# Chapter 3 Science and Technology System Reform

## 1 Fostering, Securing, and Activating Competent Persons

### 1 Establishing an Environment that Enables Individuals to Play Active Roles

The future of S&T in Japan and the maintenance and enhancement of the country's international competitiveness depend on the capabilities of people fostered in Japan, and it is important to cultivate an environment that enables a diverse pool of individuals, including young researchers, female researchers and foreign researchers, to become highly motivated and exercise their capabilities. Described below are the outlines of major policies adopted by ministries and agencies as categorized by purpose.

#### (1) Supporting the independence of young researchers

If Japan is to aim towards becoming an advanced science- and technology-oriented nation, it is critical to foster and secure distinguished young researchers with abundant creativity capable of leading future research activities. To this end, research institutes are expected to provide opportunities for research activities and promote researcher independence, and universities are expected to attract and provide opportunities for assistant professors to assume active roles, in an environment of competition based on fair and transparent personnel evaluations.

In order to foster next-generation researchers in the field of information and communications technologies (ICT), MIC implements R&D through the Fostering Young ICT Researchers [literal translation] as part of the Strategic Information and Communications R&D Promotion Programme (SCOPE), providing research funds for R&D projects proposed by young researchers.

In FY 2006, MEXT implemented the program Promotion of Environmental Improvement to Enhance Young Researchers' Independence under the Special Coordination Funds for Promoting Science and Technology to enable young researchers to play an active role. Under this program, MEXT provided support for 30 projects (28 organizations) as of FY 2008, promoting introduction of the tenure track system (which enables young researchers to gain experience as independent researchers by obtaining fixed-term positions at universities before securing a more stable position after a rigorous screening of their achievements) and supporting efforts to improve the research environment by providing start-up funds necessary for independent research activities.

MEXT also enhances its efforts to foster young researchers who have flexible mind-sets and the spirit of challenge through the provision of the Grants-in-Aid for Scientific Research. In FY 2008, MEXT earmarked approximately 34.3 billion yen for research grants as part of its efforts to expand competitive funds for young researchers. These grants include the newly established indirect costs of 30% for the Grant-in-Aid for Young Scientists (B) and Grant-in-Aid for Young Scientists (Start-up).

In addition, the ministry provides through JSPS excellent young researchers with opportunities to devote themselves to their research activities and independently choose topics without restriction by making the Research Fellowships for Young Scientists available and by providing opportunities to gain research experience abroad in order that they may improve themselves by competing with foreign researchers through the Postdoctoral Fellowship for Research Abroad to foster and secure researchers capable of playing an active role across national

borders.

MHLW invites applications for funding to foster young researchers who will conduct the ministry-related research activities in future under projects funded by the Health and Labour Sciences Research Grants.

MAFF establishes an award as part of its Human Resources Development Program in Agriculture, Forestry and Fisheries Research [literal translation] to recognize researchers under 40 years of age who have achieved excellent results as a means of motivating young researchers.

Meanwhile, the National Agriculture and Food Research Organization implementes a research promotion program aimed at supporting innovative research by young researchers. The National Institute of Agrobiological Sciences promotes the independence and enhancement of young researchers' motivation through a junior researcher system, which is intended to allow graduate school students enrolled in doctoral programs to advance their education while working for research institutions.

METI provides through NEDO subsidies for young researchers' R&D activities aiming at industrial applications.

MOE supports the improvement of work carried out by young researchers by setting up a special reserve for the ministry's competitive funds.

### (2) Improving the mobility of competent persons and limiting the proportion of alumni

In order to develop researchers with broad creative perspectives and to achieve competitive and dynamic R&D environments, it is important to improve the mobility of researchers, to form a creative research environment, and to provide opportunities that allow researchers in versatile sectors to gain experience at various research sites. The Basic Plan calls for universities and public research organizations to make continued efforts to ensure widespread adoption of a fixed-term system and the system is being introduced by them. (Tables 2-3-1 and 2-3-2). Furthermore, universities are encouraged to pay sufficient attention to the proportion of alumni on their faculties, and it is expected that universities with an excessively high proportion of alumni on staff will endeavor to lower the proportion.

