

Chapter 4

Science and Technology Supported by Society and the Public

1 Responsible Approaches to Ethical, Legal, and Social Issues in Science and Technology**(1) Establishment of a sense of ethics for researchers and engineers**

In recent years, Japan has faced a situation where misconduct, such as fabrication, falsification, or plagiarism (FFP) of data in research, has been revealed. Such misconduct in scientific research must not be allowed since it goes against the essential qualities of science to create new knowledge through accumulated searches for truth. Misconduct also undermines public trust in science and hinders scientific progress.

Following the approval of the Proper Counteractions against Research Misconduct by the Council for Science and Technology Policy (CSTP) in February 2006, CSTP revised the Countermeasures against Misconduct in Research Activities by the Competitive Research Fund (agreement in the Liaison Committee of Ministries and Agencies Concerned with Competitive Funding) in November 2006 to stipulate measures for FFP in research. Thereafter, the establishment of guidelines, reflection in application guidelines, and other measures were promoted among the related ministries and agencies.

MEXT established a special committee on research misconduct under the Council for Science and Technology to review the actions for any misconduct in research that uses competitive funds. In August 2006, the committee finalized guidelines on the systems and rules to be formulated by MEXT, funding agencies, and other research organizations such as universities. The guidelines requested them to implement approaches to misconduct, including establishment of a reception desk for accusations, investigation systems, and formulation of provisions related to the above-stated issues; MEXT established a reception desk for accusations within the ministry in November 2006. The Ministry of Agriculture, Forestry and Fisheries (MAFF) also finalized such guidelines on actions for misconduct in research, requested related organizations to implement approaches to misconduct, and established a reception desk for accusations.

The Science Council of Japan (SCJ) formulated the statement Code of Conduct for Scientists in October 2006 and requested universities/research institutes, academic conferences, and associations to formulate their own codes of conduct by referring to the Council's Code and to disseminate their codes to the research activities of each scientist.

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

To adequately deal with problems regarding bioethics that could occur as a result of the rapid growth in life sciences in recent years, CSTP implements surveys and studies on important issues; MEXT and the Ministry of Health, Labour and Welfare (MHLW) review necessary acts, regulations, and guidelines. (Refer to Part 2, Chapter 2, Section 2, 1)

(3) Measures for social impact of nanotechnology

In order for nanotechnology to be accepted and developed by society, it is necessary to correctly assess the impacts of nanomaterials on the human body and the environment. For this purpose, MEXT conducts research in characterization of nanomaterials, such as the Research Project on Facilitation of Public Acceptance of Nanotechnology and the Multi-experts Panel on the Implication of Nanotechnology granted by the Special Coordination Funds for Promoting Science and Technology. (Refer to Part 2, Chapter 2, Section 2, 4)

2 Accountability for Science and Technology and Improvement of Information Dissemination

Many Japanese feel that science and technology make contributions to society, but their concern is declining, particularly among the younger generation. While there are high expectations for S&T in safety or relief in living and spiritual richness, many people are uncomfortable with the rapid progress in S&T. In the future, in order for S&T to keep growing and be accepted by society, it is important to continuously improve its levels to create intellectual and cultural values and also to enhance efforts to return the fruits to society. At the same time, it is also important to enhance accountability and develop a dialogue with people by disseminating the results in easy-to-understand ways, thus winning the understanding and support of the public. It is necessary to give positive approaches for activities to achieve these issues.

From FY 2005, MEXT stipulated in the application guidelines for the program Research and Development Program for Resolving Critical Issues that about 3% of direct expenses should be allocated to outreach activities^{fn} under the Special Coordination Funds for Promoting Science and Technology and that the outreach activities should be subject to interim and post evaluations.

In addition, in order to raise interest and concern towards S&T among children, *the Children's White Paper on Science and Technology* has been published every year since FY 1999, wherein timely issues such as space development and disaster prevention technology are explained in an easy-to-understand style of a comic book. The entire text is posted to the MEXT website, and the book is distributed to educational organizations and sold in Government Publications Service Centers and bookstores nationwide.

The *Children's White Paper on Science and Technology IX* (FY 2007 Edition) featured the results of specific research using cartoons with quizzes, including the spacecraft *Hayabusa*, the development of comparative cognitive science through chimpanzees, blue LEDs, and iPS cells.

