FY2009

BASIC RESEARCH PROGRAMS
(CREST, PRESTO)

Invitation for Application of Research Proposals
[Application Guideline]

Japan Science and Technology Agency
Office of Basic Research

March, 2009

Notes for Application of Research Proposals for FY2009

1. **Segmentation of the invitation for application period and Application Guideline**

In FY 2009, the applications of Research Proposals of Basic Research Programs (CREST and PRESTO) are invited as in the table below.

Please note that only one application can be submitted through all the Research Areas in CREST and PRESTO.

Furthermore, note that the deadline for the application period differs for each research type as follows.

Research Type	Research Area of Research Proposals to be applied for	Application Period for Research Proposals
CREST	Already existing Research Areas started in FY2007 and FY2008 term and new Research Areas starting in FY2009	March 17, 2009 (Tue) to **May 19, 2009 (Tue) at 12:00 hour (noon)**
PRESTO	Already existing Research Areas started in FY2007 and FY2008 terms and new Research Areas starting in FY2009	March 17, 2009 (Tue) to **May 12, 2009 (Tue) at 12:00 hour (noon)**

2. Application method Important

The research proposals will be made using the Cross-ministerial R&D Management System (e-Rad).

Please obtain a login ID for e-Rad to apply for a CREST Research Director position or for a PRESTO individual Researcher position (No login ID is required for a CREST Main Research Collaborator position at the time of application; however, one is required when accepted.). Before obtaining a login ID for e-Rad it is necessary to (1) register research institute information on e-Rad (by system administrator in MEXT) and register researcher information on e-Rad (by administrative staff in those institutes) for researchers affiliated with research institutes and (2) register researcher information on e-Rad (by e-Rad system administrator in MEXT) for those researchers unaffiliated with a research institute. Refer to the e-Rad portal site below for the registration method. The registration procedures may take several days; please, start the registration procedure at least two weeks in advance. When registration is complete, there is no need to re-register when other ministries invite applications for their programs or projects. Also, it is not necessary to re-register when registration is already complete for programs or projects at other ministries.

In addition, the application for CREST and PRESTO does not need the approval of the research institution, and will be submitted by the applicant him/herself.

Cross-ministerial R&D Management System (e-Rad) Portal Site
http://www.e-rad.go.jp/ (Japanese only now)

3. Research proposals for CREST

- For CREST research proposals, please choose from the two Research Expense classes. For details, see section II. B. 6. “Research Expenses” (page 11 to 12).
- For Research Team organization, please propose an optimal research group that would best represent the research concept of the Research Director. If setting up a group of Research Collaborators, aspects such as the need for the group, the appropriateness of the research expenses allocations to the group, and cost performance will be important considerations.

4. Research proposals for PRESTO

- ”High impact type” was newly started in 2009. The achievement is not clearly envisioned; however, research proposals that promise significant and revolutionary results when accomplished will be adopted.
- In the case of the research proposal for Research Areas started in FY2008 and 2009 of PRESTO, please choose from research periods of 3 or 5 years. For details, see section II. C. 4. “Research Periods”.
- When selecting, a period that matches the research proposal is a very important decision.

JST promotes gender equality!

JST is promoting gender equality in science and technology.

The Council for Science and Technology Policy has described about the slogan of "Promoting the activities of female researchers" in the 3rd Basic Program for Science and Technology (http://www8.cao.go.jp/cstp/kihonkeikaku/index3.html), which has policies to promote in research and technology by the Japanese Government until FY2010. There is the consideration that the future of technology in Japan relies upon the power of those who play an active part, and that it is essential that an environment must be established in which diverse and versatile individuals can demonstrate their ambition and potential. As the part, it has a definite numerical target as "the prospective overall recruitment target of female researchers for natural sciences should be 25%."

JST hung up as one of the activity ideas at the time of promoting an enterprise as follows, "JST decided a plan of JST promotes gender equality, and promote to advance production of environment which can demonstrate capability on various research talented people, such as a female researcher with their own initiative."

Selection of new subjects will also be advanced based on the viewpoint of gender equality. Proposals of research plans will be strongly appreciated in which men and women can participate and play an active part together. Moreover, active applications from both male and female researchers will be invited.

KITAZAWA Koichi, Ph.D.
President
Japan Science and Technology Agency

For a further leap forward

All female researchers, let's take this opportunity to apply for a further leap forward!

The percentage of female researchers is 13% (As of 2007. 2008 report on Survey of Research and Development by Ministry of Internal Affairs and Communications). The number is rising but still very low. Some of the reasons behind this low number include the difficulties in continuing research due to child bearing, child rearing and nursing care, inadequate system for the employment of female researchers, very limited number of female students who major in science, and majors in limited areas.

The government is working on this issue.　I believe that change in the way of thinking of female researchers is also necessary.　I would like these capable individuals to take the challenge of continuing their studies towards a further step-up and avoid giving up, or accepting the idea that "This is my limit." or "I am okay with where I am now"

I hope that female researchers will take this opportunity to apply themselves, develop their own research ideas, prosper as researchers, and become role models to encourage others.

Kashiko KODATE
Program Director
Office for a Gender Equal Society,
Japan Science and Technology Agency
(Professor, Japan Women's University)

JST Gender Equal Society website: http://www.jst.go.jp/gender/ (Japanese only)

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I. Outline of Programs

1. Object of Basic Research Programs

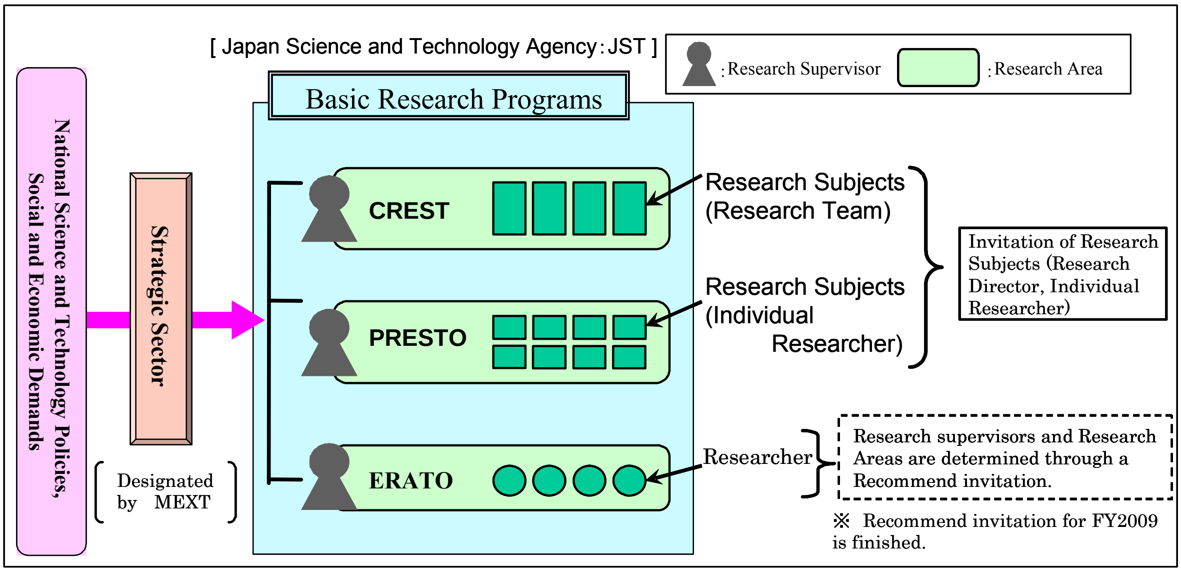
JST promotes basic research in prioritized research fields with these programs that are positioned as one of the essential research systems leading innovations in science and technology which bring revolutions in the society and the economy. We aim at creating innovative technology seeds that lead to further development of science and technology and help new industries to emerge.

2. Outline of the Basic Research Programs

The national government (the Ministry of Education, Culture, Sports, Science and Technology) sets overall strategy "Strategic Sector" with large social impact in accordance with national policies on science and technology, and social/economic needs of nation. JST sets "Research Areas" based on the strategic sectors, and promotes objective basic research in order to achieve these objectives under the Research Supervisors' leadership.

The Research Areas of CREST and PRESTO of these Programs are administrated as Virtual Institutes by Research Supervisors who are responsible for the Research Areas.

Research proposals will be invited for each research areas. The selection of each Research Subjects will be conducted by the Research Supervisors in cooperation with each research area advisors. Under each Research Area, the selected Research Directors of CREST who organize the research team, or the selected Researchers of PRESTO carry out their researches.



II. Guidance for Application and Selection

A. General

This section describes the common issue for Application for Research Proposals of CREST and PRESTO. For specific issues for each research type, please refer to "II. B. CREST" and "II. C. PRESTO".

1. Research Areas for which the Research Proposals are invited

(1) The research areas considered for the Research Proposal Invitation for Applications are in 14 CREST and 13 PRESTO Research Areas. Please note that only one application can be submitted through all the Research Areas in CREST and PRESTO. Pertaining to duplicated applications, see section VI. "Duplicated Applications for JST Programs"

Please note that only one application can be submitted through all the Research Areas in CREST and PRESTO.

CREST（Application period: Mar. 17(Tue) to May 19(Tue), 2009 12 p.m. (noon)

Research Areas (Research Supervisor)	Page	Strategic Sectors	Page	Set up year of Research Areas
Creation of human-harmonized information technology for convivial society (Research Supervisor: Yoh'ichi	51	Creation of Fundamental Technologies for Harmonization of Information Environment with Human	101	FY2009 (New Research Areas)
Creative research for clean energy generation using solar energy (Research Supervisor: Masafumi Yamaguchi)	53	Creation of natural light energy conversion materials and utilization of basic technologies through the interaction of various research fields	104	
Elucidation of the principles of formation and function of the brain neural network and creation of control technologies (Research Supervisor: Seiji Ozawa)	55	Clarification of the control mechanisms of neural circuit operation and its formation	110	
Innovative Technology and System for Sustainable Water Use (Research Supervisor: Shinichiro Ohgaki; Mikio Yoda)	57	Development of innovative technologies for realizing sustainable water management by mitigating water problems intensified by climate change	113	
Fundamental technologies for medicine concerning the generation and regulation of induced pluripotent stem (iPS) cells (Research Supervisor: Toshio Suda)	59	Creating fundamental technologies for advanced medicine through generation and regulation of stem cells, based on cellular reprogramming	116	FY2008
Enhancing applications of innovative optical science and technologies by making ultimate use of advanced light sources (Research Supervisor: Tadashi Itoh)	61	Enhancing advanced materials science and life science toward innovations using new light sources, including state-of-the-art laser technology	117	

Creation of nanosystems with novel functions through process integration (Research Supervisor: Jun'ichi Sone)	63	Creation of next-generation nanosystems through process integration	120	
Development of high-performance nanostructures for process integration (Research Supervisor: Masahiro Irie)	65			
Creation of innovative technologies to control carbon dioxide emissions (Research Supervisor: Itaru Yasui)	66	Creation of innovative technologies related to reducing global warming in an effort to realize a sustainable society	122	
Etiological basics of and techniques for treatment of allergic and autoimmune diseases (Research Supervisor: Kazuo Sugamura)	68	Development of medical technology using immunoregulation to overcome allergic and autoimmune diseases including pollinosis	125	
Creation of a novel technology towards diagnosis and treatment based on understanding of molecular pathogenesis of psychiatric and neurological disorders (Research Supervisor: Teruhiko Higuchi)	69	Creation of innovations toward the development of diagnosis and treatment of psychiatric and neurological disorders based on elucidation of complex and higher brain functions	133	FY2007
Fundamental technologies for dependable VLSI system (Research Supervisor: Shojiro Asai)	71	Development of fundamental technologies for the large-scale integrated-circuit system that can guarantee high reliability and high security	135	
Research of innovative material and process for creation of next-generation electronics devices (Research Supervisor: Hisatsune Watanabe)	73	Exploitation of materials and nanoprocesses for the realization of novel electronic devices with novel concepts, novel functions and novel structures	137	
Alliance for breakthrough between mathematics and sciences (ABMS) (*1) (Research Supervisor: Yasumasa Nishiura)	75	Search for Breakthrough by Mathematical / Mathematical Sciences Researches toward the Resolution of Issues with High Social Needs (Focusing on Collaboration with Wide Research Fields in Science and Technology)	140	

PRESTO (Application period: Mar. 17(Tue) to May 12(Tue), 2009 12 p.m. (noon)

Research Areas	Page	Strategic Sectors	Page	Set up year of Research Areas
Information environment and humans (Research Supervisor: Toru Ishida)	76	Creation of Fundamental Technologies for Harmonization of Information Environment with Human	101	FY2009 (New Research Areas)

Photoenergy conversion systems and materials for the next generation solar cells (Research Supervisor: Shuzi Hayase)	78	Creation of natural light energy conversion materials and utilization of basic technologies through the interaction of various research fields	104	
Light energy and chemical conversion (Research Supervisor: Haruo Inoue)	80			
Formation of and information processing by neural networks, and control (Research Supervisor: Fujio Murakami)	82	Clarification of the Control Mechanisms of Neural Circuit Operation and its Formation	110	
Epigenetic control and biological functions (Research Supervisor: Tsunehiro Mukai)	84	Creating fundamental technologies for advanced medicine through generation and regulation of stem cells, based on cellular reprogramming	116	
Understanding life by iPS cells technology (Research Supervisor: Shin-Ichi Nishikawa)	85			FY2008
Innovative use of light and materials/life (Research Supervisor: Hiroshi Masuhara)	87	Enhancing advanced materials science and life science toward innovations using new light sources, including state-of-the-art laser technology	117	
Nanosystem and function emergence (Research Supervisor: Yoshihito Osada)	89	Creation of next-generation nanosystems through process integration	120	
Decoding and controlling brain information (Research Supervisor: Mitsuo Kawato)	91	Creation of innovative fundamental technologies for utilizing information related to action and judgment in the brain	128	
Synthesis of knowledge for information oriented society (Research Supervisor: Hideyuki Nakashima)	93	Creation of fundamental technology for the generation and utilization of “knowledge” from diverse and large-scale information.	130	
Materials and processes for innovative next-generation devices (Research Supervisor: Katsuaki Sato)	95	Exploitation of materials and nanoprocesses for the realization of novel electronic devices with novel concepts, novel functions and novel structures	137	FY2007
Alliance for breakthrough between mathematics and sciences (ABMS) (*1) (Research Supervisor: Yasumasa Nishiura)	96	Search for Breakthrough by Mathematical / Mathematical Sciences Researches toward the Resolution of Issues with High Social Needs (Focusing on Collaboration with Wide Research Fields in Science and Technology)	140	

Innovative model of biological processes and its development (Research Supervisor: Nanako Shigesada)	99	Elucidation of the Dynamic Mechanism of Biological System and Establishment of Fundamental Technology	142	

(*1) In the Research Area "Alliance for Breakthrough between Mathematics and Sciences (ABMS)", both CREST and PRESTO research proposals will be considered. As shown above, please note that the application periods for CREST and PRESTO research proposals are different.

2. **Schedule of application and selection**

The schedule for Applications and the selection period is as follows:

(All dates in the table below are for 2009)

	CREST	PRESTO
Start accepting research proposals	March 17 (Tue)	
Application deadline (Deadline for applications through the e-Rad)	May 19 (Tue) at 12:00 noon (No delay accepted)	May 12 (Tue) at 12:00 noon (No delay accepted)
Document screening period	Late May – Mid-July	
Notification of document screening results	Mid-July – Late July	
Interview period	Late July – Mid-August	
Notification/announcement of selected research subjects	Late August	
Research begins	After October	

* The underlined dates are final, but all others are expected dates. They are subject to change.
* The schedule of interview selection will be announced on the homepage listed below as soon as it is fixed.
  http://www.jst.go.jp/kisoken/teian-en.html

3. Application method

The research proposals will be made using the Cross-ministerial R&D Management System (e-Rad)*. For details application method through **e-Rad**, see Appendix 3.

Please obtain a login ID for e-Rad to apply for a CREST Research Director position or a PRESTO individual researcher position (No login ID is required for a CREST Main Research Collaborator position at the time of application; however, one is required when accepted).

Before obtaining a login ID for e-Rad, it is necessary to (1) register research institutes information on e-Rad and register researchers information on e-Rad (by administrative staff in those institutes) for researchers affiliated with research institutes and (2) register researchers information on e-Rad for those researchers unaffiliated with a research institute. Refer to the e-Rad portal site below for the registration method. The registration procedures may take several days; therefore, please start the registration procedures at least two weeks in advance. When registration is complete, there is no need to re-register when other Ministries invite applications for their programs or projects. Also, it is not necessary to re-register when registration is already effectuated for programs or projects at other ministries.