Table 2-3-1 Status of the Introduction of a Fixed-term System at Research Organizations, etc.

| | Number of organizations | Number of full-time researchers on fixed-term | Ratio of fixed-term researchers included in full-time researchers |
|---|---|---|---|
| National experiment and research organizations | 29 | 175 | 7.6% |
| Independent administrative institutions for R&D (Note) | 29 | 3,016 | 23.64% |

Note: Independent administrative institutions for implementing S&T-related business which have an R&D function internally

Source: Cabinet Office *Survey on S&T-Related Activities at Independent Administrative Institutions, National University Corporations, etc. (Business Year 2007)* [literal translation], MEXT survey (As of March 3, 2007)

Table 2-3-2 Status of the Introduction of Fixed-term Faculty Members at Universities, etc.

| | Number of universities, etc. | Number of fixed-term members | Ratio of fixed-term faculty members included in full-time ones |
|---|---|---|---|
| National universities | 81 | 11,156 | 18% |
| Public universities | 47 | 2,840 | 24% |
| Private universities | 414 | 17,371 | 18% |
| Inter-university research organizations | 14 | 281 | 21% |

Source: MEXT survey (As of FY 2007)

### (3) Promotion of the activities by female researchers

The ratio of female researchers in Japan is lower than in European countries and the US. It is important to promote activities by female researchers not only in order to promote gender equality but to broaden the base of S&T-related competent persons.

The Basic Plan calls for a variety of initiatives to promote activities by female researchers. In response to this, MEXT supports the establishment of an environment which allows excellent female researchers who have taken a parental leave to return to research through the JSPS's Research Fellowships for Young Scientists.

Moreover, MEXT implemented a program in FY 2006 to invite proposals for initiatives that will serve as model projects to encourage female researchers to simultaneously pursue their careers in research while raising children. Selected initiatives are funded by the Special Coordination Funds for Promoting Science and Technology at 33 organizations.

JST Basic Research Programs establish and support a system that enables researchers to postpone their research activities for parental leave or to return from their leaves.

The ministry implements a project to encourage female students of lower and upper secondary schools to follow science career paths by creating opportunities for them to mingle with female researchers and by providing courses as a way to foster their interest in S&T.

Under the slogan "Challenge Champaign: Choice of S&E Courses for Female Students [literal translation]," the Cabinet Office provides them with information related to S&E to raise their awareness about this area.

AIST examined measures for the support of the simultaneous pursuit of nursing and business, including the holding of gender-equal symposia, and recruitment seminars targeting female students, at its Gender Equality Office, and it also executed surveys and organized study meetings concerning nursing care as a means of improving the work environment. Moreover, AIST organized a consortium consisting of universities and research institutions in order to expand its related measures by improving the work environment, career building and motivation of female researchers. (Twelve organs including AIST have participated in this consortium as of January 2009.)

### (4) Promotion of the activities by foreign researchers

Along with the promotion of active participation by a diverse range of individuals, it is important, not only from the perspective of attracting competent persons, but from the perspective of improving the level and international nature of research activity in Japan, to prepare an environment that allows talented researchers from other countries to live and work.

However, the percentage of foreign nationals in general among highly skilled workers is extremely low in Japan relative to international levels. Japan hosts only about 11,000 foreign researchers[1], accounting for only 1.34% of the total number of researchers in the country.

The acquisition of talented researchers is currently the focus of fierce international competition among the US, European countries, and China. In order to attract excellent foreign researchers, the Japanese government has reformed its immigration control system so as to expand the special measure allowing foreign researchers to stay in Japan the original three years to up to five, an extension that was previously applied only to designated structural reform districts where programs for the promotion of receiving foreign researchers were in place. MEXT implements measures through JSPS such as the Strategic Fund for Establishing International Headquarters in Universities, to support the globalization of the research environment, the Postdoctoral Fellowship for Foreign Researchers, and the Invitation Fellowship Programs for Research in Japan, etc. with the goal of inviting about 5,700 excellent foreign researchers per year to Japan.

### (5) Appointment of ability of elderly researchers

It is important for improvement of the level of S&T in Japan that researchers who are recognized as truly excellent across the world can continue to contribute at any age.

AIST established a reemployment system to secure employment for persons up to 65 years of age in response to the Revised Act concerning Stabilization of Employment of Older Persons in FY 2007 and is working proactively to appoint elderly researchers.

