

3.4 Science and Technology to be Supported by Society and the Public

3.4.1 Responsible Measures to Resolve Ethical, Legal, or Social Problems Caused by Science and Technology

(1) Establishment of the sense of ethics among researchers and engineers

Recently in Japan, misconduct in research activities such as fabrication, falsification and plagiarizing of data is being revealed in succession. Such misconduct in scientific research not only contradicts the essence of science, which is an activity to build up quests for truth and create new knowledge, but also undermines our trust in science and hinders the development of science, which therefore is completely unacceptable.

Following the approval of the "Proper Counteractions against Research Misconduct" by the Council of Science and Technology Policy (CSTP) in February 2006, "Countermeasures against Misconduct in Research Activities by Competitive Research Fund (agreement in the Liaison Committee of Ministries and Agencies Concerned with Competitive Funding)" was revised in November 2006 to stipulate measures taken when research misconduct such as fabrication and plagiarizing is found. Thereafter, each ministry had been preparing guidelines and revising application instructions for research funds.

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) established "Special Committee on Research Misconduct" under the Council for Science and Technology. It had been discussing in particular the reactions to misconduct in research activities conducted by competitive funds, and summarized a guideline regarding systems and rules to be established by MEXT, a fund allocating organization and research institutes such as universities in August 2006. In response to this, MEXT asked the relevant organizations for efforts to respond to misconduct such as to establish windows to accept accusations, to prepare an investigation mechanism and to develop regulations related thereto. At the same time, MEXT itself established a window to accept accusations in November 2006. The Ministry of Agriculture, Forestry and Fisheries (MAFF) also prepared a guideline on countermeasures against research misconduct, asked the relevant organizations for efforts to respond to

misconduct and established windows to accept accusations.

The Science Council of Japan formulated the "Code of Conduct for Scientists" in October 2006 to show matters to which scientists should adhere. It also requests research institutes such as universities and academic associations to establish their own code of conduct by referring to the aforementioned principles, and to make sure that such code of conduct is reflected in the behaviors of scientists. Furthermore, the President of the Science Council of Japan released a statement on acts contradicting the ethics of science, such as the fabrication of experimental data, conducted in a TV program featuring the health effect of food in January 2007.

(2) Efforts in relation to bioethics and safety in life science

In order to appropriately cope with ethical problems that may occur in accordance with the rapid development of life science lately, Council for Science and Technology Policy is implementing survey and study on key issues, and MEXT and the Ministry of Health, Labour and Welfare (MHLW) are preparing and carrying out necessary laws and guidelines (refer to 3.2.2.1).

(3) Efforts related to social impact of nanotechnology

For nanotechnology to be accepted and develop in the society, it is necessary that the social effect of the technology and effects of nanomaterials on health and environment are accurately evaluated. To this end, MEXT is promoting research on the property evaluation of nanomaterials such as "Research on the Promotion of the Social Acceptance of Nanotechnology" and "Panel of Specialists in Multiple Areas on the Effect of Nanotechnology." (refer to 3.2.2.4).

3.4.2 Accountability Relating to Science and Technology and the Improvement of Information Transmission

Many Japanese people believe that science and technology are making contribution to the society. However, their interests towards science and technology are decreasing mainly among younger generations. While there is a high expectation for science and technology in terms of safety, feeling of assurance and spiritual richness in daily life, there are also many people who feel alarm at the rapid progress of science and technology. In order for science and technology that will be further developing to be accepted smoothly in the society in the future, it will be important to attempt to make constant progress in the level of science and technology to create new intellectual and cultural values, and to strengthen efforts to return the fruits of science and technology to the society and public. At the same time, it is also important to enhance accountability so that the public can evaluate the impact of science and technology, and to win their understanding and support by promoting dialogues with the public. It is necessary to actively work on such activities under these purposes.

From Fiscal 2005, MEXT has provided in the application instructions of the "Research and Development Program for Resolving Critical Issues" under the Special Coordination Funds for Promoting Science and Technology (SCF) that about 3% of its direct expenses should be allocated to Outreach Activities³¹, and that such Outreach Activities should be subject to mid-term and ex-post evaluation. Japan Science and Technology Agency implements "Model Project for Promoting Information Transmission by Researchers" from Fiscal 2005 with an aim to develop a model for Outreach Activities by researchers and to spread such model.

In addition, in order to raise interest towards science and technology among children, "Children's White Paper on Science and Technology" is published every year, wherein timely themes such as space development and disaster prevention technology are explained in an easy-to-understand manner employing the style of a comic book. The entire text of this Children's White Paper is uploaded to the website of MEXT. The book is also distributed to educational organizations and sold in Government Publications Service Centers across the country.

"Children's White Paper on Science and Technology VIII" (2006 Edition) featured the usage of particle beams, and explains about particle beams that are utilized in state-of-the-art science such as bioscience, material science and neutrino astronomy to support our daily life in broad terms, in an easy-to-understand manner with comics and quizzes.

