

Chapter 4 Enhancement of Basic Research and Human Resources

Section 1 Drastic Enhancement of Basic Research

The significance and importance of basic research have increased in recent years as basic research plants the seeds for driving innovation (seedbed for diversity), extensively creates new intellectual and cultural values, and makes direct and indirect contributions to social development. In order to ensure the basis of STI in Japan, it is essential for Japan to focus on creative, diversified basic research and aggressively promote those projects; therefore, the government will implement efforts to drastically enhance basic research.

1 Enhancement of Creative and Diverse Basic Research

Basic research that is rooted in the intellectual curiosity and the spirit of inquiry among researchers, and that is conducted based on their initiative and creativity, will lead to the creation of intellectual assets common to humankind and to the accumulation of profound knowledge. The government will, therefore, strengthen efforts to promote such creative, diversified research extensively and consistently.

(Grants-in-Aid for Scientific Research)

Grants-in-Aid, offered by MEXT and the Japan Society for the Promotion of Science, are the only competitive research funds that cover all kinds of academic research (research based on researcher's creative ideas) across the entire spectrum of scientific fields, ranging from the humanities and social sciences to the natural sciences. By supporting creative research activities while maintaining the diversity of research, the grants play important roles in promoting the expansion of the range of scientific research, the development of long-term studies and the accumulation of profound academic knowledge.

Starting from FY 2011, the fund allows researchers to use the grants over multiple years at their discretion in various categories (Scientific Research [C], Challenging Exploratory Research, and Grant-in-Aid for Young Scientists [B]). In all these categories, selection rates have been increased to about 30% (FY 2011 budget: 263.3 billion yen). In the main research categories, about 26,000 applications were selected through peer review¹ from approximately 92,000 new applications and approximately 64,000 cases were supported, including research projects that continued for multiple years.

(Strategic Basic Research Programs)

The Japan Science and Technology Agency (JST) is conducting the "Strategic Basic Research Programs (creation of new technological seeds)" to achieve national policy objectives. The agency promotes purpose-orientated basic research that aims to create new technological "seeds" that can lead to innovation by forming time-limited consortia across institutional boundaries (virtual institute).

¹ Application screening conducted by multiple researchers in the same academic field.

(Promotion of the Joint Usage / Research system in universities and inter-university research institutes)

Inter-university research institutes and joint usage / research centers in universities (83 centers in 34 universities, as of April 2011) have large facilities and adequate equipment as well as valuable materials and data. MEXT is promoting the Joint Usage / Research system that allows researchers to jointly use the assets for their research regardless of the organization to which each of them belongs.

(Promotion of seeds creation by the Ministry of Agriculture, Forestry and Fisheries)

The Ministry of Agriculture, Forestry and Fisheries (MAFF) has been developing DNA-assisted selection marker methods that use a massive amount of genetic information obtained through the progress of genome analysis to identify and use many genes of crops that are important in agriculture (resistance to disease and pest, etc.).

The MAFF is also conducting the creation of technological seeds that are intended to identify, and then use the genes related to complex agricultural characteristics, such as yielding ability and quality, by using the ultra-high-speed sequencer¹ with a dramatically improved genome sequencing speed.

In addition, the genome research has been promoted to apply its results to livestock and insects to create new demands for medical materials.

The MAFF is also working on the development of nanoscale processing / evaluation techniques for rice and other grains to develop new food materials using nanotechnology.

2 Enhancement of World Class Basic Research

Over recent years, global competition in recruiting the best and brightest researchers has intensified. To maintain and improve Japan's scientific and technological standing, we need to position ourselves within the global flow of outstanding human resources while creating research platforms that will naturally attract and amass such human resources in Japan.

(Establishment of World Premier International Research Centers)

Concerning this issue, MEXT has promoted the “World Premier International Research Center Initiative (WPI)” which aims for the establishment of “globally visible research centers,” each of which provides an excellent research environment and a high level of research capable of attracting top-level researchers from around the world. Each research center receives 1.3 billion yen on average per year, and this support is scheduled to continue for 10 years (15 years to a center with outstanding results). Currently, six centers are in operation (Figure 2-4-1). This program also aims to realize the creation of “globally visible research centers,” which will verify progress and take other appropriate action, by building a strong follow-up system centered on the “WPI Program Committee”(chaired by Hiroo Imura: ex-president of Kyoto University) as its main organization.