## 2 Strengthening the Fostering of Competent Persons Function of Universities

### (1) Fostering of competent persons at universities

Universities, essential institutions for the creation and utilization of knowledge, have a large role to play in fostering competent persons endowed with the creativity, broad perspective and flexible thinking necessary for exercising leadership across national borders. Universities are actively working to improve education for this purpose. For example, the number of universities introducing major-minor systems that enable students to systematically study in a broad range of fields has been increasing over the past few years, with 152 universities (undergraduate level) and 89 universities (graduate level) adopting this system as of FY 2007. Furthermore, in order to improve and enhance the education environment, 664 universities executed organizational efforts to improve the educational strengths of teachers (faculty development) in FY 2007, and 319 universities (undergraduate level) and 235 universities (graduate level) executed performance evaluations for teachers in the same year.

MEXT provides support to excellent efforts by national, public and private universities to reform university education in order to promote the implementation of education and research that reflect their own characteristics.

### (2) Drastic enhancement of graduate school education

In a modern society in which specialization and segmentation of knowledge is progressing

1 Statistical figure for persons whose residence status falls under the category of "professor" or "research" in the Ministry of Justice *Statistics on Foreign Residents Resistered* [literal translation].

and international competition is intensifying, there is a pressing need to foster competent persons equipped with both deep expertise and broad versatility that can adapt to new academic fields and rapid technological innovations. With regard to graduate schools, which should play a central role in the development of such persons, quantitative improvement has steadily progressed with the number of graduate school students rising by about 70,000 over the 10-year period between FYs 1999 and 2008. From now, it is necessary to further improve the quality of education at graduate schools.

In this context, it is important to have graduate schools clarify the objectives of their curriculums while taking into account social needs and, based on such definitions, promote the substantiation of graduate school education (enhancement of systematic development) in such a direction that systematic education programs leading to degrees should be created and offered, and that management and transparency of the processes should be diligently pursued. MEXT implemented the Support Program for Improving Graduate School Education in FY 2007 and supports excellent organizational and systematic educational projects in graduate schools for developing high-level personnels who can take an active part in a variety of different fields of society including industry. By FY 2008, MEXT had adopted 192 programs proposed by 83 universities.

### (3) Drafting of initiatives related to the reform of graduate school education

In accordance with the Basic Plan and the Central Council for Education's recommendation paper entitled Graduate School Education in the New Age (September, 2005), MEXT formulated the Platform for the Promotion of Graduate School Education which features systematic and intensive efforts towards enhancing graduate schools over a five-year period in March 2006. This sets the direction of reform towards 1) realization of effective graduate school education, 2) assurance of conformity to international standards and credibility and 3) establishment of education and outstanding research centers that are competitive internationally. MEXT implements measures for making Japanese universities attractive across borders based on this platform.

### (4) Expansion of financial support for doctoral students

In order to secure excellent researchers, it is necessary to enable talented students to proceed to doctoral courses without overly worrying about the financial burden involved. Therefore, the Basic Plan aims to enable about 20% of doctoral students to receive financial support equivalent in amount to their living expenses.

To this end, MEXT enhanced, as a priority, support for doctoral students that is provided through the JSPS Research Fellowship for Young Scientists and expanded the amount of competitive funds that can be used to appoint as teaching assistants (TA), which lets graduate students assist educational activities, and as research assistants (RA), which allows doctoral students to participate in research projects conducted by universities. Also the JST Basic Research Programs has supported the employment of excellent doctoral students as RAs from FY 2008.

MEXT has also implemented the scholarship loan programs at the Japan Student Services Organization that expidite scholarship funding for students who achieve especially outstanding results and exempt them from scholarship repayment.

## 3 Fostering of Competent Persons that Meet Social Needs

### (1) Fostering competent persons through industry-academia collaboration

For Japan to maintain its prowess in industrial technologies and achieve sustainable development, it is important to develop, by taking account of the needs of the society including

the industrial sector, competent persons that meet such needs and that can adapt to change in the needs. To do so, it is essential that universities and companies form cooperative relations for fostering competent persons and coordinate their activities.

Therefore, from FY 2007, MEXT and METI have promoted the Industry-Academia Partnership for Fostering Competent Persons [literal translation] to provide opportunities for dialogue and activities at universities and industries. Furthermore, in cooperation with the two ministries, the Career Development Program for Foreign Students from Asia, which attracts excellent foreign students from Asian countries to Japan and promotes their activities in Japanese companies, was implemented in FY 2007.