In addition, the application for CREST and PRESTO does not need the approval of the research institution, and will be submitted by the applicant him/herself.

*The Cross-ministerial R&D Management System (e-Rad) is an online, cross-ministerial system to manage the process relating to R&D management (invitation for application → selection → adoption → management of adopted subject →research achievements report), centering on competitive funding.

Cross-ministerial R&D Management System (e-Rad) Portal Site
http://www.e-rad.go.jp/ (Japanese only now)

When the proposal by e-Rad is difficult, the case of the application for registration to e-Rad by research institution is difficult etc., please contact us at the addresses at the end of this Guideline.

B. CREST

Please be sure that you read and understand the following descriptions 1 to 14, “II. Guidance for Application and Selection A.General 1.-3.”, “V. Notes for Application” and “VI. Duplicated Applications for JST Programs” when preparing your application.

1. The system of promoting CREST research

Please refer to “I. Outline of Program” for the objectives and overview of all JST Basic Research Programs. The following describes the system of promoting “CREST (team type) research”.

(1) Overview and characteristics of CREST

a. The objective of CREST is to promote objective basic studies that are leading, creative and at an internationally high level in an attempt to achieve strategic sectors set by the government, so as to create innovative technological seeds that can contribute to the creation of new industries in the future. By the research achievements, CREST is to produce a significant impact on the development of future science and technology.

b. Research Supervisors in charge of Research Areas coordinate researchers spreading across different institutions of industry, government and academia and run the Research Areas as a "Virtual Institute."

c. Research proposals (“Research Subjects”) are collected in each Research Area, which are screened by the Research Supervisor in cooperation with Research Area Advisors and other members.

d. The Research Director directs an appropriate Research Team (group of researchers, research assistants, etc., formed for conducting studies), and implements the Research Subjects. Each Research Director shall be responsible for the entire process of carrying out research on the Subject.

(Note) The research team is headed by the Research Director. In addition to the constituent members of the laboratory of the Research Director, if deemed necessary for the execution of the research concept of the Research Director, researchers from different laboratories or institutions may be included on the team.

(2) Research Supervisors

A Research Supervisor is responsible for a Research Area. As the head of the Virtual Institute, that person manages the studies in the Research Areas by selecting Research Subjects, adjusting research plans (including budgeting research expenses and organizing Research Teams), exchanging opinions with Research Directors, providing advice for studies, evaluating Subjects, and other necessary means.

(3) Research plans

a. After the adoption, Research Directors shall prepare an overall research plan for the entire period of implementing the Research Subjects. They shall also prepare an annual research plan for each fiscal year. Research plans will include Research expenses budgeting and Research Team organization.

b. Such research plans (both overall and annual research plans) will be finalized upon confirmation and approval by the Research Supervisors. Research Supervisors shall offer advice, make adjustments or give instructions as necessary for matters concerning the research plans based on the selection process, opinions exchanged with Research Directors, daily research progress, results of the research evaluation, etc.

c. Research Supervisors might make adjustments among different Research Subjects when deciding on Research Subject plans to accomplish the goals of the entire Research Area.

(4) Research subjects evaluation

a. Research Supervisors shall understand the status of research progress and results, and conduct midterm evaluation and *ex post* evaluation of Research Subjects in cooperation with the Research Area Advisors and other members. If the research period extends through five years, the midterm evaluation should be held three years after the research starts and the *ex post* evaluation will be performed immediately after the research is completed.

b. The research evaluation may be held at times other than those specified above if the Research Supervisors deem it necessary.

c. Results of the research evaluation such as the midterm evaluation will be reflected in the adjustment of subsequent research plans and resource allocation (including increase/decrease in the research expenses, review of Research Team organization, etc.). Adjustments among Research Subjects or cancellation of some Subjects might occur in some cases.

d. After a fixed period from research termination, a follow-up survey will be conducted about the development and practical use situation of research achievements, participating researchers' activity, etc. Based on the follow-up survey result, external specialists assigned by JST shall perform a follow-up evaluation

(5) Research areas evaluation

In addition to the research evaluation described in (4), Research Area evaluation will be conducted to evaluate the Research Areas and Research Supervisors. Research Area evaluation also consists of midterm evaluation and ex-post evaluation. The evaluation will be made in view of progress toward the achievement of strategic sectors, management of Research Areas, etc.

(6) Ownership of research agreement and intellectual property rights

a. In principle, after Research Subjects are selected, JST will enter into a contract research agreement with research institutions to which Research

Directors and Main Research Collaborators (*) belong.
*"Main Research Collaborator" refers to the representative of researchers comprising the Research Team who are affiliated with research institutions other than that of the Research Director. A group of Research Collaborators (group of researchers who belong to different institutions from the Research Director of the Research Team concerned) is referred to as a "Collaborative Research Group."

b. The institution concerned might be unable to do research when a research agreement cannot be concluded with an institution, no organization necessary for management and audit of public research expenses can be prepared, or for whom the financial status is considerably unstable. For details, please refer to 12. "Requirement, responsibilities of research institution"

c. JST will pay indirect costs (overhead costs) to a maximum of 30% of contract research expenses (direct costs) to research institutions in accordance with the contract research agreement.

d. In principle, intellectual property rights such as patents obtained through the research will be vested in research institutions under the contract research agreement in accordance with Article 19 (Japanese version of the Bayh-Dole Act) of the Industrial Technology Enhancement Act.

<Reference: Changes made to the CREST program since 2004>
As a rule, all research expenses will be administered by research institutions as contract research expenses in the CREST Research Areas initiated in or after 2004 (all Research Areas accepting research proposals this year). (A large part of the research expenses in the Research Areas initiated during or prior to 2003 is administered by JST, whereas a part of the Funds is managed as Contract research expenses by research institutions.)

2. Applicant requirements

The applicants to be the Research Directors must submit proposals in person. The applicant requirements are as follows:

(1) The applicant must be a researcher who organizes a Research Team of several to approximately 20 members and promotes a Research Subject.

(2) A Research Director must be personally affiliated with a domestic research institution and conduct research there.

Note 1: "Domestic research institutions" refers to universities, independent administrative institutions, national/public testing and research institutions, specially authorized corporations, public-service corporations and enterprises, etc., which must satisfy predetermined requirements. For details, please refer to "12. Requirements and responsibilities of research institution"

Note 2: Any individual who satisfies any of the following conditions is also eligible to apply as a Research Director.

- A researcher holding citizenship other than Japanese who belongs to a domestic research institution.
- A researcher who is not currently affiliated with a particular research

institution, but who will be affiliated with a domestic research institution and able to conduct research there if selected as a Research Director.

- A Japanese researcher currently residing overseas who will be affiliated with a domestic research institution and able to conduct research there if selected as a Research Director.

(3) The applicant must be a researcher who can be responsible for the entire Research Subject as one in charge of his or her own Research Team throughout the research period.

Note: The Research Proposal might be excluded from selection process if a Research Director and the Research Supervisor have a vested interest in each other. (For details, see "7.(3) Selection process", page 12).

3. Eligible research proposals

(1) In Research Proposal Invitation for Applications for CREST, FY2009, research proposals are invited in 14 Research Areas established based on 13 strategic sectors in "IV. Strategic Sectors. Please read thoroughly "III. Outline of the Research Area and Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area", and present one research proposal that is appropriate for the Research Area. Only one application for research proposal is allowed over CREST and PRESTO. The application for research proposals is limited to one in the Research areas iterated above. Applications are not accepted for both CREST and PRESTO.

(2) We expect to receive proposals for leading and original studies that will create new technology and industries, bring about innovative development of science and technology, which will be highly valued at the international level. Any research proposal that carries out only a part of another research project or subject, and research proposal that outsources a substantial portion of the research are not applicable.

4. Research Team organization

(1) Make a proposal for necessary, sufficient and optimal Research Team organization to execute the research concept of the Research Director.

(2) A Research Team might be headed by the Research Director. In addition to the constituent members of the laboratory of the Research Director, if deemed necessary for the execution of the research concept of the Research Director, researchers from different laboratories or institutions may be included on the team. If including other laboratories, their necessity and effectiveness are important points to consider in the selection.

(3) When necessary for research progress, researchers (including non-Japanese), research assistants, etc. may be employed to join a Research Team within the scope of research expenses.

(4) A researcher affiliated with an overseas research institution might join a Research Team and carry out research in the overseas research institution upon the approval of the Research Supervisor when the following two conditions are met.

a. The research at the overseas research institution is deemed indispensable for realizing the research concept of the Research Director and the research could not be conducted anywhere but at the overseas institution.

b. Intellectual property rights can be shared between the overseas research institution and JST.

(Note) If you wish to form a Research Team that includes an overseas research institution, write in CREST-Form 11 the reasons why the collaborative researcher affiliated with an overseas institution is needed.

5. Research period

(1) The research period is five (5) years.

(2) The research may be ended at the end of the last fiscal year of the research period. (e.g., a research project selected in FY2009 to run for a period of five years will end on the last day of March 2015 for the maximum period.)

6. Research Expenses

(1) Choose the class of your research subject from the following two by estimating total research expenses required for your research proposal. Propose optimal research expenses based on the standard of the total research expenses for each class described blow, to execute your research concept (the following total research expenses are merely standard and not limited to the following range).

When selecting, which research expense class was chosen is an important factor for consideration. Fund class Ⅱ (high expenses) proposals, compared to Fund class Ⅰ ones, are expected to give substantially greater research results and, simultaneously, require a much greater responsibility; therefore, examine carefully your research expense options and system structure.

Fund class	Approximate total research expenses
I	About 150 – 250 Million Yen (30 – 50 Million Yen/yr for 5-Year Research)
Ⅱ	About 300 – 500 Million Yen (60 – 100 Million Yen/yr for 5-Year Research)

(Note) Please describe the total research expenses through the research period (unit: 1 million yen) in CREST-Form 1 of Research Proposal Application, and your research expense plan for every item of expenditure and the research expense plan for every research group in CREST-Form 6 of the Research Proposal Application.

(Note) A proposal of greater scale is also acceptable depending on the research contents. Please itemize and describe "Needs for large research expenses" on the specific information field of CREST-Form 6 of the Research Proposal Application when the total research expenses exceed 600 million yen.

(2) The research expenses will be administered as Contract research expenses by the research institutions to which the Research Directors and Collaborative Research Group Leaders belong.

(3) "Research Expenses" described in (1)–(2) above indicate direct costs. The indirect costs (overhead costs) paid to research institutions by JST to a maximum of 30% of direct costs will be appropriated separately by JST.

(4) The Research Expenses (direct costs) will be used for the following purposes.

A. Research Expenses (direct costs) are allocated to cover the costs which are directly required for carrying out the CREST research concerned, which might be used for the following purposes.

(1) Cost of goods and supplies: To purchase new facilities, equipment and consumables etc.

(2) Travel expenses: Travel expenses incurred by Research Directors and research participants (Research Team members), and other expenses such as travel expenses for inviting individuals who are directly necessary to carry out the CREST research.

(3) Rewards, remuneration, etc.

・Labor costs: In principle, researchers, engineers, research assistants, etc. , who are newly employed on an annual salary basis to engage in the CREST research. Those who work full-time for the research are subject to payment.

・Rewards: Engineers, assistants, data processing staff, etc. , who are employed for a fixed period. Guest lecture fees and other rewards might be included.

(4) Other: In addition to the purposes specified above needed to carry out the CREST research, the following expenses, for example, might also be covered.

・Cost of research presentations (posting a research paper, printing, and publication, etc.)

・Equipment lease expense, books, freight costs

B. The following expenses cannot be covered by the research expenses (direct costs).

(1) Expenses those are not consistent with the CREST research objectives.

(2) Expenses considered appropriate to be treated as indirect costs.

C. Please inquire to JST should there be any difficulty in determining whether to expend a payment as part of research expense.
(Refer also to “Q&A” at the end of the Guidelines.)

* JST requests that the research institutions administer the research expense in a flexible and efficient manner. Because the studies are funded through the national budget, certain rules and guidelines apply for some projects through written contracts or instruction manuals for administrative procedures, based on which the institutions are to properly handle the Funds.

7. Selection process

Please refer to “II.A.2.Schedule of application and selection” for the schedule.

(1) The Research Supervisor in each Research Area will conduct the selection in two steps – document screening and interview – with the cooperation of Research Area

Advisors and other members. Other examinations may be added if necessary. An outside reviewer may join to cooperate in the selection whenever necessary. JST will determine the Research Directors and Research Subjects based on this selection.

(2) In accordance with the JST rules and in order to maintain the evaluation process to be fair and transparent, the following individuals will not participate in the evaluation;

a. Any person who is a relative of the applicant;

b. Any person who belongs to the same faculty or research laboratory at a university and research institution as the applicant, including a national institute or who belongs to the same corporation as the applicant;

c. Any person who conducts close collaborative research with the applicant. (For example, a person who is regarded to be in the same research group as the applicant, including any individual who participates in a collaborative project, who jointly writes research papers, or who conducts research with the same objective, or a person who shares a research subject with the applicant);

d. Any person who is in a position to supervise the applicant or vice versa, or who is a direct employer of the applicant;

e. Any person who is a direct competitor in a research subject of the applicant; and

f. Any individual regarded by JST to have a close relationship with the applicant.

(3) **Further, in the event that a Research Supervisor has the following relationship with an applicant with respect to a Research Area started in FY2009, such research proposal will be excluded from selection process. Please contact in advance if such might be the case.**

Contact: 03-3512-3530 (E-mail rp-info@jst.go.jp)

a. In the event that a Research Supervisor is a relative of the applicant;

b. In the event that a Research Supervisor and the applicant belong to the same minimum unit of an organization such as the same laboratory at a university or research institute including a national institute, or the same corporation;

c. In the event that a Research Supervisor and the applicant are currently conducting close collaborative research or have conducted close collaborative research within the past 5 years (For example, a Research Supervisor and the applicant are regarded to be in the same research group such as the case when they participate in a collaborative project, jointly write research papers, or conduct research with the same objective, or the case when they share the same research subject,); and

d. In the event that a Research Supervisor has an experience of being a position to supervise the applicant or being a direct employer of the applicant and period of those experiences exceeds 10 years in total. The definition of "a position to supervise" is limited to the case where both have been affiliated with the same laboratory. Nevertheless, it includes the case where the Research supervisor practically gives guidance to the applicant even if the laboratories to which they belonged differ.

(4) The names of the Research Area Advisors who will perform the selection will be announced at the time of announcement of the adopted Research Subjects.

(5) Notification of interviews and selection results

a. Applicants who have been selected for the interview as a result of the document screening will be notified in writing, along with the interview schedule* and procedure and a request for additional materials to be submitted.

* The interview schedule will be announced on the JST website (http://www.jst.go.jp/kisoken/teian-en.html) as soon as it is available

b. The applicant will explain his/her research concept in person in the interview. The interview should preferably be in Japanese. However, English can also be used, should the applicant have difficulties in communicating in Japanese.

c. Applicants who do not pass the document screening or interview will be notified of the results in writing at each stage.

d. Applicants who have been selected to conduct their studies in the final screening will be notified in writing of the result and procedures to begin the research.

8. Selection criteria

(1) The selection criteria common in all CREST Research Areas are as described below.

a. The research will contribute to the achievement of the strategic sectors.

b. The research is consistent with the intent of the Research Area.

c. The research is a leading and creative basic research at an internationally high level, which will make a significant impact on future science and technology.

d. The research will contribute to the creation of innovative technological seeds and has the potential for the creation of new industries.

e. The Research Director has the research experience required for carrying out the research and is able to hold responsibility for the entire Research Team.

f. The optimal setting for carrying out the research is in place. Main Research Collaborators from other laboratories must be deemed necessary for execution of the research concept of the Research Director.

(Note)Necessity of Main Research Collaborators is an important factor for selecting.

g. The institution with which a Research Director and Major Research Collaborator are affiliated has technical bases, such as R & D capabilities on the Research Area concerned.

h. The research expense plan is appropriate for implementing the research plan proposed by the Research Director. The cost performance of the research is examined.

(Note)For either Fund class I or II, the appropriateness of either is an important consideration. If setting up collaborative research group, the appropriateness of the research expenses allocation to collaborative research group is also an important consideration.

(2) In addition to the above, please read thoroughly "III. Overview of Research Areas and Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area" concerning original selection criteria or policy

for each Research Area.

(3) Whether the research includes "Unreasonable Duplication" or "Excessive Concentration" of the research expense will also be part of the selection criteria. Please refer to "V. Notes for Application 2." for details.

(4) Presentation of perspective for obtaining and using intellectual properties is a factor in the selection.

9. Number of proposals to be selected

The number of proposals to be selected for the Research Proposal Invitation for Applications in FY2009 will be 4 to 10 for every Research Areas (may vary depending on Research Areas and research proposal conditions).

