016)

(4) Financing support

- An interest subsidy (not exceeding 0.7 %, for 5 years) is available on loans made by a government-designated financial institution for conducting business in a comprehensive special zone.

Local Support System

Ibaraki Prefectural Government

Exemption from prefectural taxes for businesses in Ibaraki Prefecture

Exemption from prefectural taxes for businesses that set up or construct a new or add to an existing facility (factory, plant, etc.) in Ibaraki Prefecture and hire at least five additional employees by March 2018

- Exemption for three years from enterprise tax on corporations, depending on the percentage of employees additionally hired when opening a new office, etc.
- Exemption from real estate acquisition tax for buildings and land (the part on which the building is built) related to the opening of the new office, etc.

City of Tsukuba

Tax abatement for entities engaged in one or more strategic zone projects

1) Exemption from fixed asset tax and city planning tax for corporateentities that engage in projects in the international strategic zone and receive corresponding national preferential tax measures (taxmeasures for the promotion of investment in plant and equipment) by March 2016
   - The following equipment and land will be exempt, for a maximum of three years, from the fixed asset tax and city planning tax:
     a) those pieces of equipment to which the above "National Support System" applies, which are eligible to receive the benefit of (3) Tax Support System;
     b) the land on which the building is constructed, provided that it contains the equipment described in (a).
2) Exemption from fixed asset tax and city planning tax for those who provide land for verification tests by March 2016

Tsukuba City Subsidy for stimulating industries

For enterprises opening new facilities or enlarging facilities in the city by March 2018, a subsidy equivalent to the fixed asset tax is granted for the facility in question.

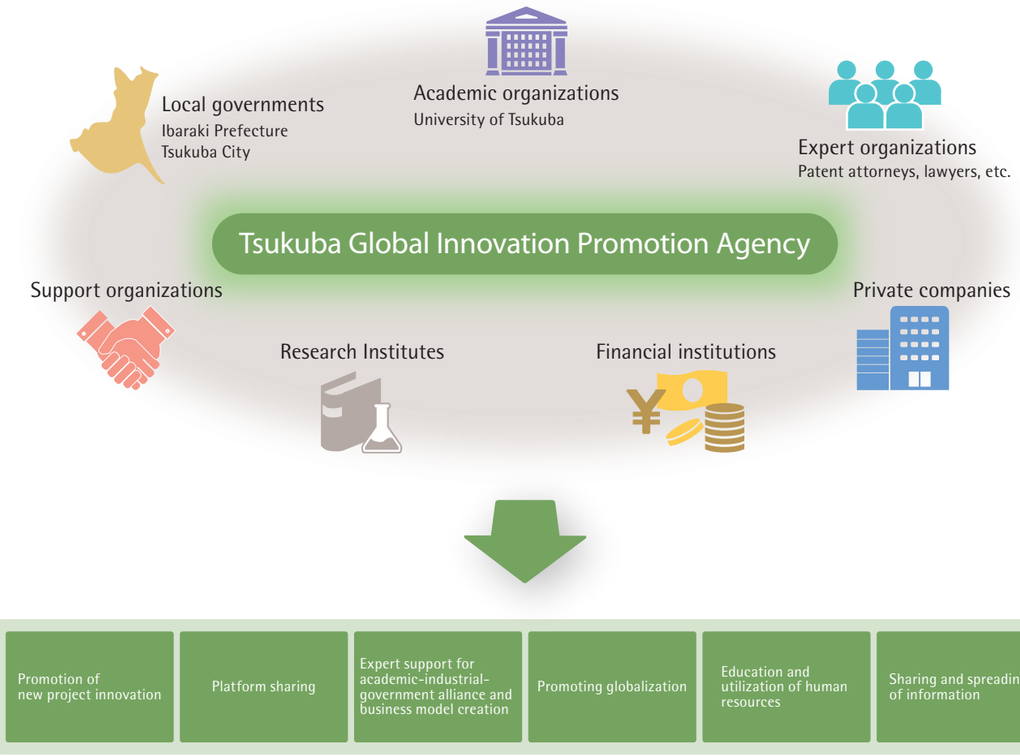
- A one-year (three years for robot/environment-related enterprises) subsidy equivalent to the fixed asset tax on the land, building and depreciable assets of the new office, etc. depending on the number of employees additionally hired when opening the new office, etc.

Tsukuba Global Innovation Promotion Agency

Working to form core global organizations in Tsukuba

Masaharu Sumikawa
Director General
Tsukuba Global Innovation Promotion Agency

Using the support for the Tsukuba International Strategic Zone conducted by the Tsukuba Global Innovation Promotion Agency as well as provided by organic partnerships with universities in Tsukuba and other research organizations, local and non-local businesses and investors, etc., we are making robust efforts to construct the "Tsukuba Innovation Ecosystem" to promote autonomous innovation in Tsukuba.
For that purpose, we are taking stock of Tsukuba's seeds for promising research and turning it into tangible results. The heretofore passive partnerships among organizations and the selling this to companies and investors is being transformed into a more dynamic approach. For that purpose, we would like to put special effort into the creation of an organic management system and build a brand for Tsukuba Innovation.
In order to fully utilize the research results obtained at Tsukuba Science City and develop it as an "innovation city," it is essential to have an integrated alliance of all relevant organizations. As the Director General of the Tsukuba Global Innovation Promotion Agency which is aiming to become a core organization of the new industry-academic-government alliance that is changing Tsukuba, I would like to pour all of my efforts into creating "Tsukuba Innovation." For that purpose, I would like to ask all of you for your cooperation and support.



http://tsukuba-gi.jp/en/

つくば
国際戦略
総合特区
Tsukuba International Strategic Zone

http://www.tsukuba-sogotokku.jp/en/

For more information, please contact:

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