MEXT promotes fostering of competent persons through industry-academia collaboration at universities, by the Support Program for Fostering Manufacturing Engineers [literal translation], which supports fostering of engineers involved in manufacturing through cooperation of regional communities and industries, and the Program for Practical Human Resource Development by Industry-Academia Cooperation – Service Innovation Human Resource Development –, which contributes to creation of innovations and cultivate competent persons.

In FY 2008, MEXT implemented the Strategic Program for Fostering Environmental Leaders under the Special Coordination Funds for Promoting Science and Technology, in order to establish centers at which foreign students from Asian and other countries can study together with Japanese students and competent persons who have the leadership potential to solve environmental problems in developing countries (called environmental leaders) can be fostered. At present, five organizations are advancing each project.

Since FY 2008, METI has provided support for the program for fostering competent persons through industry-academia collaboration based on the achievements of the above-mentioned Industry-Academia Partnership.

In 2007, the baby boomers reached retirement age, and the fostering of engineers supporting SMEs is important for maintaining and strengthening the competitiveness of Japan's industries. To this end, METI implemented measures to support fostering competent persons, including development of young engineers and the curriculum of SMEs, by utilizing the facilities of colleges of technology and enhancing practical training programs intended for specialized upper secondary school students through the collaboration of industries, technical upper secondary schools, and administration in the respective regions. In addition, METI has initiated a model program for the systematic fostering of basic skills as adults in various areas at universities, for example, the fostering of communication ability and the ability to get things done, so that university students can develop the abilities that are required by society through industry-academia cooperation.

MOE formulated the Vision of University-led Environmental Leadership Initiatives for Asian Sustainability in March 2008 to realize concepts and measures for fostering competent persons capable of leading the establishment of sustainable Asian society. Based on it, in March 2009, MOE established the Environmental Consortium for Leadership Development (EcoLeaD) as a platform for the promotion of fostering competent persons capable of leading the greener economic society.

### (2) Promotion of the activities of doctorate holders

Amid the deepening and diversifying relationship between S&T and society, it is desirable that post-docs and other personnel with expertise in S&T play an active role not only at universities and research institutions but in various sectors of society such as the industrial sector and administrative agencies.

However, since such personnel have not been given sufficient opportunities to do so because the career paths after post-doctoral period is uncertain, MEXT implemented the project to

promote diversification of career paths for S&T-related personnel since FY 2006, which extends organized support and cultivates a favorable environment for the diversification of the career paths of doctorate students and post-docs. Currently, 12 organizations participate in this project. In addition, MEXT launched the Fostering Young Researchers for Innovation Creation [literal translation] (Special Coordination Funds for Promoting Science and Technology) in FY 2008. Ten organizations are promoting the development of a system to foster research personnel by which young researchers can acquire not only specialized ability in specific disciplines but the ability to produce creative results in various fields both within and outside Japan.

AIST recruited doctorate holders since FY 2005 based on coordination and collaboration agreement with a company to develop doctorate holders recruited through joint research projects with the company as personnel capable of making contributions to the company immediately. In addition, to foster competent persons who can contribute to innovation in industries, AIST implemented training for developing industrial technology personnel in which knowledge that would be indispensable in industries is provided to doctorate holders, and held corporate briefing conferences. From FY 2008, AIST has established the AIST School of Innovation as the program for its doctorate holders in order to produce the personnel who have broader perspectives as well as better communication skills and cooperativeness with specialists in different fields.

### (3) Fostering of diverse competent persons capable of utilizing knowledge and feedback to society

**(Fostering of competent persons related to intellectual properties and management of technology)**

In order to promote the creation of innovation, it is necessary to foster competent persons capable of creating, protecting and utilizing intellectual properties and those capable of effectively leading the results of R&D to the creation of market value based on understanding of both technology and business management.

MEXT promotes voluntary efforts by universities in this regard by supporting educational projects related to intellectual properties. For the purpose of fostering advanced professionals in areas such as management of technology, professional graduate schools with a total of 149 majors were in place as of April 2007.

**(Fostering S&T communicators)**

According to the Public Opinion Poll on S&T and Society (December 2007) [literal translation] conducted by the Cabinet Office, many people think that opportunities to know S&T information or organaizations that provide information are insufficient, though most of them can understand information related to S&T when S&T activities are experienced directly or explained in an easy-to-understand manner. In order to address this situation, it is necessary to foster and promote the activities of S&T communicators, personnel suited for promoting communications between scientists/engineers and ordinary people by explaining S&T in an easy-to-understand manner and by conveying the concerns of the society to scientists/engineers.