10. Decisions on Research Team organization, research expense and period

The actual Research Team organization and research expense and period will be decided after the adoption according to the plans for the Research Subjects. Please refer to "1. (3) Research plans" in this section (page 8).

Research expenses fixed in the research program decided after adoption might be changed during the research period according to the budget status of this whole project, the management of Research Area by the Research Director, and subject evaluation status, etc.

11. Responsibilities of selected Research Directors

(1) Leading and managing the research

a. A Research Director shall be responsible for the entire Research Team, including proposals for research plans and matters relevant to the implementation.

b. A Research Director shall submit required research reports and other materials to JST (including Research Supervisor) and correspond to the research evaluation. The Director shall report the research progress whenever requested by the Research Supervisor.

(2) A Research Director shall manage the research expense for the entire Research Team appropriately (planning and monitoring the spending, ensuring appropriate administration of research expenses by research institutions, etc.) A Research Director and the Main Research Collaborator shall use care for the research members of their own group and, in particular, the research and work environment and conditions of the researchers and other members who are employed using CREST research expense.

(3) Treatment of research achievements

a. Government will fund the studies. Therefore, a Research Director is encouraged to actively publicize research achievements both domestically and internationally while taking into account the acquisition of intellectual property rights.

b. If any result achieved through the research is to be publicized in a paper or other form, please indicate that the achievement has been made in the JST Basic Research Programs (CREST).

c. A Research Director shall be participating in workshops and symposia sponsored by JST inside and outside Japan with researchers in the Research Team and present the research achievements.

d. Please actively obtain intellectual property rights. In principle, the research institution of the Research Director shall file the application for intellectual property rights in accordance with the contract research agreement.

(4) Research Directors shall comply with the research agreement between JST and research institutions and other JST rules and regulations.

(5) JST will provide necessary information such as the titles of Research Subjects, team members and the amount of research expense to the Cross-ministerial R&D Management System (e-Rad), and the Government Research and Development Database (refer to "V. Notes for Application"). JST might also request that Research Directors or other members provide different types of information.

(6) A Research Director shall cooperate in the evaluation of Basic Research Programs, accounting investigation by JST, government audit, etc.

(7) A Research Director shall correspond to various information offers or interviews, on the occasion of the follow-up evaluation after a fixed period from the research termination.

12. Requirements and responsibilities of research institutions

The requirements and responsibilities of research institutions (institutions to which the Research Directors and Main Research Collaborators of selected Research Subjects belong) are as described below.

Applicants are advised to make appropriate arrangements such as explanation or obtaining prior consent from related institutions in advance if needed, based on the following.

(1) All research expense will be administered by the research institutions as contract research expense in accordance with the contract research agreement.

(2) Please carry out a proper accounting process according to the contract research agreement and the instruction manual for administration of the contract research agreement provided by JST, while considering flexible and efficient use of research expense. A Research Director shall cooperate in the required reports to JST, accounting investigation by JST, government audit, etc.

(3) Please cooperate with JST in facilitating the establishment of the contract research agreement for the effective promotion of the research.

(4) Please make necessary reports to JST when applying for and after obtaining intellectual property rights vested in the research institutions under the contract research agreement in accordance with Article 19 (Japanese version of the Bayh-Dole Act) of the Industrial Technology Enhancement Law.

(5) For intellectual property rights resulting from the execution of consigned research, agreements stipulating attribution to research institutions must either be exchanged with researchers participating in the corresponding research or formulate employment regulations establishing same.

(6) Any research institution with which a contract research agreement cannot be concluded might not be able to carry out the research.

(7) An institution must prepare a management / audit organization for research expenses based on “Guideline on management and audit of the public research expenses in research institutions (Practical standard)" (Feb. 15, 2007, Action by Ministry of Education, Culture, Sports, Science and Technology) Moreover, the institution shall report its enforcement status, and correspond to site investigation related to situations such as organization maintenance.

(8) JST will examine the propriety and methods of commission in advance of a research contract with profit organizations (private enterprises and institutions specified by JST). This examination result might ask them to follow a commission method particularly specified by JST. It might be considered unreliable for commissions and unable to do research when the financial status of an institution is remarkably unstable. In such a case, the research team organization might undergo reorganization.

13. Specific subject investigation

(1) Among the research proposals submitted, those in which research data can be assessed in a short period of time at a small cost, possibly allowing an accurate evaluation if the same is applied in the following year and thereafter, might be returned to the applicants by the Research Supervisor to request a specific subject investigation separately from the subjects to be selected.

(2) A specific subject investigation must be made on condition of reapplication for the same Research Area in the following year, which should last approximately six (6) months.

(3) Reapplication in the following year will be screened in the same manner as other research proposals. No special treatment will apply.

(4) Applicants may not directly apply for a specific subject investigation.

14. Filling out procedure for a research proposal (forms)

Please prepare your research proposal by following the procedures for filling out the application forms from the next page.

Filling out procedure for a research proposal (forms)

(CREST-Form 1)

Research Proposal of CREST

Proposed Research Area		
Research Subject (in approximately 20 characters in English)		
Name of Research Director		
Institute ,Section, Official title to which applicant belongs		
Researcher No.	(Please enter the Researcher's Number of Grant-in-Aid for Scientific Research. Those without this number are to enter the 8-digit Researcher No. provided when registering researcher information on e-Rad〔http://www.e-rad.go.jp/〕(Japanese only now)	
Academic Records (University and higher education)	Example: 19xx: Graduated from Dept of _____ at University of _____ 19xx: Graduated from Dept of ___ at Graduate School of ____ with Master of ____. (Supervisor: Professor________) 19xx: Graduated from Dept of ___ at Graduate School of ____ with Doctor of ____. (Name of Supervisor: Professor________) 19 xx: Received a doctoral degree in _____ from University of _____	
Research Experience (Major jobs and studies)	Example: 19xx – 19xx: Research assistant at Dept of _____ at University of _____. Researched __________ at Laboratory of Professor ________. 19xx – 20xx: Researcher at _____ Laboratory, Engaged in research on _____ at a PhD Laboratory. 20xx – 20xx: Professor of _____at University of _____ , Researched _____	
Research Period	Oct. 2009 – [mmm. yyyy] (for _ years)	
Total Research expenses	□ Fund Class Ⅰ □ Fund Class Ⅱ	Total Research expenses: _____ million yen (omit decimal places)

- **Research Area to apply for**
  Please note that no application can be made for both CREST and PRESTO.
- **Researcher No.**
  Applications are effectuated through e-Rad; however, before using e-Rad, it is necessary to register researcher information on e-Rad. Those without e-Rad login ID should contact their affiliated research institute coordinator or the e-Rad Helpdesk (see Application Points Appendix 3) without delay.
- **Research period**
  The research period is five (5) years; however, the research may be ended at the end of the last fiscal year of the research period. (e.g., a research selected in 2009 to run for a period of five years may end on the last day of March 2015 for maximum period.)
- **Total Research expenses**
  Check either Research Fund Class I or II, and fill in the right-hand side column with the definite total of research expenses. The total research expenses for Class I and II per research subject will be, respectively, about 150–250 million yen and 300–500 million yen. Do not check them if the total research expenses exceed 600 million yen.

(CREST-Form 2)

Outline of Research Subject

○ **Outline of Research Subject**

Summarize the main points of your "Research Concept" (CREST-Form 3) in approximately 400 characters in English.

● **Proposal keywords**

Select up to five (5) keywords that should help explain the Research Subject from the keyword list (Appendix 1) attached at the end of this volume. Write those keywords and their numbers. If no applicable keywords are available in the list, write your own keyword(s) with an asterisk (*) at the beginning.

Example: No. 001: Gene, No. 002: Genome, No. 010: Cytogenesis and differentiation, * XXX

● **Research field**

Select one (1) main research field and one (1) to three (3) sub-field(s) that best describe the fields into which the Research Subject is categorized from the research field list (Appendix 2) attached at the end of this volume. Write their numbers and research categories.

Example: Main research field: No. 0101: Genome

Sub-field(s): No.0102: Medicine and medical care, No. 0104: Brain sciences

● **References**

Provide the names of two (2) individuals who have good knowledge of your Research Subject (A non-Japanese person is acceptable). Write each person's name, institution and contact information (phone/fax numbers and e-mail address). The evaluators (Research Supervisor and Research Area Advisors) might contact them in reference to the research proposal during the process of screening (preliminary evaluation). Providing this reference information is not mandatory.

(CREST-Form 3)

Research Concept

-Write in a manner that is easy for evaluators to understand. To this end, add graphics and tables where necessary.
- Summarize the main points within approximately six A4-size pages.
- However, if the necessary or sufficient description does not fit within the required form or if there is any supplemental explanation, it can be simply described in "Other Special Information - Form 11 ".

1. Target and Aim of Research

Describe specifically:
- Target of research (goal of achievements that will be attained at the time of research termination), and
- Aim of research (key on the technology towards future technical innovation obtained using the above-mentioned achievements.)

2. Research background

Describe requests based on science and technology (if necessary to mention, include social requests and requests from economic and industrial interests), including the trends of the field and related fields concerned, if needed, to illustrate the importance and necessity of the Research Plan.

3. Research plans and implementation

Describe specifically the plans and details of your research.
- Show the outline of the time schedule to demonstrate your vision and plan specifically, how to attain "1. Target and aim of research", while indicating milestones of research toward "1. Target and aim of research" (criteria for evaluating the degree of achievement of research during research period.)
- Include probable challenges in accomplishing the objectives and goals and solutions.
- You may also write the description by research task.
- With respect to the intellectual property rights (including application, licensing, and maintenance) assumed under this research concept, describe your present situation in regard to the obtaining of the relevant intellectual property rights and policy for intellectual property right in the research setting.

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4. Research infrastructure and preparation

Provide the following information in specific terms, which will the basis for promoting your research concept.

- History and achievements of your own research efforts (and those of other research participants, if necessary)
- Other preliminary knowledge, data, etc. (if any)

5. Originality and novelty of the research and comparison to similar studies inside and outside Japan

Taking into account the situation and trends of research in relevant fields in Japan and other countries, present the positioning in the world, originality and novelty of your research concept and its advantages over others.

6．Future Prospect of Research

Describe development of science and technology, invention of new industry, philanthropy, etc., which are expected to be realized in the future, with the achievement of "Target and aim of research" of this research plan as a start, to the degree that the research applicant can assume.

(CREST-Form 4)

Research Framework 1

(Research framework at Research Director's Group)

- Fill in the research participants' names with the same institution as the Research Director.
- When research participants with the same organization as the Research Director participate in charge of clearly different contents from the research subject and outline of Research Director, their names might be written in Research framework 2 (CREST-Form 5.)

Research Director's Group

Example:

Research institution	Department of ___, Graduate School of ___ at University of ___ (Research location: University of ___)		
Participants from the research institution	**Name**	**Title**	**Effort (Research Director only)**
(Research Director →)	_____	Professor	__ %
	_____	Assistant Professor	-
	_____	Assistant	-

- In the "Effort" indicate the percentage of time required by a researcher to engage in the research when his/her total annual work hours is 100%. "Total work hours" refers to the overall substantial work time including education, medical care and other activities and not only the time spent for research activities. (According to the definition set by Council for Science and Technology Policy)
- Give sufficient consideration to the roles played by the members of your Research Team.
- Among the research participants, those researchers who have not decided to participate by the time of application may be indicated as "____ (the number of) researchers.
- Add rows to the list of research participants if necessary.

Special information

-When special duties (managerial positions, such as the dean, chairperson of an academic society, etc.) take working hours (effort), fill in the situation and reason.

Research tasks and overview

- **Research tasks**
- **Overview**

Write concisely an overview of the research of which the Research Director's Group will be in charge and the necessity of that research.

Research concept ranking

Write the role which a Research Director's group plays in order to execute the Research Concept.

(CREST-Form 5)

Research Framework 2

(Research framework at the Collaborative Research Group)

- Fill in the research participants' names for each collaborative research organization when researchers of institutions other than that of Research Director (collaborative research organizations) join.
- Although there is no maximum limit of the number of collaborative research organizations, compose a necessary and sufficient number of teams for execution of this research plan. It is possible to involve various institutions into the collaborative research group of a research team from industry, government, and academia.

Collaborative Research Group (1)

Example:

Collaborative Research institution	___ Laboratory at ___ Research Institute (Research location: ___ Research Institute)		
Participants from the research institution	**Name**	**Title**	**Effort (Research Group Leader only)**
(Research Group Leader →)	_____	Chief researcher	__ %
	____	Researcher	–

Research tasks and overview

- **Research tasks**
- **Overview**

Write concisely the overview of the research of which this Collaborative Research Group will be in charge and the necessity of the research.

Research concept ranking and necessity

Write the indispensability and the role of Collaborative Research Group in order to execute the Research Concept.

Collaborative Research Group (2)

Example:

Collaborative Research institution	___ Laboratory at ___ Ltd. (Research location: ___ Ltd.)		
Participants from the research institution	**Name**	**Title**	**Effort Research Group Leader only**
(Research Group Leader →)	_____	Chief Researcher	__ %
	_____	Researcher	–

Research tasks and overview

- **Research tasks**
- **Overview**

Write concisely the overview of the research of which this Collaborative Research Group will be in charge and the necessity of the research.

Research concept ranking and necessity

Write the indispensability and the role of Collaborative Research Group in order to realize the Research Concept.

(CREST-Form 6)

Research Expenses Plan

- Fill in your itemized research expenses plan and research expenses plan by institution for each year.
- At the interview selection, a more detailed research expenses plan should be submitted.
- Research expenses after adopted may be changed into the research period in according to the situation of the budget situation of this whole enterprise, management of Research Area, and Research Subjects evaluation etc.
- For research team composition, please propose an optimal group that would best represent the research concept of Research Director. If setting up collaborative research group, aspects such as the need for a collaborative research group, the appropriateness of the research expenses allocations to the collaborative research group, and cost performance will be important considerations.

Example:

Itemized research expenses plan (entire team)

	1st Year (2009.10 -2010.3)	2nd Year (2010.4 -2011.3)	3rd Year (2011.4 -2012.3)	4th Year (2012.4-2013.3)	5th Year (2013.4-2014.3)	Final Year (2014.4-2015.3)	Total (M Yen)
Equipment	30	40	40	10	10	5	135
Material /consumables	5	10	10	10	8	8	51
Travel	3	5	5	5	5	5	28
Employment, · Rewards (Number of researchers)	5 (3)	10 (3)	20 (5)	20 (5)	10 (3)	10 (3)	75
Misc.	2	10	10	10	7	7	46
Total (M Yen)	45	75	85	55	40	35	335

The items of expenditure and the purposes for spending of research expenses are as follows:

Cost of equipment: Cost for purchasing equipment
Materials / consumables expenses: Cost for purchasing materials and consumables
Traveling expenses: Traveling expenses of Research Director or research participants
Labor cost and rewards: Personnel expenses and rewards for researchers, technicians, research assistants, etc.
Numbers of researchers: The number of researchers, technicians, and research assistants who are newly employed, and
Miscellaneous: Costs other than the above (Costs of research presentations, equipment lease expense, books, freight costs, etc.)

Special information

(1) The budget amount and ratio for each item of expenditure should be considered as optimal. However, when labor costs exceed 50% of the total research expenses, or when either of material / consumables expenses or traveling expenses exceeds 30% thereof, please describe the reason herein.
(2) For a research proposal whose total research expenses through the research period exceed 600 million yen, describe "Needs for large research expenses" herein.

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Research expenses plan by group

	1st Year (2009.10 -2010.3)	2nd Year (2010.4 -2011.3)	3rd Year (2011.4 -2012.3)	4th Year (2012.4-2013.3)	5th Year (2013.4-2014.3)	Final Year (2014.4-2015.3)	Total (M Yen)
Research Director's Group	25	35	40	35	20	15	170
Cooperative Research Group (1)	10	20	25	10	10	10	85
Cooperative Research Group (2)	10	20	20	10	10	10	80
Total (M Yen)	45	75	85	55	40	35	335

Purchasing Main Equipments (50 million yen or more, equipment name, approximate price)

(Example) XXXXXX 15 (Million Yen)

XXXXXX 5 M Yen

XXXXXX 10 M Yen

XXXXXX 5 M Yen

XXXXXX 10 M Yen

XXXXXX 5 M Yen

(CREST-Form 7)

List of research papers and literary works (Research Director)

● **Major literature**

Author(s) (List all authors), title of the paper published, publication in which the paper was published, volume and page numbers and publication year

Select research papers or literary works which are considered to be the most important from those published in academic publications in recent years. List them on about one A4-size page in reverse-chronological order of the year of publication.
Place an asterisk (*) at the beginning of the title of the paper/books of which the applicant is the chief author.
Items to be written are as above, in a free order.