To convey the R&D situation and research findings concerning the agriculture, forestry, and fisheries industries in an easy-to-understand way, MAFF implements the Agricultural Science Events. This project has clear targets of juveniles, consumers, and producers, and mainly sponsors events that people can actually experience. Further, in the field of technology for genetic modification, MAFF held a communication meeting in 2008 that invited all citizens, including producers and consumers, with the participation of experts. Furthermore, independent administrative research institutions offer open lectures throughout the year to promote and disseminate the introduction of research activities and achievements.



Children's White Paper on Science and Technology IX

3 Improving Public Awareness concerning Science and Technology

In order to create a social environment where people are familiar and strongly interested in science and technology, it will be important to promote activities to convey S&T in an easy-to-understand manner, such as providing occasions to gain familiarity with S&T and to enhance accountability and information dissemination through dialogues. It will also be important to promote efforts contributing to improving people's basic knowledge and ability regarding S&T.

MEXT promotes the following efforts to support the fostering of public awareness of S&T:

^{fn} Outreach activities: Activities through which S&T are conveyed to people in an easy-to-understand and friendly manner, increase awareness of the requirements and uneasiness of people by deepening dialogues, and the outcome is reflected in S&T activities of the entity executing such activities.

(1) Efforts to improve basic education regarding S&T (S&T literacy)

Specifying knowledge and ability regarding S&T required for an adult person will contribute to raising people's interest in S&T and improving the level of math and science education. To this end, as a joint project of the National Institute for Educational Policy Research of MEXT and SCJ, the idea of science and technology literacy (knowledge, technology, and viewpoints regarding S&T expressed in easily understandable texts) was formulated in March 2008 under the extensive cooperation of scientists and engineers.

(2) Fusing S&T with culture and art

Recently, the opinion that S&T should contribute not only to material affluence, but also to spiritual richness is growing. In the future, it will be necessary to carry out the S&T policy by strengthening interdisciplinary fields. Fusing of S&T with culture may result in the creation of new works of art, which contribute to spiritual richness. On the other hand, the encounter has the potential to create new knowledge in the S&T field, such as creation of new, unique technologies.

In order to realize the creation of such new knowledge, it is important to provide opportunities where young researchers and creators form a new community. For this purpose, the technology exhibition Leading Edge Technology Showcase 2008 and the theme symposium Fusion of Art and Technology were held as supporting exhibitions of the 11th Japan Media Arts Festival by the Agency for Cultural Affairs. In FY 2007, which was the third year for these events, such an opportunity where leading-edge technologies and creators come together was provided by recruiting ideas for using research results from art university students and design-oriented special training school students, and such ideas were presented as the Creator Idea Showcase.

(3) Reinforcing and enhancing science museum activities

[Operation of the National Museum of Emerging Science and Innovation (Miraikan)]

The National Museum of Emerging Science and Innovation (Miraikan) managed by the Japan Science and Technology Agency (JST) provides exhibitions and explanations to introduce state-of-the-art science in an easily understandable manner, and at the same time, promotes exchange between researchers and the general public through lectures and events. Also, through projects such as the Science Communicator Training Program, Miraikan develops human resources who promotes an understanding of S&T in various regions. Furthermore, they develop these projects for science museums across the country to contribute to invigorating activities to increase people's awareness of S&T.

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

Science museums function as cores for activities to increase people's understanding of S&T in the respective regions. In order to further reinforce such activities, JST supports the means to enrich opportunities for pupils and students to experience and learn science, technology, and natural science, including joint development of new exhibits by regional schools and science museums, offering delivery services of experimental and manufacturing classes by science museums for regional schools and touring exhibits.

(4) Activities of National Museum of Nature and Science

The National Museum of Nature and Science holds exhibitions and implements activities to provide the opportunity to convey interesting factors in science, to think together, and to support learning, targeted for a broad range of generations from juveniles to adults, by utilizing the intellectual, material, and human resources of the museum including research achievements and specimens. In addition, as a leading museum in the country, the Museum works on the development of pioneering model programs. For instance, it established the program Partnerships with Universities in order to improve the science literacy of students and is carrying out cooperative programs such as free entrance

for students in cooperation with universities. It also started the Science Communicators Practical Training Program to develop human resources engaged in activities to increase people's understanding by utilizing the resources of the Museum. At the same time, the museum cooperates with schools to develop learning programs for children, as well as to work on developing a model program in a spirit of improving science literacy in general by including adults according to their life stages. The museum is engaged in other activities as well, including the series From Ueno Hill: Transmission of Up-to-date Science-related Infos [literal translation], which disseminates research details and results to society in cooperation with universities and research institutes, and the establishment of Science Museum Net, which is a system where 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 S&T in cooperation with science-oriented museums, universities, and research institutes.