MAFF is implementing "Agricultural Science Events for Ordinary People" from Fiscal 2006, in order to convey the research findings of agriculture, forestry and fisheries industries in an easy-to-understand manner. This project has clear targets of people such as juveniles, consumers and farm producers, and mainly conducts events which people can actually experience. Furthermore, research institutions such as the National Agriculture and Food Research Organization hold events such as open lectures to both the research activities and its achievements.

³¹ Outreach Activities: Activities aimed at introducing science and technology to the general public in an easy-to-understand and friendly manner, ascertaining people's needs and concerns through intensive dialogue and reflecting these in science and technology-related activities.

3.4.3 Improving the Public Awareness of Science and Technology

In order to create a social environment wherein people feel familiarity and become strongly interested in science and technology, it will be important to promote activities to explain science and technology in an easy-to-understand and explicit manner, such as providing various occasions to feel familiarity with science and technology, and to enhance accountability and information transfer through dialogues. It is also important to promote efforts contributing to improving people's basic knowledge and ability regarding science and technology.

MEXT is comprehensively promoting the following efforts to support the fostering of public awareness for science and technology.

(1) Efforts to improve basic education regarding science and technology (science and technology literacy)

It is considered that to specify knowledge and ability regarding science and technology that are required for an adult person will contribute to raising people's interest towards science and technology, fostering public awareness for science and technology, and improving the level of math and science education. To this end, effort is being made to formulate the idea of science and technology literacy (knowledge, technology and viewpoints regarding science and technology expressed in easily understandable sentences), under the extensive cooperation of scientists and engineers.

(2) Fusing science and technology with culture and art

Recently, people are coming to seek more spiritual well-being rather than material wealth. In the future, it will be necessary to carry out science and technology policy by strengthening the fields of science and technology that contribute in people's spiritual richness. Meeting of science and technology with culture and art may result in the creation of new works of art or new, unique technology, and has a potential to create new knowledge in the field of science and technology.

In order to create such new knowledge, it is considered that to provide an occasion wherein young researchers and creators encounter and form a new community will serve a critical role. For this purpose, "Leading Edge

Technology Showcase 07" and the Theme Symposium "The Encounter of Art and Technology Brings Originality," had been held under the sponsorship of the 10th Japan Media Arts Festival by the Agency for Cultural Affairs. This was the second year of holding these events, and "Pri/Pro Children Workshop," an experiencing-type workshop wherein children can cast their ideas into shape by using electronic circuits and computers, as an occasion for expressing ideas and experiencing excitement provided for children who will lead the next generation.

(3) Reinforcing and enhancing science museum activities

(Operation of the National Museum of Emerging Science and Innovation)

"National Museum of Emerging Science and Innovation" in Odaiba, Tokyo, managed by the Japan Science and Technology Agency, is the basis of information transmission to explain to the general public, including juveniles, the state-of-the-art science and technology which are seemingly difficult in an easily comprehensive manner by using participatory and experiencing type of exhibits, images and experiments. The facility serves a core role in the network of science museums in Japan. National Museum of Emerging Science and Innovation provides exhibition and explanation that bring easy understanding of the latest science and technology, and at the same time, promotes exchange between researchers and the general public by planning lectures and events. Also, through projects such as "Science Communicator Training Program," which started from Fiscal 2006, and training programs for staff at science museums across the country, it is developing human resources to be engaged in activities for promoting the understanding of science and technology in various regions. Furthermore, achievements of these projects are reflected in science museums across the country to contribute to invigorating activities to increase people's understanding.

(Supporting science museum activities in various regions across the country)

Science museums in various regions across the country function as cores for activities to increase people's understanding of science and technology. In order to further reinforce such activities, Japan Science and

Technology Agency is supporting measures to enrich opportunities for students to experience and learn science and technology, including the joint development of new exhibits by regional schools and science museums, holding of experimental and manufacturing class by science museum for regional schools, and exhibits on a tour.

(4) Activities of National Museum of Nature and Science

National Museum of Nature and Science holds exhibitions and implements activities to provide an occasion to convey the interesting factors of science, to think together and to support learning, targeted for a broad range of generation, from juveniles to adults, by utilizing the intellectual, material and human resources the museum has accumulated including research achievements and specimens.

In addition, as a museum with a leading role in the country, it is working on the development of pioneering model programs. For instance, it established a system of "The University Partnership Program" in Fiscal 2005 in order to contribute in improving the science literacy of students, and is carrying out cooperative programs such as free entrance for students under cooperation with universities or "Lectures on Natural History for University Students." It also started "Science Communicators Practical Training Program" from Fiscal 2005 to develop human resources that are engaged in activities to increase people's understanding by utilizing resources possessed by the museum. At the same time, the museum cooperates with schools to develop learning activity programs for children, as well as to work on developing a model program intended to improve science literacy in general, also including adults. The museum is engaged in other activities as well, including the holding of "Current Research and Development," and the establishment of "Science Museum Net," which is a system wherein information on specimens and exhibition of each museum can be cross-searched via the Internet, in cooperation with science museums across the country. Through these activities, the museum is facilitating people's understanding of science and technology under cooperation with science museums, universities, colleges and research institutes across the country.