● **Bibliography**

Author(s) (List all authors), title of the paper published, publication in which the paper was published, volume and page numbers and publication year

List any relevant literary works that are necessary for understanding your research proposal.
(Place an asterisk (*) at the beginning of the title of the paper/books for which the applicant is the chief author (if any)).
Items to be written are as above, in a free order.

(CREST-Form 8)

List of research papers and literary works (Collaborative Research Group Leader)

Author(s) (List all authors), title of the paper published, publication in which the paper was published, volume and page numbers and publication year

Select research papers or literary works which are considered to be related to the present proposal and the most important from those published in academic publications in recent years by the collaborative research group leaders. List them on about one A4-size page for each research group leader in reverse-chronological order of the year of publication. Items to be written are as above, in a free order.

(CREST-Form 9)

Patent list (Research Director)

● **Major patents**

Application number, inventor, title of invention, applicant and date of application

Select approximately important patents applied for by the Research Director in recent years (if any). List them on about one A4-size page.
Items to be written are as above, in a free order.

・ **Research Director**

・ **Collaborative Research Group Leader**

(CREST-Form 10)

Grants from Other Aid Programs

List grants from the government Competitive Research Funds and any other research subsidies (including CREST and PRESTO) that the Research Director and/or Collaborative Research Group Leaders are currently receiving, applying for, or planning to apply for by program name, indicating the Research Subject title, research period, roles, amount of research expense, and effort, etc. Your entitlement to the JST funds might be cancelled on a later day even if you have been selected should your presentation fail to be accurate.

(Note)

- **Please refer to "V. Notes for Application" about "Unreasonable Duplication and Excessive Concentration".**
- **Notify JST at the Inquiry Counter indicated at the end of this volume if, at any time during the selection process of research proposals for this program, any information provided in this form has changed for any reason, including, for example, that other research funds being applied for and/or those planned for application have been granted.**

Example:

Research Director (Applicant): Name: ________

Program [1]	Research Subject Title (Director Name)	Research Period	Roles[2] (Director/Allocation)	Research Expense[3] (1) The whole period (2) FY 2009 (3) FY 2008	Effort (%)[4]
Grants-in-Aid for Scientific Research, Fundamental research (S)	XXXXXXXX	2008--2013	Director	(1) 100 M yen (2) 25 M yen (3) −	20
Special Coordination Fund for Promoting Science and Technology	XXXXXXXX (XXXXXXXX)	2007 --2010	Allocation	(1) 32 M yen (2) 8 M yen (3) 8 M yen	10
(Under Application) XX Fund by XX Foundation	XXXXXXXX	2008 --2010	Director	(1) 15 M yen (2) 5 M yen (3) −	5
5)					

1) List grants that the Applicant is currently receiving, or selected, in the descending order of research expenses (the whole period).Then list those the Applicant is currently applying for or planning to apply for (specify "under application" in the column "Fund name").
2) Describe Directorship or allocated work as "Role."
3) Describe the amount of fund the Applicant is receiving as "Research expenses."
4) Describe as "Effort" the percentage of the time required for the research concerned in the total work hours of a researcher, letting all annual working hours be 100% (not only time for research activities but education, medical services, etc. are included.) (According to the definition set by Council for Science and Technology Policy) Describe Effort for grants the Applicant is currently receiving assuming that a CREST proposal is selected.
5) Add writing spaces if needed.

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(CREST-Form 10)

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Collaborative Research Group Leader: Name: _________

Program [1]	Research Subject Title (Director Name)	Research Period	Roles[2] (Director/Allocation)	Research Expense[3] (1) The whole period (2) FY 2009 (3) FY 2008
Health and Labor Sciences Research Grants	XXXXXXXX	2008—2013	Director	(1) 45 M yen (2) 10 M yen (3) —

Collaborative Research Group Leader: Name: _________

Program [1]	Research Subject Title (Director Name)	Research Period	Roles[2] (Director/Allocation)	Research Expense[3] (1) The whole period (2) FY 2009 (3) FY 2008
Grants-in-Aid for Scientific Research, Specific Area	XXXXXXXX (XXXXXXXX)	2007—2011	Allocation	(1) 25 M yen (2) 5 M yen (3) 5 M yen

(CREST-Form 11)

Other Special Information

- Write freely the reason(s) why you have applied for the Basic Research Programs, any requests concerning your research, or any other concerns that you might have.
- Use this space to write the reason(s) if you request that your research take place overseas.
- Describe any outstanding record of awards here if necessary.
- Use this space to provide a simply description if there are any necessary or supplementary matters that you are unable to be described in the given pages of a "Research Concept – Form 3".

C. PRESTO

Please be sure that you read and understand the following descriptions 1. through 12., "II. Guidance for Application and Selection A. General 1.-3.", "V. Instruction for Application" and "VI. Duplicated Applications for JST Programs" when preparing your application.

1. The system of promoting PRESTO research

With regard to Outline of Overall Basic Research Programs of JST, you may refer to [I. Outline of Programs]. The system of PRESTO is described as below.

(1) Overview and Characteristics of PRESTO

a. In each Research Area designated by JST on the basis of the strategic sectors set by the government, the researcher shall conduct his/her research based on his/her individual concept under the research administration by the Research Supervisor.

b. The research proposals (the research subjects) are invited for each Research Area, which are screened by the Research Supervisor in cooperation with Research Area advisors.

c. Selected researchers shall conduct his/her research individually.

(2) Overview of the High-impact Type PRESTO (Newly started in FY2009)

The possibility of achievement is not clearly envisioned; however, research that promises significant and revolutionary results (high-risk research) when achieved will be actively adopted. For this reason, in addition to the existing PRESTO selection process, the potentiality and significance as a high risk research proposal will be examined from a broad perspective.

PRESTO has, to date, promoted original and challenging research by individual researchers and will, further, promote challenging research, which are features of PRESTO, with the start of the High impact type PRESTO (here in after referred to as the "High-impact type").

a. In addition to the ordinary PRESTO selection process, applicants will also be able to undergo the screening process for the High-impact type. Applicants who wish to apply for this will need to complete "Research Proposal - Form 1" and also submit Form 7. Further, the proposal may be adopted for ordinary PRESTO (hereinafter referred to as the "Standard type") based upon the results of screening.

b. The researcher will determine a "Goal" to be aimed at during the research period and conduct research to achieve the goal through interaction with other researchers under the Research Supervisor. This research is expected to provide keys to significant and revolutionary development in science and technology through the achievement of the Goal.

c. In promoting the research, changes in research expenses (to a maximum of a twofold increase in total research expenses) may be accepted depending on the progress of the research. There may be cases in which the research period is extended on the last day of March of the 5th fiscal year from the start of the research for a set maximum period depending on the results of evaluation.

d. The midterm and ex-post evaluations will be based on the challenges of the high risk research. However, research that does not demonstrate the possibility of progress may be call off based on the midterm evaluation. Moreover, apart from the midterm evaluation, the research plan may be scaled down or called off in the middle of the research period at the sole discretion of the Research Supervisor.

(3) Research Supervisor

Research Supervisors are responsible for the Research Area and play a key role in promoting Research Area, for example, selection of research and support of research activity. Research Supervisor gives guidance and advice to researchers through activities such as Research Meetings where researchers present and discuss the progress of research and visiting research sites. The research expenses are allocated or adjusted by the Research Supervisor depending on the needs or evaluation for the research.

(4) Research Implementation System

a. Researchers shall conduct his/her research individually.
b. JST will sign a research agreement in principle with each research institute where a researcher will conduct research.
c. Each selected researcher will belong to JST as a part-time*1, full-time*2 or temporarily transferred*3 researcher during the research period. As for the terms and conditions of the employment, please refer to "11. Employment Conditions and Other Conditions for Selected Researchers".

* Applicants are advised to make appropriate arrangements such as explanations to their affiliated institutions or cooperative research organizations in advance if necessary.

*1 Part-time appointment: In case a researcher belongs to a university, a national research institute, an independent administrative agency, etc., the researcher is appointed by JST as a part-time researcher.

*2 Full-time appointment: In case a researcher does not currently belong to any research institutes or corporations or if the researcher is leaving or taking a leave of absence from the institute to which he/she belongs, the researcher is appointed by JST as a full-time researcher.

*3 Temporary transfer: In case a researcher participates in Individual Research Type Program from a company or a foundation or etc., the researcher is appointed by JST as a temporary transferred researcher.

* It is possible to change a participation scheme if needed, such as by a change of institution during the research period.

(5) Research Locations

JST will determine the participating scheme taking into account of the research content and research environment while consulting the individual researcher and the research institute where the research will be conducted. It is possible to research at a site other than the institute to which he/she belongs.

(6) Research Plans

After the adoption, each researcher is requested to submit an overall research plan throughout the whole research period. An annual research plan is also requested for each fiscal year.

(7) Research Agreement

JST concludes a research agreement with the research institutes where a researcher will conduct research.

(8) Ownership of research agreements and intellectual property rights

Ownership of intellectual property rights such as patents obtained through PRESTO research will be determined as follows:

a) Research carried out in a domestic institution

i) Part-time researchers

In principle, it will be vested in research institutions under the contract research agreement in accordance with Article 19 (Japanese version of the Bayh-Dole Act) of the Industrial Technology Enhancement Act.

ii) Full-time / temporarily transferred researchers

Ownership is determined depending on contracts with institutions where the research is carried out.

b) Research carried out in an overseas institution

The overseas institution and JST will share it. The equity of JST will be shared by the researcher and JST in principle.

(9) Research Support Structure

Supportive activities necessary for the research such as the arrangement of the research place and system, publicity for the research, communication or outreach between the researchers will be taken care of by JST on the advice of the Research Supervisor.

(10) Research Subjects Evaluation

a. Research Supervisors shall understand the status of research progress and results, and conduct midterm evaluation and *ex post* evaluation of Research Subjects in cooperation with the Research Area Advisors and other members. If the research period extends through five years, the midterm evaluation should be held three years after the research starts and the *ex post* evaluation will be performed immediately after the research is completed.

b. For Research Subjects granted a 5-year research period, the results of the research evaluation such as the midterm evaluation will be reflected in the adjustment of subsequent research plans (scale-down or termination) and increase/decrease in the research expenses.). Apart from the midterm evaluation, Research Supervisors may take action such as review of research plans and expenses at their sole discretion in the High-impact type.

c. After a fixed period from research termination, a follow-up survey will be conducted about the development and practical use situation of research achievements, participating researchers' activity, etc. Based on the follow-up survey result, external specialists assigned by JST shall perform a follow-up evaluation.

(11) Research Area Evaluation

Apart from "(10) Research Evaluation" above, Research Areas is evaluated from viewpoints, such as a progress situation towards achievement of strategic sector, and a management of Research Areas, etc.

(12) Participation of Researcher Belonging to Overseas Institutes

Research might be carried out in an overseas research institution upon the approval of the Research Supervisor when the following two conditions are met.

a. The researcher at the overseas research institution is deems indispensable for realizing his/her research concept, and the research could not be conducted anywhere but at the overseas institution.

b. A contract can be concluded between the chosen overseas research institution and JST, under which at least the following two conditions shall be met.

- The amount of the indirect costs to be paid to the oversea research institutes shall not exceed 30% of total research expenses.
- The intellectual property right must be jointly owned between the oversea research institute and JST.

Describe the reason why the overseas research must be conducted in the Research Proposal Application if you wish to carry out research at an overseas research institution.

2. Applicant Requirements

Each researcher should personally make their proposals. Applicants should meet the following requirements.

(1) An applicant should propose an original research concept, and also should independently promote his/her own research to promote research activities.

(2) The researcher in the position which presides over a laboratory and cannot concentrate on the research proposal may not be selected.

(3) The researcher who has Japanese nationality, or the foreign researcher who is conducting his/her research at the research institute located in Japan at the time of application.

* It does not matter for the status of the researcher whether he/she is working full- time or part-time, or whether he/she is paid or not paid.

Note: The Research Proposal might be excluded from selection process if a Researcher and the Research Supervisor have a vested interest in each other. (For details, see "6.Selection Process (3)", page 39.)

3. Eligible Research Proposals

(1) In Research Proposal Invitation for Applications in FY2009, research proposals are invited in 13 Research Areas established based on 11 strategic sector in "IV. Strategic Sectors". (Research Areas started in FY2007 and FY 2008 and Research Areas started in FY2009). Please see the table on the following page for the High-impact type subject areas. Please read thoroughly "III. Outline of the Research Area and Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area", and present one research proposal that is appropriate for the Research Area. Only one research proposal application is allowed over CREST and PRESTO. The application for research proposals is limited to one in the two Research areas iterated above. Applications are not accepted for both CREST and PRESTO.

Year Started	Research Area	Research Supervisor	Program considered for Application

			3 Year	5 Year	High-impact
FY2009 (New Research Areas)	Informational environment and people	Toru Ishida (Prof., Kyoto Univ.)	○	○	○
	Photoenergy conversion systems and materials for the next generation solar cells	Shuzi Hayase (Prof., Kyushu Institute of Technology)			
	Light energy and chemical conversion	Haruo Inoue (Dean, Tokyo Metropolitan Univ.)			
	Formation of and information processing by neural networks, and control	Fujio Murakami (Dean, Osaka Univ.)			
	Epigenetic control and biological functions	Tsunehiro Mukai (Trustee/Vice-President, Saga Univ.)			
FY2008	Understanding life by iPS cells technology	Shin-Ichi Nishikawa (Deputy Director, RIKEN)	○	○	○
	Innovative use of light and materials/life	Hiroshi Masuhara (Chair Professor, NCTU/Guest Prof., Nara Institute of Science and Technology)			
	Nanosystem and function emergence	Yoshihito Osada (Deputy Director, RIKEN)			
	Decoding and controlling brain information	Mitsuo Kawato (Director, ATR Computational Neuroscience Laboratories)			
	Synthesis of knowledge for information oriented society	Hideyuki Nakashima (President, Future University-Hakodate)			
FY2007	Materials and processes for innovative next-generation devices	Katsuaki Sato (Emeritus Prof., Tokyo University of Agriculture and Technology)	○	×	×
	Alliance for breakthrough between mathematics and sciences (ABMS)	Yasumasa Nishiura (Prof., Hokkaido Univ.)			
	Innovative model of biological processes and its development	Nanako Shigesada (Prof., Doshisha Univ.)			

(2) We are looking for pioneering and original research concepts that will bring about

innovative advances in various scientific technological fields and will lead to the creation of new technology/industry. Our hope is that these research projects will ultimately gain international recognition. Note that any research proposal that carries out only a part of other research project or subject is not applicable.

4. Research Period

(1)Research Period

Please confirm the table in "3.(1) Eligible Research Proposal".

a. For Research Areas started in 2008 and 2009, the period shall be 3-years period or 5-years period.

※Please choose from two Research Period type, 3 years and 5 years, at the time of an application. After the application, applicants cannot change the research period.

b. For Research Areas started in 2007,the period shall be 3 years.

(2) The research period for the research subject selected in this fiscal year shall be at latest by the end of March, 2013 for 3 years research subject, and by the end of March, 2015 for 5 years research subject.

(3) Considering the fact that the research is a high risk, the research period of the High-impact type might be extended or scaled down at the sole discretion of the Research Supervisor regardless of the initial research period. In principle, the research period should be 3 to 5 years; however, the research may be terminated in 1 year or extended on the last day of March of the 5th fiscal year for a set maximum period, depending on the status of the research and the prospects for development.

5. Research Expenses

(1)Research Expenses for Research Subjects

a. For 3-year subjects, a total of 30 million to 40 million yen over the entire research period.

b. For 5-year subjects, a total of 50 million to 100 million yen over the entire research period.

(2) A budget plan should be set for each year based on your research plan.

(3) After the research subjects are selected, Research Supervisors will determine basic points regarding research implementation and research plans, as well as research implementation plans, setting out first-year budgets for each researcher. Research Supervisors will consult with researchers in these determinations. Research implementation plans will be prepared for each fiscal year. Note that such expenses might be increased or decreased depending on the evaluation by Research Supervisor or the development progress. There might be some cases for which an increase in research expenses for the High-impact type is accepted to a maximum of a twofold increase in the total depending on the status of the research.

(4) Some Research expenses shall be executed at an institution according to the research contract between the institution and JST. Indirect costs paid to research institutions by JST to a maximum of 30% of direct costs will be appropriated separately by JST. Further, the part of Research expenses may be allocated by JST as needed.

(5) The items of expenditure and the purpose for spending of research expenses (direct costs) are as follows:

a) Research Expenses (direct costs) are allocated to cover the costs directly required for carrying out the PRESTO research concerned, which might be used for the following purposes.

