Tsukuba International Strategic Zone

Promote new Innovation and Industry

Tsukuba International Strategic Zone

From Science City to a focal point of innovation

In December 2011, the Japanese Prime Minister officially 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.

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.

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

Seven pioneering projects

The society that we are aiming for

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

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

Development of Innovation Pharmaceuticals and Medical Technologies using Biomedical Resources in Tsukuba

Practical Use of Algal Biomass Energy

TIA-nano: Creating a global hub of nanotechnology

Science City

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Prologue

FUTURE

Tsukuba Innovation City

Science City

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Prologue

FUTURE

Tsukuba Innovation City
Tsukuba International Strategic Zone

A center where industry, government and academia collaborate to deliver innovations by 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 July 1, 2013, there were 70,229 people from 131 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 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 magnetoresistance element which is now used in 98% of hard disks ($300 million in 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 educational 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.

**Tsukuba International School**
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.
- 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

Overview of activities

- Development of a treatment apparatus to be installed in hospitals
- Construction of the Radiation Treatment Medical Research Center, a center for joint studies
- Development of peripheral devices of accelerators, apparatus for controlling the posture of patients, total control system, radiotherapy planning system, etc.
- Emission of positron beam
- Completion of treatment apparatus, emission of neutron beam, launch of biological and animal experiments, etc.
- Clinical studies on 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./Meido University/Baraki Prefecture

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 (99Mo). Although Japan is the third largest consumer of 99Mo, it depends on imports for the entire supply of 99Mo. 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 99Mo 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 99Mo

Currently molybdenum-99 (99Mo) 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, 99Mo will be prepared via activation without using uranium. However, it is difficult to generate 99Mo 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

Overview of activities

- 2013: Development of the device with the fast neutron radiation irradiation tests with the research-facing reactor
- Separation, extraction, and condensation tests of technetium-99m
- 2015: Animal experiments and clinical tests of technetium-99m preparations
- 2016: Pharmaceutical application and marketing

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 apparatuses to conduct safety tests of robots developed by research organizations and companies.

Corroborative experiments in various fields

In Tsukuba there is a specially designated area called the “Tsukuba Mobility Robot Experiment Zone” where boarding-type mobility robots can be tested on public thoroughfares. Corroborative experiments are also conducted at care facilities, hospitals, etc., to determine the effects and safety of such robots in actual use scenarios.

Establishment of safety standards

Safety standards are established based on the data obtained from the experiments. Personal Care Robots were the first robots to deal with the international standard ISO13482, and in 2013 Robot Suit HAL® for social welfare purposes received the international standard ISO/DIS 13482. As it accumulates such results, the Robot Safety Center is aiming to function as an international robot certification organization.

Main institutes involved:

National Institute of Advanced Industrial Science and Technology (AIST)
University of Tsukuba

Overview of activities

2010 Start-up of the Robot Safety Center
2012 Implementation of corroborative experiments designed to bring Personal Care Robots into practical use
Corroborative experiments conducted in public thoroughfares in 2013 at the “Tsukuba Mobility Robot Experiment Zone”
2013 Establishment of safety evaluation standards and proposal for the ISO13482
2014 - 2015 Development of standards and establishment of testing methods
Corroborative experiments for ride sharing and sightseeing tours conducted in public thoroughfares
2014 Start-up of safety approval facility, and certification to be started for various robots
2015 Full-scale market entry of safety-certified robots

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

Development of Robot Suit HAL® technology for medical treatment

Efforts have been made to develop Robot Suit HAL®, which received medical equipment certification for the EU market, as medical equipment in Japan. After the pharmaceutical approval is obtained, equipment for highly advanced medical treatments will be developed using complex treatments of pharmaceuticals, regenerative medicine and HAL®, and Cyberdyne technologies. In conjunction with that, TSUKUBA MEDIX and Cyberdine International Center for the Development of Highly Advanced Treatments (tentative name) will be established in Tsukuba to create an integrated environment for such activities as technological development, verification research, clinical trials, medical treatment, and nurturing personnel, among other things. TSUKUBA MEDIX and Cyberdines International Center for the Development of Highly Advanced Treatments (tentative name) are aiming to become a world leader in innovative robotic medical equipment, cutting-edge treatment and social welfare equipment, state-of-the-art medical treatments.

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

By following the movement intentions of its wearer, the Robot Suit HAL® assists with autonomous movements. When people attempt to move, electric signals are transmitted from their brains. Sensors of the Robot Suit HAL® read bio-electric signals appeared on the surface of the skin when electric signals are transmitted from the brain to muscles through movement neurons. This activates a motor which moves simultaneously with the wearer's joints.

Development as medical equipment

There are expectations that this technology will be effective as functional improvement treatment for neuromuscular disease patients, including patients with spinal cord damage or who are suffering from apoplexy. This technology has already acquired CE marking certification for medical equipment in Europe, and soon in Japan a pharmaceutical application will be submitted and development will begin for production as medical equipment.

Creation of the global hub of innovative medical robots and medical devices.

We aim to realize the development and the social implementation of innovative medical technologies and an innovative medical robot “Robot Suit HAL®” for functional improvement or regeneration therapy. The International Center for Medical Cyberdines “TSUKUBA MEDIX” will be established for technology development, empirical studies, clinical trials, medical treatment and human resource development.
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 microalgal oil production to help solve the global energy problems. Moreover, to build 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.