(5) Activities of universities, colleges and research institutes

Japan Aerospace Exploration Agency implements

various educational activities and activities to support education. Such activities include "Cosmic College" and "Space School," provided with an aim to raise interest towards science and technology in general, including the area of space science, among juveniles who will lead the next generation, and to foster children's scientific observation, thinking and problem solving abilities.

(6) Expansion of opportunities in the region to become familiar with and to learn about science and technology

Robot technology is a fusion of cutting-edge IT (information technology) and manufacturing skills. Also, because competition using robots has an appropriate amount of the aspect of games, it is appropriate for juveniles and other people to enjoy, experience and study science and technology. Japan Science and Technology Agency supports competition using robots at schools, and the development of other programs for juveniles to experience and study manufacturing and science/technology, as well as the diffusion thereof.

Furthermore, in order to expand opportunities in regions for people to become familiar with and to learn about science and technology, it is important to foster and retain human resources such as volunteers engaged in teaching in experiment classes throughout the country, and to promote their activities. From Fiscal 2003, Japan Science and Technology Agency is recruiting human resources such as volunteers for increasing people's understanding of science and technology, and supporting their activities.

"Children's Dream Fund" established in the National Institution for Youth Education offers subsidies for hand-on activities such as science experiencing activities for children implemented by private entities.

(7) Transmitting science and technology information throughout the country

The method to provide science and technology contents (information) by using multimedia including TV broadcasting and the Internet is useful in terms of increasing our understanding of science and technology, because general public can experience science and technology in a handy way. Therefore, Japan Science and Technology Agency is creating programs that explain science and technology in an easily comprehensible manner for the general public, especially juveniles, focusing on topics related to science and technology and

interesting science experiments. These programs are delivered throughout the country by National Olympics Memorial Youth Center via CS broadcast and CATV as the "Science Channel." They are also provided via the Internet in order to accelerate the diffusion of the program (<http://sc-smn.jst.go.jp>).

Also, "JST Virtual Science Center" (<http://jvsc.jst.go.jp>) is provided broadly to the public via the Internet. This is a program wherein juveniles can experience various aspects of science and technology in an easy-to-understand manner.

(8) Science and Technology Week

"The 47th Science and Technology Week" was held from April 17 to 23, 2006 under the cooperation of related organizations such as experimental research institutions and local governments. During the week, various events including facilities opened to public, such as experiment/manufacturing classes and lectures, at related organizations throughout Japan. In Fiscal 2006, the shows of the planetarium "Megastar II" were held at Marunouchi Building in Tokyo as the "Marunouchi Event." At the same time, "Science Cafe," provided as an occasion for researchers and the general public to talk casually about science and technology while having tea, was held across the country.

(9) Activities at universities and other organizations to increase understanding of science and technology

The Ministry of Education, Culture, Sports, Science and Technology is implementing measures to promote the increased understanding of science and technology, through the holding of public lectures on science and technology at universities and colleges, and through the development and expansion of the University of the Air that offers courses in science and technology. The Ministry also supports symposiums and science lectures which aims to disseminate, in an easy-to-understand manner, information about research trends and research contents in fields which are considered to be of high interest to young people or adults in the general population through the provision of Grants-in-Aid for Scientific Research. Additionally, the Ministry is implementing specialized training for museum specialists employed at science museums, etc., in order to improve their level. Also, by dispatching expert staff such as

curators to science and other museums in foreign countries for training, it is expected that they will obtain sophisticated expert knowledge and skills.

As a part of activities to return the academic achievements to the general public, the Science Council of Japan holds lectures open to the public. Under the theme of "Frontier in Environmentology - Scenario to Realize the Society that Exits from Inducing Global Warming," lectures were held four times for this fiscal year. In addition, the entire country is divided into seven regions, and lectures are also held under the theme in accordance with the information required in each region about twice a year. Furthermore, there are various other events for the general public to further realize how interesting it is to deal with science. During the Science and Technology Week in 2006, "Science Cafe" was held in 21 locations throughout Japan with the cooperation of organizations involved. There were also hands-on events, such as "science experiments for elementary school students" and "Summer School for Female High School Students."

National Institute of Advanced Industrial Science and Technology (AIST) has permanent exhibition facilities such as Science Square Tsukuba/Rinkai, Geological Museum and JIS Pavilion. In Fiscal 2006, eight facilities throughout Japan had been opened to public with about 12,000 visitors in total.