(1) Costs of goods and supplies: To purchase new facilities, equipment, and consumables.

(2) Travel expenses: Travel expenses incurred by Researchers directly related to the PRESTO research, or domestic traveling expenses for research participants described in the research plan to publish their achievements directly related to PRESTO research.

(3) Rewards, remuneration, etc.: Personnel expenses for research assistants directly related to PRESTO research.

(4) Other: Costs of research presentations (posting a research papers, etc.), Commission preparation cost for laboratory animals, etc.

b) The following expenses cannot be covered by the research expenses (direct costs).

(1) Expenses those are not consistent with the research objectives of PRESTO research.

(2) Expenses considered appropriate to be treated as indirect costs.

c) Please refer to "Q&A" at the end of the Guidelines should there be any difficulty in determining whether to expense a payment as part of research expense.

Attention: JST requests that the research institutions administer the research expense in a flexible and efficient manner. The studies are funded through the national budget. Therefore, certain rules and guidelines apply for some projects through written contracts or instruction manuals for administrative procedures, based on which the institutions are to properly handle the funds.

6. Selection Process

As for time-schedule, please refer to Chapter II.A.2."Schedule of application and selection".

(1) The Research supervisor in each Research Area will conduct the selection in two steps – document screening and interviews – with the cooperation of Research Area Advisors and other members. The selection process for the High-impact type will be conducted in 3 steps, adding a screening process for an examination from a diversified perspective by the High-impact Type Review Committee to the ordinary 2-step screening processes as shown on the following page. The third process will be based on a screening of the application documents submitted for the High-impact type (PRESTO - Form 7) (masking screening). Acceptance will not be based on each Research Area and the screening will focus on the challenge of the research subject. Other examinations might be added if necessary. An outside reviewer might cooperate in the selection whenever necessary. JST will determine the Researchers and Research Subjects based on this selection.

(2) In accordance with the JST rules and in order to maintain the evaluation process to be fair and transparent, the following individuals will not participate in the evaluation.

a. Any person who is a relative of the applicant;

b. Any person who belongs to the same faculty or research laboratory at a university and research institution as the applicant, including a national institute or who belongs to the same corporation as the applicant

c. Any person who conducts close collaborative research with the applicant. (For example, a person who is regarded to be in the same research group as the applicant, including any individual who participates in a collaborative project, who jointly writes research papers, or who conducts research with the same objective, or a person who shares a research subject with the applicant);

d. Any person who is in a position to supervise the applicant or vice versa, or who is a direct employer of the applicant;

e. Any person who is a direct competitor in a research subject of the applicant; and

f. Any individual regarded by JST to have a close relationship with the applicant.

(3) **Further, in the event that a Research Supervisor has the following relationship with an applicant with respect to a Research Area started in FY2009, such research proposal will be excluded from selection process. Please contact in advance if such might be the case.**

Contact: 03-3512-3530 (E-mail rp-info@jst.go.jp)

a. In the event that a Research Supervisor is a relative of the applicant;

b. In the event that a Research Supervisor and the applicant belong to the same minimum unit of an organization such as the same laboratory at a university or research institute including a national institute, or the same corporation;

c. In the event that a Research Supervisor and the applicant are currently conducting close collaborative research or have conducted close collaborative research within the past 5 years (For example, a Research Supervisor and the applicant are regarded to be in the same research group such as the case when they participate in a collaborative project, jointly write research papers, or conduct research with the same objective, or the case when they share the same research subject,); and

d. In the event that a Research Supervisor has an experience of being a position to supervise the applicant or being a direct employer of the applicant and period of those experiences exceeds 10 years in total. The definition of "a position to supervise" is limited to the case where both have been affiliated with the same laboratory. Nevertheless, it includes the case where the Research supervisor practically gives guidance to the applicant even if the laboratories to which they belonged differ.

(4) The names of the Research Area Advisors who will perform the selection will be announced at the time of the announcement of the adopted Research Subjects.

(5) Interview for Selection and Notice of Selection Result

a. As a result of the documental selection, the notice of interview selection will be given in writing to the applicant who will be invited for interview selection. The guidance for interview selection, time schedule, and supplementary information or explanation will be notified as well.

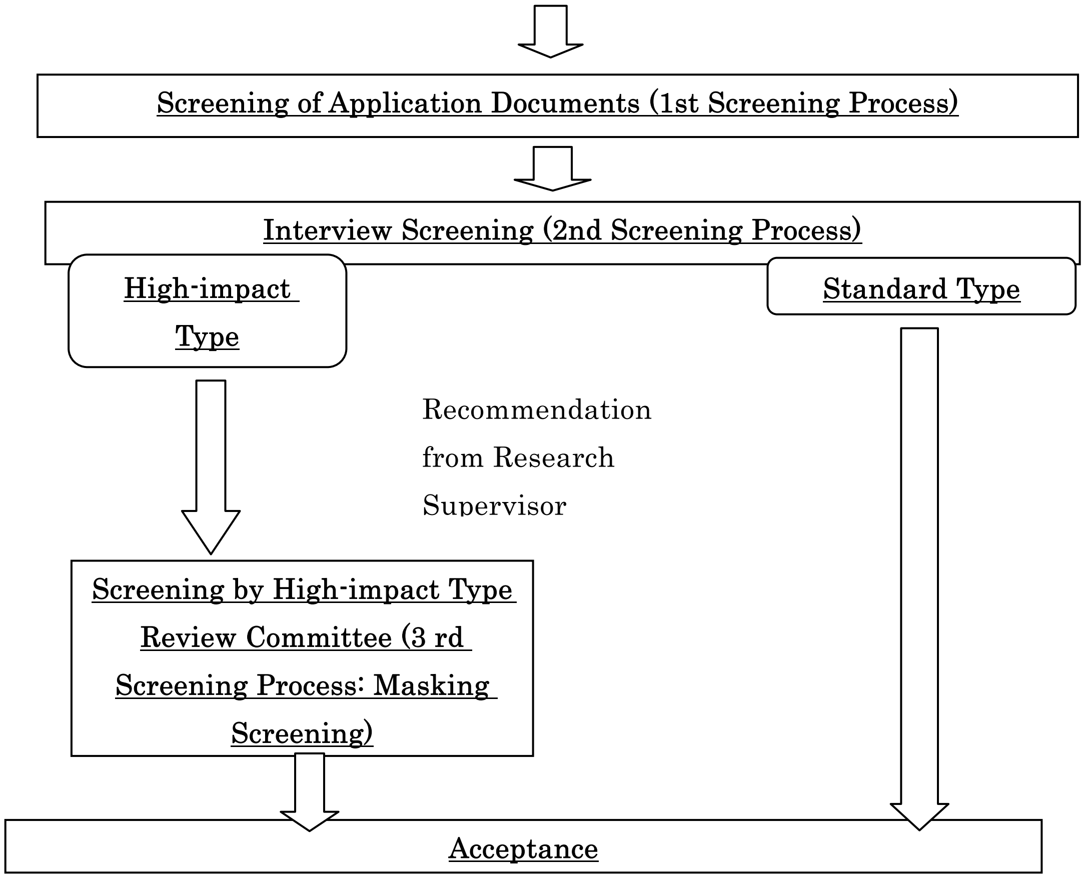
*JST will announce the interview schedule on the website.
(http://www.jst.go.jp/kisoken/teian.html) as soon as it is finalized.

b. Interviewers will request the researcher who has made a research proposal to explain his/her research concepts personally during the interview. As a rule, JST will conduct interviews in Japanese, but interviews will be conducted in English for those who have difficulty in understanding Japanese.

c. At each stage of documental selection or interview selection, the selection result will be given in writing to the applicants who will not be invited to the next stage.

d. As a result of selection, the notice of adoption will be given in writing to the applicant whose research subject is selected. The guidance for the procedures to start the adopted research will be notified as well.

Submit Research Proposal



7. Selection Criteria

(1) The criteria in common for selection of each Research Areas of PRESTO are as follows.

a. Research proposals should contribute to attain strategic sectors.

b. Research proposals should be consistent with the aim of their respective Research Areas.

c. The research concept is his/her own conception.

d. It is original.

e. The approach and clues to realizing the research concept have already been identified.

f. It has potential to impact scientific technology in future (e.g. creating intellectual properties, new technology and solving important issues).

g. The expected size of the research is appropriate.

The following criterion is added to the High-impact type:

h. The possibility of attainment is not clearly envisioned; however, a significant and revolutionary result is promised when achieved.

(2) Besides above, Chapter III. "Outline of the Research Area" and "Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area" can be referred to in details relating to the point of view and policy of its own selection for each Research Area.

(3) Such elements as "unreasonable duplication" of research expenses or "excessive concentration" will be subject to review for selection. Chapter V. 2.

8. Number of proposals to be selected

The total number of research proposals to be selected from the applications will be approximately 130 from all 13 Research Areas.

In the Research Areas starting in FY2008 and FY 2009, the research subjects of 5-years research period will be selected about 20% from adoption number of each Research Areas. A few applicants will be selected for the High-impact Type in each Research Area in addition to the selection for the Standard Type.

In the Research Areas starting in FY2007, the research subjects are all 3-years research periods.

9. Responsibilities of Selected Researchers

(1) Promotion and Management of Research Activities

Selected researchers should assume responsibility for the promotion of the overall research activities and for research results. In addition, they should perform administrative tasks, including preparation of research plans and submission of regular reports.

(2) Selected researchers should assume responsibility for administration and management of research expenses, paperwork, employment and management of research workers and business trips.

(3) Management of Research Results

Selected researchers may be required to submit research progress status reports to the Research Supervisor etc. They should work to obtain intellectual property rights including patent rights. They should also actively present their research results both within and outside Japan. When they present papers on the research results obtained in their research work, they should state in the papers that the research results have been obtained through the Basic Research Promotion Programs of JST. Moreover, we request that they participate in workshops and symposiums held by JST in Japan and/or overseas to present their research results.

(4) Selected researchers participate in the Research Area meeting (2 times per year) of the training camp form which Research Supervisor sponsors. Researchers must present a research result etc. in the meeting.

(5) Each selected researchers shall comply with the external research contracts signed between JST and the research institute, as well as with all other JST regulations.

(6) JST will provide necessary information such as the titles of Research Subjects, team members and the amount of research expense to the Cross-ministerial R&D Management System (e-Rad), and the Government Research and Development Database (refer to "V. Notes for Application"). The researchers may be requested to release various information as required.

(7) The program evaluation of the Basic Research Programs, the financial audit or any other inspection will be corresponded with depending on the situation.

(8) A variety of information offers or interviews will be corresponded with on the occasion of the follow-up evaluation after a fixed period from the research termination.

10. Responsibilities of research institutions

(1) Research institutions shall carry out a proper accounting process according to the contract

research agreement and the instruction manual for administration of the contract research agreement provided by JST, while considering flexible and efficient use of research expenses. They shall correspond with required reports to JST, accounting investigation by JST, government audit, etc.

(2) They shall make necessary reports to JST when applying for and after obtaining intellectual property rights vested in the research institutions under the contract research agreement in accordance with the Industrial Technology Enhancement Law, Article 19 (Japanese version of the Bayh-Dole Act).

(3) Research institutions shall prepare a management / audit organization for research expenses based on "Guideline on management and audit of the public research expenses in research institutions (Practical standard)" (Feb. 15, 2007, Action by Ministry of Education, Culture, Sports, Science and Technology). They shall report its enforcement status, and correspond to site investigation about situations such as organization maintenance.

11. Employment Conditions and Other Conditions for Selected Researchers

(1) Employment Condition

As a rule, all researchers must follow regulations of JST; however, work hours, breaks and holidays will be determined for each research site.

(2) Remuneration and Social Insurance for Researchers

a. Part-time Researchers

A part-time researcher is the person holding an additional post of JST's research, who was already employed by research institute (e.g. university). A certain amount of remuneration to be paid by JST to the researcher will be paid monthly in accordance with the rules and regulations of JST. Any social insurance will be covered by the research institute to which he/she belongs.

b Full-time Researchers

A full-time researcher is the person employed by JST as a researcher. JST determines remuneration for its full-time researchers based on the annual salary system by regulations of JST. The annual salary will include the employee's salary, various benefits, and bonus. Researchers must also join the health insurance with which JST is affiliated, the employee's pension insurance, the employee's pension fund and the employment insurance.

c. Temporarily Transferred Researchers

JST will pay salary and business proprietor obligation fees (health insurance, welfare annuity insurance, accrued employees' retirement benefit, etc.) multiplied by the part-time occupation ratio for temporary transfer researchers to their institutions. The part-time ratio for each researcher will be determined in consultation with the organization to which the researcher belongs after he/she is selected; however, we would like to have the researcher work at JST for more than 80%.

The researcher will continue to belong to the health insurance, the employee's pension insurance, the employee's pension fund and the employment insurance at the organization from which he/she being transferred; however, JST will be the applicable employer for his/her worker's compensation insurance.

12. Filling out procedure for a research proposal (forms)

Please prepare your research proposal by following the procedures for filling out the application forms from the next page onward.

Filling out a research proposal application (forms)

(PRESTO-Form 1)

Research Proposal of PRESTO

Proposed Research Area	
Research Subject (in approximately 10 words in English)	
Name of Researcher	
Institute ,Section, Official title to which applicant belongs	
Researcher No.	(Please enter the Researcher's Number of Grant-in-Aid for Scientific Research. Those without this number are to enter the 8-digit Researcher No. provided when registering researcher information on e-Rad〔http://www.e-rad.go.jp/〕(Japanese only now)
Academic Records (University and higher education)	(Example) Kawaguchi Institute of Technology, Kawaguchi, Japan B.S. in Electronic Engineering, Semiconductor technology minor, 1993 Graduate School, JST University, Kawaguchi, Japan M.S. in Electronic Engineering, 1995 Dissertation: (Title to be specified, when available) Instructor: Professor John Smith, Ph.D. Graduate School, JST University, Kawaguchi, Japan Ph.D. in Electronic Engineering, 1998 Thesis: (Title to be specified, when available) Instructor: Professor John Smith, Ph.D.
Research Experience (Major jobs and studies)	(Example) Apr. 2003 – Present Research Associate, JST Research Institute Research subject: (Title to be specified) Advisor: Professor John Smith, Ph.D. Apr. 1998 – Mar. 2003 Postdoctoral Research Assistant, Faculty of Electronic Engineering, JST University Research subject: (Title to be specified, when available)
Research period and cost	☐ 3 years ☐ 5 years (only Research Areas started in 2008 and 2009) Total desired research cost for entire research period (yen) ※Enter the amount without indirect operational expenses.
Application for High-impact Type (Only Research Area started in 2008 and 2009)	☐ Apply for the selection of High-impact Type. ※If an applicant wishes to apply, please complete a Form 7. ※There may be cases in which the proposal is selected for Standard Type based upon the selection results. ※Applications only for High-impact Type will not be accepted.
Preferences about the place of the research	☐ The institute the researcher belongs to currently ☐ Other (The place of the research:)

- **Research Area to apply for**

  Please note that no application can be made for both CREST and PRESTO.

- **Researcher No.**

  Applications are effectuated through e-Rad; however, before using e-Rad, it is necessary to register researcher information on e-Rad. Those without e-Rad login ID should contact their affiliated research institute coordinator or the e-Rad Helpdesk (see Application Points Appendix 3) without delay.

(PRESTO-Form 2)

Outline of Research Subject

○ **Outline of Research Subject**

Summarize the main points of your "Research Concept" (PRESTO-Form 3) in approximately 200 words in English.

● **Proposal keywords**

Select up to five (5) keywords that should help explain the Research Subject from the keyword list (Appendix 1) attached at the end of this volume. Write those keywords and their numbers. If no applicable keywords are available in the list, write your own keyword(s) with an asterisk (*) at the beginning.

Example: No.001: Gene, No. 002: Genome, No. 010: Cytogenesis and differentiation, * XXX

● **Research field**

Select one (1) main research field and one (1) to three (3) sub-field(s) that best describe the fields into which the Research Subject is categorized from the research field list (Appendix 2) attached at the end of this volume. Write their numbers and research categories.

Example: Main research field: No. 0101: Genome

Sub-field(s): No. 0102: Medicine and medical care, No. 0104: Brain sciences

● **References**

Provide the names of two (2) individuals who have good knowledge of your Research Subject (A non-Japanese person is acceptable). Write each person's name, institution and contact information (phone/fax numbers and e-mail address). The evaluators (Research Supervisor and Research Area Advisors) might contact them in reference to the research proposal during the process of screening (preliminary evaluation). Providing this reference information is not mandatory.