Project timetable

2011: Preparation for demonstration experiment on indoor/mass production of microalgae
2012: Selection and acquisition of desertified cultivated land for the demonstration experiment
2013: Construction of an outdoor demonstration plant
2013: Driving experiment of Tsukuba City local government’s official vehicles with algal oil blended fuels.
2013: Production of algal oil in the demonstration plant

Main institutes involved:
University of Tsukuba/Tsukuba City/Ibaraki Prefecture

Hydrocarbon producing algae

* The yellow part is oil.

- Botryococcus: freshwater photosynthetic green alga that fixes carbon dioxide and accumulates hydrocarbon oil in its cell and colony (20 - 75 % of dry cell weight)
- Aurantiochytrium: marine and brackish-water heterostrophic alga that grows using organic matter and oxygen and produces hydrocarbon called squalene (20 - 30 % of dry cell weight)

Development of mass production technology of algal oil

Indoor Laboratory Cultivation (1 - 2,000 L) Outdoor Pool Culture (10 - 50 t) Outdoor farmland plant for mass culture demonstration experiments (200 t -)

TIA-nano, Creating a global hub of nanotechnology

From “Tusukuba” towards Future Industries: Open innovation platform for interconnection and expansion

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. In June 2009, presidents of these core institutes and KEIDANREN (Japan Business Federation) issued a Joint Communiqué. Furthermore, the High Energy Accelerator Research Organization (KEK) joined TIA-nano as a core institute in April 2012.

Core research domains and infrastructures

TIA-nano has set six core research domains as priority areas where capital and human resources of the public and private sectors are gathered to perform R&D, as well as three core infrastructures as systems for carrying out prototype device production and evaluation, shared use of advanced nanotechnology equipment and promotion of human resources development.

Overview of activities

2012 R&D by open innovation models where multiple enterprises participate. Establishment of NOIC, NIMS Open Innovation Center and TPEC, Tsukuba Power Electronics Constellations
2013 Launch of TIA Collaboration Center, and establishment of TIA Graduate School by universities, research organizations and industries in Japan and abroad
2019 Establishment of industry-academia-government alliance: More than 10 billion yen (2010 - 2014)
2019 Number of corporate members of the industry-academia-government alliance: More than 300 (2010 - 2014)

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)

Research and development aimed at industrialization

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

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.
Tsukuba has one of the world’s largest repositories of biomedical resources. Research institutes and pharmaceutical companies in Tsukuba are jointly working to develop innovative pharmaceuticals and medical technologies using the resources and research facilities and are constructing systems for early implementation of the results.

Biomedical resource repositories in Tsukuba

- **Tsukuba Human Tissue Biobank Center (THB)**
  THB collects several types of tumor/non-tumor tissues with their clinical information, and provide them to researchers. It has already collected a large number of tissues obtained from more than 1,500 patients in THB.

- **NIAS (National Institute of Agrobiological Sciences) Genebank**
  NIAS Genebank collects genetic resources related to food and agriculture in and outside Japan, assesses their properties, stores and distributes the resources, and discloses information.

- **RIKEN BioResource Center**
  The Center collects, stores and provides murine, experimental plant and cell specimens, gene materials, and microbial samples. It is also developing technologies for making efficient use of the resources and provides technical training courses.

- **Research Center for Medical Plant Resources, National Institute of Biomedical Innovation**
  The Institute stores and controls medicinal plant resources.

Drug discovery seeds matching the needs of society

- **Against cancer**
  - Development of an anticancer agent utilizing recombinant bifidobacterial drug delivery system
  - Development of antibody drugs specific to cancer cells
  - Development of "autologous cancer vaccine" against brain tumor
  - Development of cancer therapy by using nanoparticle adjuvants

- **Against epidemic diseases**
  - Development of novel anti-influenza agents
  - Development of highly sensitive influenza detectors

- **Establishment of cell therapy and regenerative therapy**
  - Development of novel therapy based on the transplantation of genetically-engineered fat cells (adipocytes)
  - Development of regenerative therapy using stem cells and innovative pharmaceuticals

- **Development of functional foods and healthcare products**
  Development of functional foods and healthcare products from Tsukuba City and Ibaraki Prefecture

Overview of activities

2012 - 2013 Construction of a common platform of biomedical resources
2013 Establishment of the Consortium of Biomedical Resources Clinical research and R&D for innovative medicines
2016 Clinical trials and pharmaceutical applications of innovative medicines Marketing of 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.
Special exceptions and supports in Tsukuba International Strategic Zone

National Support System

(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 investment 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 of designating business establishment and acquiring facilities, etc.: March 31, 2014)

(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 office (factory, plant, etc.) in Ibaraki Prefecture and hire at least five additional employees by March 2015
  - 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 corporate entities that engage in projects in the international strategic zone and receive corresponding national preferential tax measures (tax measures 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 a new office, etc. in the city by March 2015, a subsidy equivalent to the fixed asset tax for the office 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

Management Structure
The Strategy Conference has been established to discuss the directionality, etc., of the Tsukuba International Strategic Zone.
The Conference consists of the Governor of Ibaraki Prefecture, the Mayor of Tsukuba City and representatives from major research institutes in Tsukuba.
The Operation Conference, composed of representatives and specialists from governmental organizations and various institutes in Tsukuba, has also been established to investigate and provide expert advice on individual issues.

Activities
Working in close cooperation with member institutes having appropriately allocated roles, the Tsukuba Global Innovation Promotion Agency will establish a system for enhancing business alliances throughout Tsukuba Science City. The Agency will promote advanced projects, as well as establish new businesses and industries by creating and promoting new projects.

For more information, please contact:


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