MEXT supports universities that will provide courses intended to train S&T communicators through the Fostering Talent in Emerging Research Fields [literal translation] program, which is funded by the Special Coordination Funds for Promoting Science and Technology. The National Science Museum and the National Museum of Emerging Science and Innovation make active efforts to foster S&T communicators and promote their activities, through training courses or programs.

**(Fostering engineers)**

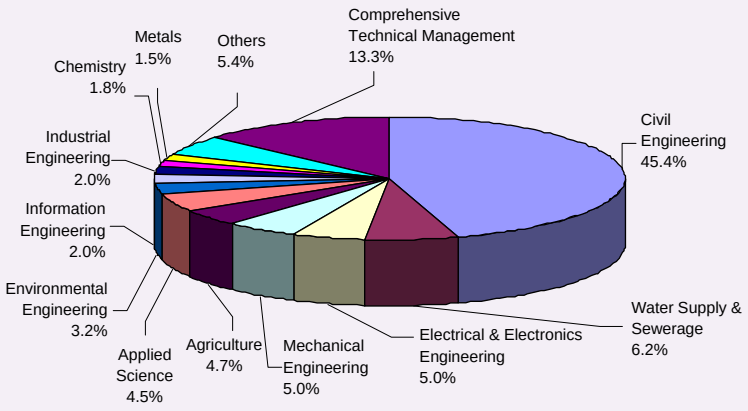
To become an advanced science- and technology-oriented nation, it is necessary to create industrial frontiers and strengthen international competitiveness through technological innovation, as well as to strengthen the technological platform. For this purpose, efforts are being made to foster sufficient leading engineers through the following policies.

**1) Professional engineer system**

The professional engineer system was established with the enactment of the Professional Engineer Act in 1957 (revised in 1983). It aims to contribute to the improvement of S&T and the development of the national economy through sound engineering, by conferring the qualification of professional engineer on those who possess advanced and specialized abilities in applying S&T to planning and design work.

Those who apply to become a professional engineer are required to pass the national examination that is given in 21 fields of specialization, and become registered as a professional engineer. The examinations are held annually for both professional engineer and associate professional engineer. In FY 2008, the test resulted in 8,383 individuals being certified as associate professional engineers, and 4,143 being certified as professional engineers. As of the end of December 2008, there were a total of 23,061 individuals registered as associate professional engineers, and 63,567 registered as professional engineers. The distribution by sector is shown in Figure 2-3-3.

Figure 2-3-3 Distribution of Professional Engineers, by Sector




**2) Mutual recognition of engineering qualification**

Based on the Osaka Action Agenda adopted at the Asia-Pacific Economic Cooperation (APEC) summit meeting of 1995, work has been progressing on the APEC Engineer Mutual Recognition Project for the promotion of mutual acceptance of professional engineer qualifications within the APEC region. Japan actively participated in studies for this project, toward the realization of mutual recognition of the professional engineer qualification with corresponding qualifications overseas.

In November 2000, the APEC Engineers Manual was published based on the results of studies at APEC. As of December 2008, there were 13 participating economies registered, including Japan.

### 3) Supporting the continuous development of engineer abilities

JST supports engineers in acquiring extensive basic knowledge in S&T and knowledge of failure by providing internet educational tools for self-learning that covers the respective areas of S&T and across different areas at http://weblearningplaza.jst.go.jp/ (Web Learning Plaza website), as well as the Failure Knowledge Database at http://shippai.jst.go.jp/ (JST Failure Knowledge Database website) that includes failure cases in the S&T field together with lessons learned from failures.

### 4) Others

The Japan Patent Office (JPO) prepared complimentary texts for industrial property rights intended for students of upper secondary schools (special courses), colleges of technology, and universities for the purpose of mastering correct knowledge and basic practical affairs concerning intellectual rights through the National Center for Industrial Property Information and Training (INPIT). Furthermore, to cultivate awareness to pay regard to intellectual property during the school education stage, JPO prepared supplementary readers for teaching intellectual property rights intended for elementary, lower secondary, and upper secondary schools and provides them free of charge to schools that are interested. JPO, by utilizing these texts, holds seminars intended for children, pupils, students and teachers at various locations to cultivate and create an awareness of intellectual property rights, as well as to support related education.