(PRESTO-Form 3)

Research Concept

-Write in a manner that is easy for evaluators to understand. To this end, add graphics and tables where necessary.
-The length should be approximately five A4-size pages. However, necessary and sufficient description is more important. For that reason, the quantity is not fixed.

1. Aim of Research

2. Definite Research Background

Describe the process through which you reached the research vision concerned, and relationship with your previous research, etc.

3. Originality and novelty of the research and comparison to similar studies

Describe the research trend of related fields, domestic and international.

4. Contents of research

List and describe for each item the necessity of research, preliminarily available knowledge and data, and definite research subjects, and the way to advance thereof (including anticipated problems in the aim and goal achievement, their possible solutions, etc.).

5. Future prospect of research

Describe the contents of the contribution of your research to the future society, such as expected outcomes, future prospect, accumulation of intellectual property, and invention of new technologies.

(PRESTO -Form 4)

List of research papers, literary works and patents

● **Major literature**

Author(s) (List all authors), title of the paper published, publication in which the paper was published, volume and page numbers and publication year

(List research papers or literary works that are considered to be important from those published in academic publications in recent years. List them in reverse-chronological order of the year of publication. Place an asterisk (*) at the beginning of the title of the paper/books of which the applicant is the chief author. Items to be written are as above in a free order.)

● **Bibliography**

Author(s) (List all authors), title of the paper published, publication in which the paper was published, volume and page numbers and publication year

(List any relevant literary works that are necessary for understanding your research proposal. (Place an asterisk (*) at the beginning of the title of the paper/books for which the applicant is the chief author (if any)).)

○ **Major patents**

Application number, inventor, title of invention, applicant and date of application

[Items to be written are as above in a free order.]

(PRESTO –Form5)

Grants from Other Aid Programs

List grants from the government Competitive Research Funds and any other research subsidies that the Applicants are currently receiving, applying for, or planning to apply for by program name, indicating the Research Subject title, research period, roles(representative, participant, etc.), amount of research expense and effort. Your entitlement to the JST funds might be cancelled on a later day even if you have been selected should your presentation fail to be accurate.

Example:

Fund Name[1)]	Research Subject Title (Director Name)	Research Period	Roles [2)] (Director/ Allocation)	Research Expense[3)] (1) FY 2008 (2) The whole period	Effort (%)[4)]
PRESTO					80
Grants-in-Aid for Scientific Research (Basic Research C)	XXXXXXXXXXXX	April,2008 to March, 2011	Director	(1)2,000/yr (2)3,000/yr	10
_____					
_____					

1) List grants that the Applicant is currently receiving, or adopted, in descending order of research expenses (the whole period).
   Then list those the Applicant is currently applying for or planning to apply for (specify "under application" in the column "Fund name").
2) Describe Directorship or allocated work as "Role."
3) Describe the amount of funds the Applicant him/herself is receiving as "Research expenses" in units of 1,000 yen.
4) Describe as "Effort" the percentage of the time required for the research concerned in the total work hours of a researcher, letting all annual working hours be 100% (not only time for research activities but education, medical services, etc. are included.) [Note that this definition of Effort is given by the Council for Science and Technology Policy.] Describe Effort not for grants the Applicant is currently applying for or planning to apply for, but for grants the Applicant is currently receiving assuming that only PRESTO proposal is selected. Note that the Efforts for PRESTO and for the grant currently being receiving shall not exceed 100% in total.
5) Add writing spaces if necessary.

(PRESTO-Form6)

Other Special Information

・ Write freely the reason(s) why you have applied for the Basic Research Programs, any requests concerning your research, or any other concerns that you might have. ・

・Use this space to write the reason(s) if you request that your research take place overseas.

(PRESTO-Form 7)

Application Documents for the High-impact Type

※Masked screening shall be performed using only these documents in the third screening process for the High-impact type. Please write in a manner by which the individual applicants will not be identifiable.

※Write in a manner by which an evaluator in a different field will be able to easily understand.

※Write within two A4-size pages.

1． Outline of Research

Summarize the main points of the Research in English in approximately 200 words.

2． Innovativeness and Originality of Research

Describe the novel and innovative ideas that breakthrough the existing common assumptions, the possibility of new findings and innovations as a result of the development of research, the possibility of bringing change to existing scientific areas, and the possibility of creating new scientific areas.

3． Goal and Concept towards Achievement of Goal

Describe the goal to be achieved during the research period for the High-impact type. Also, describe the manner in which the goal is to be achieved (include the assumed midterm goal 3 years after the start of the Research for a 5 year program), the clues to preliminary findings and data, and the expected difficulties.

4． Impact and Ripple Effect on Society, Economy and Science in the Future.

Describe the impact and ripple effect expected in 10 to 20 years.

Ⅲ. "Outline of the Research Area" and "Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area"

【CREST】

Research area in the strategic sector:

"Creation of fundamental technologies for harmonization of information environment with human"

(1) "Creation of human-harmonized information technology for convivial society"

Research Supervisor: Yoh'ichi Tohkura

(Professor / Deputy Director General, National Institute of Informatics)

Outline of Research Area

This research area aims for the establishment of fundamental technologies to achieve harmony between human beings and the information environment by integrating element technologies such as real-space communication, human interfaces, and media processing.

Specifically, this research area promotes trans-disciplinary approach among following research scopes to establish Human-Harmonized Information Technology.

- Recognition and comprehension of human behavior and real-space context by utilizing sensor networks and ubiquitous computing
- Technologies for facilitating man-machine communication by utilizing robots and ubiquitous networks
- Contents technologies related analysis, mining, integrating and structuring of a variety of different types of media, including text, voice, music, and picture images

Furthermore, this research area also promotes researches that create the breakthrough technologies for the harmonious interaction of human and information environments, and trans-disciplinary researches on cognition processes in the perspective of creating human harmonized information technologies.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

The development in information-communication technologies have been creating new information environments. In fact, various types of information environments have been provided for practical applications. But in utilization of such information environments, people are still required to fit themselves to the environments. Now, the concepts of "*interworking between human and the information environment*" and "*harmonization between human beings and the information environment*," or in other words "*the ambient intelligence*" are required to enable any person to enjoy the benefits of timely and optimal information depending the situation.

Previously, research and development of *"the ambient intelligence technologies"* have been independently promoted in various research fields. In fact, There exist many technologies of great potential but still immature. They would lead toward Human-Harmonized Information Technology by promoting cooperation, fusion, and integration of individual research fields Therefore, proposals of joint research aiming for innovative technologies that create a Human-Harmonized Information

Technology through inter- or trans-disciplinary research are expected.

Once the ambient intelligence is being enabled, it is possible for information equipment or network actively communicate with human. Under such circumstances, individual users are capable of acquiring the necessary and optimal information depending on the time, place, and occasion, easily and unawarely. Such an information technology might lead human beings who stop thinking and acting. To the contrary, however, the important thing for the Human-Conscious Information Technology is not to produce passive human beings but to derive the intellectual or action-taking abilities of human beings. In this way, innovative technologies for establishing an information environment that brings out synergic effects in terms of intelligence and actions with human beings are expected.

In addition, researches to elucidate the cognition processes of human intentions, behaviors, or spatial information, as well as the cognition processes for understanding the degree of harmonization between human and the information environment in a quantitative manner, from the aspects of psychology and cognitive science, by integrating with Human-Conscious Information Technology, are also important target. It should be noted, however, the research that targets only the elucidation of cognition processes should not be included in the scope.

Furthermore, in the execution of research for the Human-Harmonized Information Technology, it is important to visualize the form of implementation in daily life in the future. Therefore, proposals should clearly show specific pictures for the target to be achieved and the progress schedule of achievement during the research period.

Research area in the strategic sector:

"Creation of natural light energy conversion materials and utilization of basic technologies through the interaction of various research fields"

(2) "Creative research for clean energy generation using solar energy"

Research Supervisor: Masafumi Yamaguchi

(Principal Professor, Toyota Technological Institute)

Outline of Research Area

This research covers solar photovoltaic technology that converts sunlight directly into electrical energy encompassing; research and development that contributes to the creative clean energy generation for the future, including the creation of chemical fuel technologies for hydrogen generation using solar energy; and technology for the simultaneous production of electrical energy and chemical fuel.

Specifically, the target of the research and development are solar cells and materials composed of silicon crystals and thin films, compound semiconductors, dye-sensitized and organic materials, and new super high-efficiency solar cells, in addition to the creation of useful fuels, such as hydrogen, and the simultaneous creation of valuable material and clean energy using solar energy.

In this research area, we will focus on the basics of material search, fundamental physical analysis (light absorption, charge separation, material deterioration, and so on), and on new principles for realizing higher efficiency and longer lifetime. We will perform creative research and development that establishes the breakthrough technologies in the future. To this end, the research will be a fusion of material sciences and device physics; consequently to create breakthrough technologies in this area, we will combine the expertise of researchers from the different fields of physics, chemistry, and electronic engineering and utilize cutting edge nanotechnology to promote research and development by combining the strengths of different disciplines.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

In order to solve global environmental and energy problems that are becoming ever more serious, it is most important to develop creative clean energy technologies using inexhaustible solar energy. This research area targets new clean technologies for solar photovoltaics (solar cells) that convert solar energy into electrical energy, chemical fuel generation technologies to create hydrogen from solar energy, and the simultaneous generation technologies of electrical energy and chemical fuels. However, biomass technology is not included in this research area.

Since its invention 55 years ago, many practical applications for solar cell technology have emerged; however, conversion efficiency, cost, and lifetime of the solar cells still remain problematic, hindering their widespread applications. Noting solar cells as an example, technical development has been conventionally been conducted through research and development funded by organizations such as the Ministry of Economy, Trade and Industry and NEDO. The specific targets for conversion efficiency and cost used to be set, and a short term view of technical development was inevitably taken. The foundation for technical development was mainly semiconductor engineering and electronic engineering, so the promotion of creative research and development was not always sufficient. In order to dramatically expand future research fields, it is important to make the most effective use of human resources.

For the dramatic deployment of clean energy, the development of creative clean energy generation technologies using solar energy is extremely important. In order to promote creative research and development, we intend to effectively fuse different research areas. We feel that conducting research from different viewpoints will be effective in promoting creative research and development. We are looking for changes in thinking that lead to breakthroughs. In this research area, it is necessary to ensure complementary cooperation with technological development by the Ministry of Economy, Trade and Industry and NEDO.

The following are examples of the fusion of different areas that we seek.

1. For the dramatic improvement in conversion efficiency, an understanding and control of the physics of the surface, interface and imperfections, such as defects and impurities, are important; consequently, we encourage the participation of researchers in physics, chemistry, crystal physics, surface science, materials science, membrane engineering, and device physics, in addition to semiconductor engineering. We consider the fusion of above-mentioned research to be effective in developing an understanding of the light degradation phenomenon, which is an issue with amorphous silicon materials, and which will lead to a resolution of the problem.
2. Quantum nanostructures, such as quantum dots, are also an attractive research topic; however, the principle has not yet been verified and the understanding and control of fundamental processes such as light absorption, carrier generation, and recombination should be considered an issue to create new concept and new devices, so we encourage the participation of researchers in basic research, mainly quantum physics. Additionally, light collection and light confinement control are also effective for higher efficiency, so we seek the participation of researchers in light theory such as light control through photonic crystals.
3. As for the dye-sensitized and organic solar cells for which low cost is anticipated, big problems are lower conversion efficiency and shorter lifetime. In the past, research and development have been conducted mainly by chemists, but we think an understanding of fundamental issues such as absorption, carrier generation, charge separation, charge transfer, and surface phenomena are necessary. In addition to chemistry and the materials sciences, we consider the participation of researchers from physics, semiconductor engineering, and electronic engineering to be important. Furthermore, we also anticipate the participation of researchers from related fields such as organic EL displays and photocatalysts.
4. As for useful material and energy generation technologies using solar energy, the creation of valuable fuels, such as hydrogen, simultaneous generation of useful material, and energy from sunlight also considered. For the generation of hydrogen through the complete breakdown of water, discovering the basic principle and device physics are issues for consideration, and we hope to fuse chemistry, electric chemistry, physics, and electrical engineering. The aforementioned dye-sensitized solar cells and the generation of hydrogen from the complete breakdown of water have the same common basic principles, so we anticipate the fusion of research in these areas.

Research area in the strategic sector:
"Clarification of the control mechanisms of neural circuit operation and its formation"

(3) "Elucidation of the Principles of Formation and Function of the Brain Neural Network and Creation of Control Technologies"

Research Supervisor: Seiji Ozawa

(Vice President / Executive Director of Research and International Exchange, Gunma University)

Outline of Research Area

This research area aims to elucidate the molecular and cellular mechanisms of the generation, development, and regeneration of the brain neural network; to investigate how neural networks composed of a variety of elements in individual brain areas work and express their specific functions; and to clarify how the brain works as a coherent system by integrating the activities of these local networks. On the basis of such research, it also aims to create technologies for controlling the process of formation and activities of the brain neural network.

Specific approaches may include elucidation of the molecular mechanisms of development, differentiation, regeneration, target recognition, and migration of neurons (components of neural networks) and glial cells that significantly influence neural network formation and functions; elucidation of the mode of neural network activities by combining new technologies, such as visualization of specific neurons with the use of specific expression molecules and fluorescent proteins, simultaneous recording of activities of many neurons, and local stimulation with a caged compound; research to clarify the relationship of higher order brain functions with synaptic events through the combination of research at the network and system levels in model animals and research on the regulatory mechanism of synaptic transmission at the molecular and cellular levels; elucidation of the mechanism of neural network reorganization at the critical period or after brain damage; and creation of technologies for intervention in its process.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

The brain is an information processor consisting of an enormous number of neurons. Individual neurons do not work independently but are connected to each other via synapses and form local neural networks in various areas of the brain that execute local information processing. Thus, the brain is characterized as a large assembly of such local networks for higher order information processing. In order to understand the function and pathological conditions of the brain, it is necessary to evolve research at multiple levels from molecules to cells to local networks to systems and to integrate their findings. This research area focuses on investigation into the function of local networks, as well as attempts to elucidate the molecular and cellular mechanisms of their development, differentiation, and regeneration. Furthermore, it aims to figure out the interactive principles of local networks governing the system.

Brain science research has recently made dramatic progress thanks to advances in molecular biology, cell biology, and information science, and there is increasing public expectation and interest in brain science, specifically in the three fields of *brain and society and education, brain and mental and physical health*, and *brain and information and industry*. However, many questions remain to be clarified regarding the molecular aspects of the principle of neural network formation, the information processing mechanism in local networks, and the brain function as a system for integration of local network functions. In-depth research about these issues to further strengthen the infrastructure for practical research in the above three areas is now an important challenge.

In light of this, in this area, researchers are expected to propose projects related to research in the fields of molecular biology, cell biology, morphology, physiology, biochemistry, pharmacology, and behavioral science that aim at elucidating the principles of neural network formation and functions, particularly those where multidisciplinary approaches using molecular, cellular and system neuroscience techniques are adopted in order to understand brain functions from molecular to system levels. Although this area is mostly characterized by basic science, researchers are encouraged to present strategic creative research projects that aim to develop innovative technology to control the generation, development, regeneration, and function of the neural network and may help develop technologies for the prevention and treatment of brain diseases, for recovery from a disability, and for compensation for defective functions in the future.

Research area in the strategic sector:
"Development of innovative technologies for realizing sustainable water management by mitigating water problems intensified by climate change"

(4) "Innovative Technology and System for Sustainable Water Use"

Research Supervisor: Shinichiro Ohgaki

(Professor, Department of Urban Engineering, School of Engineering, The University of Tokyo)

Deputy Research Supervisor: Mikio Yoda

(Senior Chief Engineer, Information & Control Systems Division, Hitachi Limited)

Outline of Research Area

This research area is focused on the creation of physical and/or social water management systems that would be adaptive measures for a variety of water issues of concern to Japan or other countries and caused by climate change or other factors. Using innovative water treatment technologies and water resources management systems, optimal water use, as measured by qualitative and quantitative criteria, is sought in the respective stages of water supply, discharge, reclamation, and resource recovery. Proposed researches should contribute to sustainable water use from the most rational of many perspectives, including energy consumption, socioeconomic impact, environmental load, public health, and/or site-specific circumstances of targeted areas.

Examples of research topics to be considered in this research area are: 1) basic R&D in materials science for advanced water treatment and seawater desalination using ozone or membranes and ceramic materials; 2) water quality assessment; and 3) comprehensive water resources (surface and subsurface water) and environmental management systems at the watershed scale. Comprehensive management systems should consider water treatment, reclamation, and resource recovery in different water uses including drinking water, sewage, industry, and agriculture.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

Water, along with energy and foodstuffs, is an essential resource to sustain our society. However, among these three items, only water has no alternative. In addition, rainfall and snowfall, which replenish terrestrial water resources, are unstable and unevenly distributed locally. Therefore, there is concern about the direct impact of climate change on water resources. Ecosystem is vulnerable to severe negative consequences as a result of slight decreases in water quality.