(5) Activities of universities and research institutes

The Japan Aerospace Exploration Agency (JAXA) implements a variety of different educational activities. Such activities include the Cosmic College and Space School, with the aim of raising interest in S&T in general, including space science among juveniles who will lead the next generation, and to foster children's scientific observational, thinking, and problem-solving abilities.

(6) Promoting activities for enhancing understanding of S&T in regions

JST supports experiment/manufacturing classes by science museums, universities and volunteers, and the development of exhibits in science museums through the Support Project of Regional Activities for Understanding of Science & Technology.

In addition, through the Children's Dream Fund established in the National Institution for Youth Education, JST subsidizes experimental activities for experiencing science by children organized by private sectors.

(7) Disseminating S&T information to regions across the country

JST creates programs that explain S&T in an easy-to-understand manner for the general public, especially for juveniles, focusing on topics related to S&T and interesting science experiments. These programs are delivered throughout the country via CS broadcast and CATV under the title Science Channel by the National Institution for Youth Education, and the programs are also offered via the Internet (<http://sc-smn.jst.go.jp>). JST Virtual Science Center is provided broadly to the public via the Internet. This is a program where juveniles can experience various aspects of S&T in an easy-to-understand manner (<http://jvsc.jst.go.jp>).

(8) Science & Technology Week

The 48th Science & Technology Week was held from April 16 to 22, 2007, in cooperation with related organizations, such as experimental research institutions and local governments. During the week, various facilities are open to the public for experiment and manufacturing classes and lectures from related organizations in different locations around the country. In FY 2007, the show of the planetarium *Megastar II* was held in Nihonbashi, Tokyo, as the Nihonbashi Event. Also, the Science Cafe was held every day during the Week. This is an occasion for researchers and the general public to talk casually about science and technology over a cup of coffee.

(9) Activities at universities and other organizations to increase understanding of S&T

MEXT implements measures to promote the increased understanding of S&T by holding public lectures at universities and by developing and improving the University of the Air, which offers S&T courses. MEXT also supports symposiums and science lectures that aim to disseminate and enlighten,

in an easy-to-understand manner, information on research trends in fields that are considered to be of high interest to young people or adult members of society through Grants-in-Aid for Scientific Research. In addition, MEXT implements specialized training for the personnel of museums and science museums to improve their level. Also, by dispatching expert staff, such as curators, to science-oriented and other museums in foreign countries for training, it is expected that they will obtain sophisticated knowledge and skills.

As a part of the activities to return academic achievements to the general public, SCJ opens lectures; six lectures were provided this fiscal year. The subjects included For realization of anti-cigarette society—Proposing measures based on evidences—; Current situation and the future of scientific researches in Japan—Seeking for creation of better research environment; Population and gender—Measures against declining birthrate effective?; Sustainability of mineral resources and outlook on resources problems; Current situation of assisted reproduction technologies—Seeking for social agreement—; and Thinking about the universe, life and human beings—For the future of mankind.

Furthermore, MEXT offered a variety of other events for the general public, particularly for elementary and lower secondary school students, to further realize how interesting it is to deal with science through activities in which scientists speak directly to the participants. In FY 2007, MEXT implemented on-site training programs like the Science Cafe and Summer School for Female High School Students to encourage the interest and concern of the young generation in fields of science as well as science and technology. The National Institute of Advanced Industrial Science and Technology (AIST) has permanent exhibition facilities, such as the Science Square Tsukuba/Rinkai, Geological Museum, and the JIS Pavilion. In FY 2007, eight facilities were opened to the public with about 12,000 visitors in total. Furthermore, as one of the largest public research institutions in Japan, AIST positively implements Science Communication projects, including the Science Cafe and Experiment Class, so that the activities will help the public to understand S&T.