Furthermore, to the students of upper secondary schools, colleges of technology, and universities, patent contests are being executed through joint hosting by MEXT, JPO, the Japan Patent Attorneys Association, and INPIT to cultivate an intellectual property mind and enhance understanding on the intellectual rights system through actual experience. Regarding excellent inventions among those applied, pupils or students will actually apply patents for acquisition of their rights. (Table 2-3-4)

Since FY 2007, lower secondary school student's Monodzukuri intellectual property report contest [literal translation] has been implemented, so that the contest will trigger them to become aware of importance of thinking highly of intellectual property (Table 2-3-5).

AIST continued the program to foster expert engineers from FY 2007 in order to train engineers to acquire advanced expertise useful for R&D by utilizing its versatile research activities and the cutting-edge research infrastructure.

Table 2-3-4 List of Inventions Awarded by the FY 2008 Patent Contest

| | Title of invention [literal translation] | Name of inventor | Name of school or university |
|---|---|---|---|
| Organizer's Award | Container for Storing Viscous Fluid | Yoichi Udagawa | Toho University |
| | Soy Sauce Pot | Yuta Morioka | Tokuyama College of Technology |
| Patent-application -supported invention | Care Aids | Manatsu Jin | JIYUGAOKA SANNO College |
| | Container for Storing Viscous Fluid | Yoichi Udagawa | Toho University |
| | Rocket Separation/Jettison Mechanism | Keisuke Seki | Akita University |
| | Aids for Cutting Adhesive Tape | Natsuki Kanai<br>Tomotaka Uemura<br>Naoki Morimoto<br>Kiyoshi Yushita | Advanced Course, Gifu National College of Technology |
| | Rack that Automatically Closes when Detecting Earthquake | Takafumi Tsukada<br>Hisashi Hotta<br>Tomoki Morii<br>Zenpei Kimura<br>Hiroko Matsui | Advanced Course, Gifu National College of Technology |

| | | | |
|---|---|---|---|
| | Electronic Key | Yuki Horise<br>Takumi Miyatake | Advanced Course, Takuma<br>National College of Technology |
| | Stapler | Ryutaro Machida | Advanced Course, Kurume<br>National College of Technology |
| | Soy Sauce Pot | Yuta Morioka | Tokuyama College of Technology |
| | Dog Food | Mizuki Kazaana<br>Ayano Murashita<br>Yuji Sato | Aomori Prefectural Sanbongi<br>Agricultural High School |
| | Rubber Band Gun | Shogo Noguchi<br>Yuta Hasumi<br>Ryota Kazama<br>Shunsuke Ozawa | Saitama Prefectural Kawagoe<br>Technical High School |
| | Chamfering Machine | Yasushi Kameko<br>Takeshiro Sakurai<br>Masayuki Hirano<br>Shoki Furukawa<br>Masaki Matsumoto | Kagoshima Prefectural Kanoya<br>Technical High School |
| | Treatment of Waste Water Colored with Dye | Kanami Iio<br>Yuki Kikugawa<br>Akio Yoshida | Ehime Prefectural Imabari<br>Technical High School |

Table 2-3-5 List of Robot Idea Challenge Award Winners of Lower Secondary School Student's Intellectual Property Contest

| Name of award | Name of report [literal translation] | Name of school | Name of team [literal translation] | Name of pupil |
|---|---|---|---|---|
| Highest award | Aiming at Giant's Fingers! - Robot that Tosses, Picks up, and Tosses Again a Ring - | Hiroshima Municipal Takatori-Kita Junior High School in Hiroshima Prefecture | ADF | Tatsuya Asuka<br>Masato Sakata<br>Shota Yasumura |
| Award in report category | Production Report on Robot that has Hands Made of PET Material with Appropriately Curved Surfaces | Toki Municipal Seiryo Junior High School in Gifu Prefecture | SEIRYO one 2.0 | Hirotaka Kato |
| | Bikkuribako | Hiroshima Municipal Takatori-Kita Junior High School in Hiroshima Prefecture | Bikkuribako | Suguru Sukemorita<br>Takeshi Kanatani<br>Toshiki Kuramoto<br>Masato Kaji |
| Award in design category | Development of Ejecting Mechanism by Team Clost - Toward Smooth, Efficient Ejection Mechanism - | Ami Municipal Asahi Junior High School in Inashiki Gun, Ibaraki Prefecture | Team Clost | Sayaka Yokoyama<br>Kasumi Nakanishi<br>Haruna Nozue<br>Izumi Nakane |
| | Miracle! 8 Goals in 2 Seconds | Toki Municipal Izumi Junior High School in Gifu Prefecture | IZUMI WBB | Akira Daito<br>Yuta Mizuno<br>Takahiro Tanaka<br>Tsubasa Kai |
| Award in naming category | Robot Production Plan for Smoother, Quicker Item Setting | Niigata Municipal Kobari Junior High School in Niigata Prefecture | | Masakazu Asaoka |
| | Can Classification and Separation Robot | Niigata Municipal Kobari Junior High School in Niigata Prefecture | | Kosuke Iwafune |
| Judges' special award | Nasuemon - Robot with Very Flexible Hand | Ina Municipal Tobu Junior High School in Nagano Prefecture | Suzutake-Nasuemon | Soichiro Tashiro<br>Riku Ogura<br>Yu Kanbayashi<br>Nozomu Ohsugi |