As stated above, water resources are limited both quantitatively and qualitatively. Thus, highly advanced technologies and resource management systems are now required. Such technologies and systems must be durable and withstand the natural disturbances of climate change, fluctuations in social demand, and other factors. The research area aims to propose new technologies and systems that will contribute to present water use issues in Japan and the world or those that are likely to occur in the future. The abundant academic and industrial achievements of Japan in water-related technologies and systems, especially in the control and operations of water systems, make it the obvious choice to lead the world in this important research area.

Applicants are requested to offer proposals after carefully reading and understanding the statements in Strategic Sector "Development of innovative technologies for realizing sustainable water management by mitigating water problems intensified by climate change." More specifically, research that merely deepens understanding in specific academic fields is not eligible. Research should address the role of water use in public health and socioeconomic development.

For the operation of the research area, collaboration among researchers from different fields will be positively pursued with sufficient recognition of the diversity of strategic research concerning water use. For this purpose, we think it is necessary to provide opportunities for interaction with many researchers of diverse specialties in order to provide inspiration for each other. In addition, it is anticipated that the research area will include research teams with different expertise. For example, a successful research area will include researchers in the development of materials technologies, systems integration, and control and assessment methods. No less important in the research area are researchers from additional topics, including those who specialize in site-specific water use systems in individual regions and the research and development of universal technologies. Therefore, applicants are required to be clear about how they can contribute in the category of water issues in the world and in Japan. Based on the selected researchers, the scope of the Research Area will be soon taken shape.

Research area in the strategic sector:
"Creating fundamental technologies for advanced medicine through generation and regulation of stem cells, based on cellular reprogramming"

(5) "Fundamental technologies for medicine concerning the generation and regulation of induced pluripotent stem (iPS) cells"

Research Supervisor: Toshio Suda

(Professor, School of Medicine, Keio University)

Outline of Research Area

The objective of this research area is to establish fundamental technologies contributing to advanced medicine through the development of cellular reprogramming technology. Remarkable progress has been made in this field recently, especially the generation of iPS cells. The research objectives include the advancement and simplification of this technology, the elucidation of pathological mechanisms through the development of model cells, the formulation of new therapy strategies, and novel methods for the early discovery of diseases.

Specifically, included is research on cellular reprogramming and differentiation mechanisms using genomics, chromosome structure and epigenetic analysis; research on gene transfer regulation; high-throughput screening of reprogramming-inducing compounds; and research using iPS cells generated from patients with congenital diseases for the elucidation of pathological mechanisms. Moreover, the research also covers an area that may lead to the pioneering of new therapy methods and preventive medicine through the integration of stem cell research and pathological studies.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

Since November 2007 when the human iPS cells were first successively established, research on this technology has advanced remarkably. New findings have been reported domestically and internationally, causing not only researchers engaged in this area of research but also the general public to realize how rapidly the research is advancing. However, even Dr. Yamanaka, the leading researcher in this area, says that there are still many uncertainties regarding iPS cells, indicating that there are many phenomena that need clarification and issues that need resolution for clinical study and application of the research achievements. Meanwhile, further possibilities in the research on the technology for cellular reprogramming are being markedly expanded. We should aim at clarifying the cellular reprogramming mechanism to create new medical infrastructure by continuously addressing expansion of the range and outlet of R&D for iPS cells.

We had raised good research themes in this research area since 2008. Limited people had actual experience in the research of iPS cells the previous year. However, many researchers might research iPS cells independently to reinforce basic or applied research on cellular reprogramming. Also, beyond biology and medicine, some researchers engaged in conventional areas that had less to do with stem cells have been inspired by the research on cellular reprogramming aiming for innovation. We are looking for researchers who can propose substantial and challenging research themes that will open up a new paradigm, as opposed to remaining an adherent of conventional research on iPS/ES or tissue stem cells. Recently, researchers in abroad have made outstanding achievements. We are waiting for researchers in Japan to go ahead with their research by incorporating the new concept of cellular reprogramming into their own research base. s

Regarding newly adopted research subjects, about 1 or 2 meetings will be held every year to exchange information and to present research achievements. Also, the exchange of cells or other materials will be promoted to accelerate research.

<u>Preliminary notes on proposing a subject in this research area</u>

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) settled on the Total Strategy for Acceleration of Research on iPS (induced Pluripotent Stem) Cells ("Total Strategy") (approved by MEXT on January 20, 2009) to promote research on iPS cells nationwide in Japan. As part of the program in 2008, MEXT iPS Cell Research Network ("Research Network"), which involves research institutes and researchers in projects relating to research on iPS cells supported by MEXT and JST, was established to comprehensively accelerate research on iPS cells. The Research Network will effectively function to comprehensively promote research on iPS cells by licensing intellectual property rights and utilization of tangible property, such as living organisms, free of charge within the Research Network according to common rules for intellectual property rights, publication of research achievements, and maintenance of confidentiality prescribed under rules of Research Network.

This research area is also a constituent of the Research Network; therefore, anyone engaged in the adopted research after selection, should be a member of the Research Network to follow the policy based on the Total Strategy in principle.

Research area in the strategic sector:

"Enhancing advanced materials science and life science toward innovations using new light sources, including state-of-the-art laser technology"

(6) "Enhancing applications of innovative optical science and technologies by making ultimate use of advanced light sources"

Research Supervisor: Tadashi Itoh

(Professor, Graduate School of Engineering Science, Osaka University)

<u>Outline of Research Area</u>

The present research area aims at accelerating collaboration and fusion of potential research and development (R&D) capacities related to light utilization science and optical technologies that currently are individually investigated in different fields such as substances and materials; processing and measurement; information and communication; environment and energy; and life sciences, so as to build up foundations for creation of a innovative new stream for "relation of materials to photons" in the field of optical science and technology.

At present, various types of advanced light sources represented by high performance, state-of-the-art lasers are widely available, leading to rapidly increasing numbers and extent of research projects performed for investigation of their usage. However, since the advanced light sources are placed into black boxes, these light sources are not always utilized to the extent of their maximum potential. Taking these circumstances into account, the present research area promotes distinguished research regarding "relation of materials to photons" in which characteristics of light sources are extremely utilized.

Furthermore, this research area covers leading research that will enable achievement of breakthroughs in the field of light utilization science and technology, and also includes objective-oriented basic research in a wide range of fields such as life sciences and environmental and energy. It should be noted that this research area puts special importance on seeds that will create research aimed at fusion of advanced optical science and optical technology as well as at creation of a novel stream, e.g. by showing truly effective methods of making extreme use of state-of-the-art light sources such as lasers. In these research projects, analyses of events or identification of principles do not mean the end of the research, but instead how these technologies can be put to practical use will always be taken into account. The present research area does not aim at the world record of the light source performance itself but includes research that identifies any relevant and advanced need regarding the light source required for research processes and provides feedback on such needs to the light source development research, contributing to practical advancement of optical utilization science and optical technology fields.

<u>Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area</u>

Today, rapidly developing optical technology is spreading and expanding as an important social infrastructure with the deepening and expanding of our understanding of optical science, and not only is it a useful tool in the industrial world, it plays a role as the base for creating innovation. In order for the optical science and technology necessary for our country's manufacturing industry, medicine, and the environment to develop dramatically, this research area takes the initiative in promoting the utilization and R&D of optical science and technology, with "the relationship between material and light” as the key phrase. Through this, we aim to create technical innovation that will have a pervasive effect on practical use.

Our recruitment policy for this fiscal year will especially welcome research that controls the performance of cutting edge light sources to the limit and contributes to creating innovation. If the need for a certain kind of optical technology is clear, we will accept research that includes technical development for the precise control of light sources. We also welcome research of utilizing the adoption of cutting edge lasers to solve the pressing issues that concern the entire human race such as medicine and the environment, that promotes the development of light source. Proposals utilizing important cutting edge light sources other than lasers will also be accepted. All research proposals should have an active and challenging target, provide data on the current direction, and specifically state the annual targets for the entire plan as well as the cooperative structure between researchers.

Our selection policy will be to conduct relative evaluation based on such points as to whether it is an issue that needs to be resolved now, an original idea that provokes true astonishment, research that aims to lead the world, whether the research structure is a fusional one, whether the idea spreads to other areas, whether it will create the seeds of technology that are long lasting, and whether the direction is one that leads to industrial and social needs. The research fund classification requires that Class II (average 400 million yen) research proposals provide results that are more practical or meet more precisely the expectations of society than the Class I (average 200 million yen) research proposals. We expect proposals for research that do not just depend on the performance of commercially available advanced light sources, but instead, through synergy between use researchers and development researchers, create new seeds of technology that cannot be achieved individually.

As for the management of this research area, we will work to develop innovative research by actively cooperating with “Photon Frontier Network Program” conducted by the Ministry of Education, Culture, Sports, Science and Technology.

Research area in the strategic sector:

"Creation of next-generation nanosystems through process integration"

(7) "Creation of nanosystems with novel functions through process integration"

Research Supervisor: Jun'ichi Sone

(Vice President, Central Research Laboratories, NEC Corporation)

Outline of Research Area

This Research Area aims at creation of next-generation nanosystems that produce novel functions by promoting evolution and integration of top-down processes such as photolithography and bottom-up processes based on self-organization.

Specifically, this aims at development to build up technologies such as sensors, actuators, biochips, electronic and optical devices, and energy devices that bring breakthrough in the functions and performance, focusing on studies on novel functions produced by fusion of nanostructured devices, such as nanoelectronic circuits, Micro Electro Mechanical Systems (MEMS) and Nano Electro Mechanical Systems (NEMS) manufactured using top-down processes, and materials such as biological, organic, and self-organized materials, or studies on construction of functional bottom-up nanostructures as systems applicable to engineering. In addition, development of next-generation nanosystems based on the integration and optimization of these technologies is also taken into consideration in the promotion of research.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

Research regarding forming nanostructures, elucidating their properties, and producing novel functions in those nanostructures show steady progress, and there is growing momentum towards their applications in engineering. These functions in the nanostructures have potential to generate significant innovation in various devices in information and communication fields; environment and energy fields; and life science fields. However, despite great expectations for engineering and industrial applications of nanostructures, it is difficult to say that their high potential has been fully realized. This Research Area aims to create nanosystems with novel functions by integrating top-down and bottom-up nanoprocesses.

In the processes of collecting, screening, and implementing the Research Subjects in this Research Area, integration of top-down and bottom-up processes as well as fusion of different fields are considered to be the important keys. The reasons are as follows:

Until now, the remarkable progress of performance in electronic systems has been realized through the miniaturization of semiconductor devices. However, miniaturization by top-down processes has already reached to the range of a few tens nanometers, and now its technological and economical limitations are becoming apparent. Therefore, in order to go further in miniaturization, bottom-up processes, i.e., self-organizing formation of nanostructures utilizing autonomous chemical reactions, are considered to be necessary in some way. Combinations of bottom-up and top-down processes are expected to bring not only formation of nanostructures on atomic- or molecular-scales, but also low-cost manufacturing, enabling expansion of nanosystems in a wide range of applications.

Needless to say, advanced information and communication technology is necessary to realize a future society where we can enjoy comfortable, convenient, safe, and secure lives. In the future information society, various sensors will be distributed around us, and information from the sensors will be uploaded into communication networks and processed by high performance computing systems connected to the networks. Information required by individuals will be provided when needed through various means from these computing and networking systems. In such a society, not only electronic and optical devices that execute high-speed information processing and transmission but also a variety of devices such as various sensors and actuators, biochips for real-time and molecular-level monitoring of individual health status, and advanced batteries to supply energy to the above-mentioned devices will be necessary. These devices will be packaged in downsized, wearable, and tagged forms and deployed around us. Fusion of technologies among different fields is considered to be necessary for the realization of these functions and essential for future evolution of integrated nanosystems.

The concepts of next-generation nanosystems are not limited to the case described above. The nanosystem will provide new possibilities that may lead to innovations in the environment and energy fields. In this Research Area, a variety of possibilities for next-generation nanosystems are expected to be explored to solidify their images and to materialize them by executing the research projects. In addition, we want to send a clear message to the public world-wide about the next-generation nanosystem by encouraging cooperation among research projects.

The second invitation is done this year, where proposals to realize nanosystems will be invited from a wide range of research areas, and, especially, the challenges to bring solutions for the environmental and energy issues through the creation of nanosystems are expected. From the perspective of industrial applications, proposals involving industry-university collaboration are also welcomed. In addition, as the next step of the previous individual technology development in nanotechnology-related projects including CREST, proposals aiming at engineering applications for nanosystems having novel functions are also welcomed. Although there is no question that originality of the proposal is the most important point in the selection of Research Subjects, potential for evolution, influence to wide spread areas, and industrial impact of the proposals will be highly appreciated. Research Subjects will be selected, more specifically, based on the following criteria:

- Whether bottom-up and top-down fusion process is challenged.
- Whether there are possibilities for innovative development of opening up new science fields or new markets.
- Whether the evidence to realize the idea is presented in the form of scientific data and technique.

To achieve the goals of this Research Area, an interim assessment three years after adopting the projects is considered important. Be aware that the project may be substantially reviewed and, in some cases, terminated, if achieving the goal of the project is judged difficult. We want many researchers to actively exhibit their proposals so that Japan will lead in this area and continuously send new message of next-generation nanosystems to the world.

Research area in the strategic sector:

"Creation of next-generation nanosystems through process integration"

(8) "Development of high-performance nanostructures for process integration"

Research Supervisor: Masahiro Irie

(Professor, Department of Chemistry, Rikkyo University)

Outline of Research Area

This research area focuses on studies that aim at development of new high-performance nanostructures by further sophistication of traditional bottom-up processes, such as self-organization. The nanostructures are expected to be integrated into high-performance nanosystems by fusion with top-down processes and become important components of the nanosystems in the future.

Specifically, this research area includes studies that aim to develop previously-accumulated, sophisticated molecular-level functions to actually useful technology and create nanostructures with advanced functions by incorporating new methods of self-structuring and self-repairing into bottom-up processes of self-organization and self-assembly. Studies should be conducted in consideration of the fact that these high-performance nanostructures will be integrated further as necessary and become components of high-performance nanosystems such as nano-actuators, nano-motors, nano-sensors, nano reaction fields and batteries.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

For efficient, flexible development of next-generation nanosystems, the linkage of top-down and bottom-up processes is essential. The objective of this research area is to explore how to connect molecular nanostructures and functions to structures and functions of macroscopic materials and to create self-sustained high-performance materials with unique functions that can be achieved only by the bottom-up processes.

At the molecular and supramolecular levels, minute molecular machines, molecular motors, and artificial muscles have been constructed, and specific functions have been discussed. However, we have not yet succeeded in connecting the functions of macroscopic materials. Molecular materials have the potential to be modified in different ways due to their diversity. Proposals are expected that try to link the minute structures and functions (e.g., chemical and physical responsive properties, catalytic properties, electrical conductivity, and magnetism) to the real macroscopic world based on this potential and to create self-sustained, high-performance materials. For example, recently reported self-repairing rubber materials (*Nature*, 451, 977 (2008)) and polymeric materials that control the elastic modulus by the stimuli-responsive switch (*Science*, 319, 1370(2008)) are included here.

As with last year, in this research area, predominant applicants are from the areas of material, especially chemistry. We are waiting for applications from a variety of different areas, including physics, engineering, and biology, such as preparation of nanocarbon materials (vapor-phase as well as purely chemical synthesis of graphene, nanotube and fullerene) to biomineralization.

Research area in the strategic sector:

"Creation of innovative technologies related to reducing global warming in an effort to realize a sustainable society"

(9) "Creation of innovative technologies to control carbon dioxide emissions"

Research Supervisor: Itaru Yasui

(Vice Rector Emeritus, United Nations University; Principal Fellow, Center for Research and Development Strategy (CRDS), Japan Science and Technology Agency (JST))

Outline of Research Area

This research area was chosen for the purpose of developing innovative technologies to be used chiefly to reduce CO_2 emissions, with roughly twice the efficiency of existing technologies. The resulting technologies are to contribute to halve global greenhouse gas emissions by 2050, which is in line with the proposals of the Japanese Government at Heiligendamm Summit, 2007. The research projects in this Area shall aim to create a low-carbon society, using new concepts and principles to achieve direct or indirect means of CO_2 emission reduction, for example, technologies to realize dramatic performance improvements in renewable energy and technologies to dispose CO_2 in an innovative manner.