¹ Device for reading base sequences that compose DNA

Figure 2-4-1 / World Premier International Research Center Initiative (WPI)



World Premier International Research Center Initiative (WPI)

《Background》 Competition for securing the world's finest brains has intensified. To maintain and improve Japan's scientific and technological standing, we need to place ourselves within the global flow of outstanding human resources while creating research platforms that attract them from around the globe.

《Purpose》

The WPI provides priority support for proposals aimed at creating world premier international research centers. By achieving a very high research standard and providing an excellent research environment, the centers should be "globally visible research centers," able to attract top-level researchers from around the world.

《Requirement for creating centers》

- **Physical concentration** (or core) of talented researchers
- **International-standard** administration and environment
 - **Strong leadership** by center director
 - **English** as the primary language (including at administrative division)
 - **Environment** in which researchers can **devote themselves exclusively** by providing sufficient staffs etc.
- **Securement** of additional resources that match or exceed the amount of the project grant







(Image of research centers)

- At least 10-20 world-class principal investigators (PI)
- A total of at least 200 staff members
- **At least 30% overseas** researchers

→ "Advancing leading-edge research", "Creating interdisciplinary domains", "Establishing international research environments", "Reforming research organizations"

《Program Contents》

- Targeted fields
 - Basic research
 - Funding period
 - 10 years
 - (15 years for a center with outstanding results)
 - Project funding
 - Around ¥1.3-1.4 billion a year per center
 - Follow-up
 - Scrutinized supervision of progress by strong follow-up system centered on the "WPI Program Committee," including members of Novel laureate and noted foreign intellectual, as its main organization has been carrying out.

<p>Osaka University IFReC:Immunology Frontier Research Center —Elucidating the dynamic immune system using Biomaging technology Director: Shizuo Akira  The most cited immunologist in the world over the past ten years</p>	<p>Kyoto University iCeMS:Institute for Integrated Cell-Material Sciences — Integrating cell and material sciences to create new cross-disciplinary-fields, thereby advancing stem cell technologies and mesoscopic sciences Director: Norio Nakatsui  Japan's pioneer in the establishment and distribution of human ES cell lines, and a leader in ES/iPS cell-based drug discovery</p>	<p>Tohoku University AIMR:Advanced Institute for Materials Research — Discovering innovative substances and creating related devices/systems using atomic/molecular control methods Director: Motoko Kotani  Mathematician; leader of the interdisciplinary research between math and material science in Japan</p>
<p>(Five centers adopted in 2007) (One center adopted in 2010)</p>		
<p>Kyushu University FCNER:International Institute for Carbon-Neutral Energy Research — Creating science-driven technologies for producing, storing and using hydrogen and for capturing and sequestering CO₂ Director: Petros Sofronis  Rationalized and linked experimental evidence of hydrogen-induced plastic flow localization at the macroscale with the shielding effect of hydrogen at the microscale</p>	<p>The University of Tokyo Kavli IPMU:Kavli Institute for the Physics and Mathematics of the Universe — Elucidating the origin and evolution of the universe through collaboration among math, physics and astronomy Director: Hitoshi Murayama  Leading theorist in particle physics and principal investigator of a world-leading observational project in astrophysics</p>	<p>National Institute for Material Science(NIMS) MANA:International Center for Materials Nanoarchitectonics — Developing materials to advance sustainable development based on nanoarchitectonics Director: Masakazu Aono  Pioneer in nanoscale science and technology; awarded the Feynman Prize, etc.</p>

Source : Created by MEXT

Section 2 Development of Human Resources that can Lead S&T

Japan is poor in natural resources and its population is expected to continue decreasing in the future. In order to vigorously push forward the STI policies in this country, it is essential to constantly foster and secure human resources who will become leaders in these fields. We should take measures so that people who will lead the future of our country can proactively enter the fields of STI with visions and hope. Therefore, we are actively making efforts to foster and secure human resources who are able to demonstrate their capabilities at home and abroad, lead the world in their specialties, and lead the next generation, as well as the efforts to improve their career paths.

1 Development of Human Resources Capable of Working Actively in Diverse Scenes

(1) Drastic enhancement of graduate school education

In modern society, where S&T have been highly advanced, knowledge has been increasingly specialized and fractionalized, and international competition has been intensified. Our urgent issue is to foster human resources who have profound professional knowledge and a wide range of practical skills that can be applied to new fields of study and rapid technological innovation. Graduate schools should play a key role in developing such human resources, and the number of their students has increased by a factor of 2.8 in