## 4 Expanding the Range of Next-generation S&T-related Personnel

To foster next-generation S&T-related personnel, the government has systematically promoted the enhancement of math and science education. This creates an environment in which children at the level of elementary, lower secondary education can become friendly with and learn S&T and develops an effective environment that fosters the ability of children who are interested in math and science.

CSTP called for deliberations on and enhancement of measures concerning various strategic initiatives, including the fostering of top-level personnel, the use of outside experts to strengthen the teaching staff and improve school education, training of S&T communicators, and enhancement of outreach activities of research institutions. It was reflected in the FY 2009 budgets of the relative ministries and agencies.

### (1) Fostering children brimming with intellectual curiosity

**(Science education assistant allocation program)**

In order to enhance observation and experiment activities and the capabilities of teaching personnel in elementary school science classes, JST utilizes outside personnel including researchers, engineers, undergraduate (graduate) students, and retired teaching staffs as nature study support staff and special lecturers. In FY 2008, the program was implemented in 62 prefectures and government-designated cities.

**(Education support project utilizing part-time outside lecturers** [literal translation]**)**

In cooperation with MEXT, METI recruited engineers employed in industry as part-time outside lecturers, created a curriculum that combines elementary-school science classes with technologies and knowledge owned by local companies, and executed the program for, for example, developing regional networks consisting of industy- and academia-related organizations.

**(Science teacher training)**

In order to improve the ability for practical leadership of teaching personnel involved in science and mathematics in their experimental and problem-solving activities, including observation and experiments concerning S&T, nature study, and mathematics, JST implements a project to support the training of teaching personnel in cooperation with boards of education, universities and science museums, etc.

**(Science partnership project)**

JST supports initiatives implemented in cooperation with schools, boards of education, universities and science museums, etc. to provide hands-on education and problem-solving education in order to enhance the interest of pupils and students in S&T and mathematics, and to foster their inquiring spirit. More specifically, these initiatives include educational activities such as observations and experiments supervised by front-line researchers and engineers, and science camps (camp-type learning activities) for hands-on S&T lessons in the latest research environment, and other activities.

**(Enhancement of facilities and equipment for science and mathematics education)**

Efforts are underway, based on the Act for Promotion of Science Education [literal translation], to systematically enhance the facilities and equipment used in science and mathematics education at elementary, lower secondary, and upper secondary schools, as they are insufficient in number and outdated in many cases.

**(Development of advanced digital materials for S&T and science education)**

JST is engaged in the development of digital materials for science education and provision of such materials to schools via the internet, conducts demonstration tests and evaluation related to utilization of such materials at schools jointly with boards of education.

**(Project for the development of private career education coordinators and evaluation systems** [literal translation]**)**

METI supports career education to encourage children to understand work through the first-hand experience of Monodzukuri, etc. In FY 2008, the ministry launched a coordinator

fostering program for the further enhancement of career education in response to the increasing need for coordinators to combine the industry with local schools.

**(Project targeted at school students for fostering engineering-related personnel** [literal translation]**)**

To help lower and upper secondary school students flesh out their future career perspectives and improve the effectiveness of their classes by showing knowledge-society linkage and careers in engineering while utilizing local industrial engineers and facilities, METI not only executed development and verification tests of the programs designed to locate cooperative enterprises and link industrial technology with basic knowledge acquired through education, but developed networks between organizations of industry and academia.

### (2) Development of the individuality and capacity of talented children

**[Super Science High Schools (SSHs)]**

Since FY 2002, MEXT promoted, with the support of JST, the development of S&T-related personnel capable of playing an active role internationally by designating upper secondary schools and other schools that focus on science and mathematics education as Super Science High Schools. Specifically, efforts are underway to provide advanced science and mathematics education in collaboration with universities, and develop curriculums with an emphasis on science and mathematics. In FY 2008, 102 upper secondary schools engaged in unique efforts in this regard.

**(Program for supporting international science and technology contests)**

JST supports domestic competitions of international science and technology contests in mathematics, physics, chemistry, biology, informatics, etc., the sending of Japanese teams to international competitions, and international contests within Japan in order to increase students' interest, intention, motivation, and ability for S&T and science and mathematics and to foster competent persons capable of leading future S&T. (In Japan, the International Biology Olympiad is to be held in FY 2009, and the International Chemistry Olympiad in FY 2010.) (Table 2-3-6).

**(Fostering Next-generation Scientists)**

In FY 2008, JST launched the program Fostering Next-generation Scientist to foster excellent, aspiring scientists by supporting projects carried out by universities in order to provide a continuous supply of high-level, evolutionary learning experiences outside the schools throughout the year to pupils who have excellent motivation and ability in science and mathematics.

**(Interconnection between upper secondary schools and universities)**

It is important to develop the individuality and capacity of talented pupils and students, and improvement in the interconnection between upper secondary schools and universities is essential for that. In this regard, in FY 2008, about 70% or more of universities adopted the admission office (AO) entrance examination, which comprehensively evaluates the applicants' capacity, aptitudes and motivation.

## Table 2-3-6 International Science Olympiads 2008 Japanese Medalists

### ●International Mathematical Olympiad (IMO)

Gold

Norifumi Seki
3rd grade, high school
(Hyogo)

Gold

Makoto Soejima *1
2nd grade, high school
(Tokyo)

Silver

Tomohiro Asano
3rd grade, high school
(Hyogo)

Silver

Shiro Imamura
2nd grade, high school
(Hyogo)

Silver

Kazuhiro Hosaka *1
2nd grade, high school
(Tokyo)

Bronze

Motoki Takigiku *1
2nd grade, high school
(Tokyo)

### ●International Physics Olympiad (IPhO)

Gold

Yuto Murashita
3rd, grade high school
(Hyogo)

Silver

Eiichi Matsumoto *2
3rd grade, high school
(Tokyo)

Bronze

Shuhei Yoshida
3rd grade, high school
(Hiroshima)

### ●International Chemistry Olympiad (IChO)

Bronze

Seiichi Azuma
3rd grade, high school
(Hyogo)

Bronze

Yuta Suzuki
3rd grade, high school
(Miyagi)

Bronze

Norihito Fukui
3rd grade, high school
(Hyogo)

Bronze

Naoya Ozawa
2nd grade, high school
(Tokyo)

### ●International Biology Olympiad (IBO)

Silver

Yu Uchiumi
3rd grade, high school
(Chiba)

Silver

Ihori Ebinuma
3rd grade, high school
(Tokyo)

Silver

Kentaro Ohkawara
2nd grade, high school
(Tokyo)

Bronze

Shunichiro Mizuno
3rd grade, high school
(Fukui)

### ●International Olympiad in Informatics (IOI)

Gold

Kazuhiro Hosaka *1
2nd grade, high school
(Tokyo)

Silver

Makoto Soejima *1
2nd grade, high school
(Tokyo)

Bronze

Eiichi Matsumoto *2
3rd grade, high school
(Tokyo)

Bronze

Motoki Takigiku *1
2nd grade, high school
(Tokyo)

The information in parentheses indicates the location of the participant's school.
Photo Credit: [Mathematics] Mathematical Olympiad Foundation of Japan, [Physics] Organization of Japan Physics Challenge Olympiad Committee [literal translation], [Chemistry] Chemical Society of Japan, [Biology] Organization of Japan Biology Olympiad Committee, [Informatics] Japanese Committee for International Olympiad in Informatics
Note 1: Soejima, Hosaka, and Takigiku won medals at the both IMO and IOI.
Note 2: Matsumoto won medals at the both IPhO and IOI.