In specific terms, the research area covers all new energy technologies with the exception of nuclear power. Such technologies include: energy production and storage technologies that can fundamentally improve the efficiency of conventional products, technologies that bring innovative reductions in energy consumption – such as those utilizing new-concept solar cells, CO_2 processing technologies, ocean energy and bio-energy technologies. Included also are carbon capture and sequestration technologies on the assumption that fossil fuels will continue to be used. Though the research area concentrates on the supply side of the energy chain, demand-side technologies are also considered to enable enhancement of energy efficiency. Therefore, projects in this area will be accepted if they are innovative and promise high social impact.

We expect to receive research proposals of fundamental research with definite targets that would bring innovation to the industrial structure and energy infrastructure of future society. When making the proposal, the applicant must provide a quantitative scenario in terms of the expected emission reduction in million tons if the technology concerned is to be commercialized in about 2020 to 2030 or so.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

This area will cover innovative technology aimed at reducing CO_2 emissions from fossil fuel. The main purpose of this area is to widely consider the possibilities of the choices we have in CO_2 emission reduction technology, in other words, build an objective portfolio of innovative technology.

The development of new emission reduction technology is vital to reducing emissions, but a cooperative effort is necessary on both the supply side and consumption side of the energy chain. Last fiscal year, the focus was on the energy supply side, especially energy producing technology. This was because more time was required in its development and the hurdles to be cleared are higher in changing the social system currently associated with the supply side.

However, this fiscal year, a new CREST research area was established specializing in technology to obtain power and hydrogen directly from sunlight. Therefore, the natural energy applications for this area in this year will be limited to areas other than the direct conversion of solar energy.

So, when we say the supply side of the energy chain, we mean we would like to strengthen expansion into areas other than energy generation. Technology for combining the different natural energy and control technologies are some examples. Additionally, we would also like to maintain an opening for proposals from the consumption side of the energy chain, that is, research on energy conservation.

Of course, this does not change the fact that proposals from the supply side of the energy chain are important. Even if direct conversion of solar energy is excluded, there is still a wide area that is covered, such as the effective use of wind power, ocean, and bio-energy. We anxiously await applications that are new and challenging.

The basic stance of this research area is to place it within the of environment energy research for building a sustainable society. To realize this, it is important for the person who heads each research subject to appreciate the positioning of his or her own research within the wider context and to realize fully its social role. No matter how advanced and cutting edge the research, it is necessary for the proposal to acknowledge and describe a firm connection to society. That is, we will evaluate research with a priority on its contribution to society instead of just the advanced science aspect of the research.

The reason for such priority is because no matter how superior the environmental research is elementally, the reality that needs to be acknowledged is that you cannot expect widespread use unless it is accepted socially.

We adopt the same attitude towards research on the energy consumption side. Naturally, the need for outstanding technology is extremely great, but it also has to be technology that can be accepted naturally by the general public who are to use it.

In short, creating an "innovative technology portfolio" of technologies that will be commercialized is another aim of this research area. Such are the basic perceptions on which work should be based: all Research Teams should regard themselves as members of "a virtual lab." They should become more deeply aware of their contact with society at large. Our great hope is for some spin-off effects to arise, for the Teams perhaps to instigate a movement in society.

In summary, we are asking the research proposal to offer the distinctive elements of leading-edge science and social benefit/all-encompassing view. Applicants should understand that this is because the aim of this research area is to generate seeds of technologies with a strong potential for diffusion that can start around 2020 to 2030. Therefore, we call for applications of excellent proposals from a broad range of areas and from a wide perspective - proposals that would enable innovative technological development to materialize.

Applicants should ensure that the research path and timescale can be foreseen in concrete terms, for example through research scenarios and milestones.

Finally, this is an advance notice. In the final call for applications a year from now, for all the CO_2 reduction measures, we are looking for proposals for research that conducts evaluation from a global viewpoint.

Research area in the strategic sector:

"Development of medical technology using immunoregulation to overcome allergic and autoimmune diseases including pollinosis"

(10) "Etiological basics of and techniques for treatment of allergic and autoimmune diseases"

Research Supervisor: Kazuo Sugamura

(Professor, Graduate School of Medicine ,Tohoku University)

Outline of Research Area

This research area aims to improve prevention, diagnosis, and treatment of human immunological diseases, centered on allergic and autoimmune diseases, and includes research for development of basic technologies for improvement of appropriate functioning of the immune system.

Diseases centered on allergic responses and autoimmune systems vary from those that may lower the quality of life (QOL) of patients to those leading to death in serious cases. Deepened understanding of the immune mechanism and control of such diseases at levels of molecules, cells, organs, and tissues will be evolved into understanding of a higher-level control immune network system at individual levels, leading to clinical application.

Specific examples of research projects include immunoregulatory mechanisms by regulatory cells, construction mechanisms of the mucous membrane immune system, autoimmune system, acquired immune system, and natural immune system and their control, etiological mechanisms of autoimmune and allergic diseases, immune and infection control mechanisms, development of drugs and vaccines against diseases and measurement of their effects, establishment of methods for diagnosis and treatment of diseases, and so forth.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

Allergic diseases, including pollinosis, which affects 10 and several percent of the population, and autoimmune diseases, such as rheumatoid arthritis, many of which are considered to be intractable, are caused by excessive immune responses. This research area is open to research aiming at creation of innovative medical technology that can property modulate the immune system to overcome these immune diseases. Last year, the selected projects demonstrated originality and brilliant previous achievements, included abnormal phagocytosis and decomposition of apoptotic cells and immune diseases, cytokine dysfunction and immune diseases, immune disease control targeting cytoskeletal regulation, disease control through immunocyte reprogramming, positive and negative control mechanisms of the immune system and immune diseases, and mucosal immunoregulation. This year, we look forward to proposals with high prospects for the innovative development of treatment of immune diseases in the area of the immune system and basic research in life science, as well as projects approaching immune regulation with an original concept.

Research area in the strategic sector:

"Creation of innovations toward the development of diagnosis and treatment of psychiatric and neurological disorders based on elucidation of complex and higher brain functions"

(11) "Creation of a novel technology towards diagnosis and treatment based on understanding of molecular pathogenesis of psychiatric and neurological disorders"

Research Supervisor: Teruhiko Higuchi

(President, National Center of Neurology and Psychiatry, Japan)

Outline of Research Area

Psychiatric and neurological disorders attributable to disorders of higher brain functions, such as cognition and emotion, are an issue of high social demand in Japan, which is increasingly affected by a declining birthrate, aging, and social tension. This Research Area aims at the creation of a novel technology for prevention, diagnosis, and therapy for psychiatric and neurological disorders.

More specifically, it targets research towards evidence-based objective diagnosis and curative therapy based on the understanding of molecular pathogenesis of psychiatric and neurological disorders that engender higher brain function disorders. Exemplary research objects include: development of diagnostic methods using, for example, biological markers, which are available as an objective index from biochemical or molecular genetic points of view, or functional markers such as non invasive brain imaging technology; analysis of animals used in disease modeling reproducing gene mutation or environmental change; and search for and identification of target molecules towards innovative drug development for implementing basic treatment.

This Research Area also deems important those studies that aim at organic fusion of different research areas or study methods, including clinical study for disorders vs. fundamental study like brain science, psychiatric disorder study vs. neurological disorder study, and intermediate phenotype analysis studies like brain imaging vs. gene analysis study, to advance these studies.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

In today's Japan, a society that is coping with intense social stress and an aging society, one in five people is presumed to suffer from certain psychiatric and neurological disorders at sometime in life. This in itself has become a looming social problem. This research area is intended to elucidate the etiology and pathogenesis of psychiatric and neurological disorders that present as higher brain dysfunction and to establish a novel technology aimed at development of diagnosis and treatment based on scientific evidence.

Influential genes for some psychiatric disorders have been discovered. However, it is unlikely that the cause of disorders consists of a single gene. The study of this avenue is complicated because many factors are involved and because of the possibility of the existence of a single gene that specifies brittleness whose interaction with circumstances produces a crisis. That scenario commands a much higher probability of being correct than that of a gene independently causing a specific disorder. Therefore, it seems that the essential study must be pursued through irregular approaches. Such approaches include, for example, establishment of a diagnostic technique before the results of gene analyses are obtained; arrangement of issues of heterogeneity, which for the time being are based on the outcome to conduct pathogenesis research; or to carry out gene analyses after narrowing down an object.

Meanwhile, neurological disorders indicate a different aspect from psychiatric disorders. A single gene has already been specified and etiologies causing disorders in function, behavior, and metabolism have been identified for each of many neurological disorders. Future research seems to be focused on practical and full-scale therapies. Accordingly, the study of neurological disorders should be focused on implementing translational research using model animals on the basis of etiology, pathogenesis, and molecular processes. Specific candidate subjects include the identification of causal molecules, elucidation of a neurodegenerative mechanism, and development of a curative therapy that blocks the degeneration process.

Consequently, in this research area, a methodology is invited that seeks both gene analysis and intermediate phenotypes and investigates the relationships in one individual. A method will not be welcome that is based only on an independent methodology that is already known and which does not represent an advancement over conventional procedures. Note that the ultimate goal of research conducted in this research area includes an investigation of the pathogenesis, development of diagnostic techniques, and discovery of novel therapies. Accordingly, an investigation of normal cerebral function will achieve no important target. It is strictly necessary that research be of a sick brain. Applicants starting with fundamental research are advised to show a road map that traces a path from their research to development of a diagnostic method or therapy. Moreover, disorders of interest should be indicated because this is, after all, a research of disorders.

Intended disorder fields are, as described in the Strategic Sectors section, the following two fields: psychiatric disorders and neurological disorders. These two fields are different not only clinically, but in the level of attainment of fundamental and clinical studies. However, there are also many common areas in this research field, in view of its emphasis on higher brain function studies. It is important to perform interchange and collaborative work between both fields, in addition to individual studies in each field. I hope, if possible, for both fields to plan a common subject, to approach it from both sides, and to exploit this new Research Area. The fields except selected fields in FY 2007, schizophrenia, anxiety disorders, dementia (Alzheimer's disease), Parkinson's disease, will be selected mainly in FY 2008. In addition, this research area will include spinal cord disease.

Disease fields not selected in FY 2007 were preferentially selected in FY 2008. However, FY 2009 is the last year for this research area, and thus any disease fields will be selected.

Research area in the strategic sector:

"Development of fundamental technologies for the large-scale integrated-circuit system that can guarantee high reliability and high security"

(12) "Fundamental technologies for dependable VLSI system"

Research Supervisor: Shojiro Asai

(Vice President, Rigaku Corporation)

Outline of Research Area

This Research Area covers the R & D of fundamental technologies for the VLSI system that can guarantee high reliability and high security. It is a societal requirement today to guarantee the reliability and security of information systems, on which human activities depend to an ever increasing extent. The VLSI, its engine, is also a gigantic system itself containing a huge number of circuit elements, and its reliability and security is at the core of those of any information system. This Research Area addresses problems that have to be solved to realize VLSI systems with advanced levels of integration, while ensuring required reliability and security.

To be concrete, the scope of this Research Area includes subjects as follows. Some of the major physical problems are fluctuation associated with ultimate miniaturization of integrated-circuit elements, single-event data failure, and deterioration brought by long time use. These degrading factors not only cause malfunctions, but also might prevent a VLSI from large-scale integration. An extensive search for novel technologies to alleviate those factors is required at the device level, circuit level, and system level. On the other hand, because large-scale integration by miniaturization will soon reach its limit, technologies for packaging many chips in three dimensions while ensuring reliability and security are also important subjects. Another R & D subjects are design techniques that prevent mistakes in design that accompanies increase in the scale of integration and complexity of system. Software that facilitates design, verification, manufacturing, and testing is sought for. Also required is R & D of architecture and circuits that detect, confine, and relieve threats to reliability and security from inside and outside of the VLSI system during operation. Requirements for a VLSI system come from the quality and performance requirements of the information system it is used in. How to specify and evaluate reliability and security requirements for the VLSI system is also a subject of this Research Area.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

(1) The scope of R & D

1) The scope of this Research Area is described in the above "Outline of Research Area."

2) Each proposal should include in its scope exploring relevant metrices of dependability of VLSI and their quantitative evaluation. Proposals that focus on the evaluation of VLSI in terms of dependability are also invited.

3) Attempts are encouraged that start out from any realistic system and try to specify and quantify reliability and security requirements for a VLSI system to be used in it.

(2) Policy for invitation and selection

1) Aggressive research proposals are invited which meet the objective and aim of the Research Area, which are challenging, and which can compete internationally.

2) Special emphasis is placed on whether or not specific solutions and targets that are most favored are clearly stated by perceiving important issues of dependability that are specific and mainstream at the scene of the field use, inspection and design of VLSI systems and studying

these issues in depth.

3) As for the scope of the research, proposals dealing with contact with OS, and anti-tampering, which are not fully covered in the current issues, are especially welcome.

4) Also considered important are whether the target is presumed appropriate in view of the level of advancement from present technology, the usefulness at the period of achievement, the technological impact, and the degree of difficulty of achievement.

5) Applications will be selected considering previous research achievements in similar problem-solving by the applicant (or team), or the expected enhancement of the team's capability. Not only academic papers, but achievements in patent applications, technology transfer, management, etc., are considered.

(3) The policy in management

1) All research teams are assumed as constituents of one large virtual laboratory of the Research Area, where research will be conducted with promotion of mutual stimulation among teams. In addition to the Area Meetings held several times a year at CREST Members gather together, active efforts are made to promote cooperation between teams.

2) The progress of research teams shall always be disclosed to the Research Supervisor.

3) The Annual Progress Meeting will be held in principle under the supervision of the Research Supervisor, who will feedback opinions to research teams about how to proceed in research during the subsequent year and the review results will be considered when the Research Supervisor decide on the research budget for the following fiscal year. As a result of the review, modification of a research plan, or when extreme, discontinuation of a research subject might be advised.

4) To enable such comprehensive management, a research center might be established if deemed necessary.

(4) Attention for research proposal preparation

1) Describe related previous studies by the applicant and competitors all over the world, and compare them in "4. Research infrastructure and preparation" and "5. Originality and novelty of the research and comparison to similar studies" in "Research Concept" (Form 3). Also state the role the proposal plays in the world, considering the development trends of the industries.

2) Prepare a proposal in which possible collaborative use of assets and capabilities of other organizations and researchers is maximized, as well as your own previous research results.

3) Clarify the role and responsibility of each cooperative research group and of each individual in a research team.

4) Set appropriate milestones and describe corresponding outcomes in "3. Research plans and implementation" in "Research Concept" (Form 3). Be sure to clearly state targets for the midterm (basically the end of the third year).

5) Furthermore, describe conditions deemed necessary to conduct the research smoothly and risk factors that might inhibit success in "3. Research plans and implementation" on "Research Concept" (Form 3).

6) Assume a prospect corporation which would receive the outcome of the research and put it into practical use, and if possible, let that organization join in your proposal to form a strong collaboration system from the first stage.

Research area in the strategic sector:

"Exploitation of materials and nanoprocesses for the realization of novel electronic devices with novel concepts, novel functions and novel structures"

(13) "Research of innovative material and process for creation of next-generation electronics devices"

Research Supervisor: Hisatsune Watanabe

(President & CEO, Semiconductor Leading Edge Technologies, Inc.)

Outline of Research Area

This Research Area aims at transcending saturation of technology evolution based on a semiconductor Roadmap strategy. It covers research on material, structure, and process development for creating innovative and viable electronics devices that have novel function and high performance that can not be realized merely by the scaling paradigm.

Specifically, candidate subjects include: research for highly integrated information processing devices with a novel principle that can solve practical issues, such as increased power consumption and inflation of manufacturing cost; research for devices demonstrating novel function and high performance by the fusion of various technologies or materials including organic substances; process research that enables the above; or research exploiting a novel application thereof.

This Research Area promotes research that is expected to engender practical technologies, rather than investigation of properties and mechanisms of materials and processes.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

The performance improvement of silicon integrated circuits had been focused on the scaling-down of device structures and on the operating frequency increase of circuits. However we are facing several difficulties of these development roadmap achievements. The potential solutions due to the parallel processing of logic circuits and 3D packaging seem to be vigorously attempted. On the other hand, because of the stronger requirement to environmental concerns, it is expected that ultra-low energy consumption should be achieved by introducing advanced scaling technologies and new device structures, and superior additional values should be gotten by adopting a new device architecture.

This research area seeks: 1. **Discovery** Science: proposals that endeavor to create new concepts through an exhaustive understanding obtained by getting back to the basis of material and process science for the facing stalemate; 2. **Disruptive Technology**: proposals that attempt to replace conventional technology with totally innovative materials, processes and devices; and 3. **Fusion Device**: proposals that try to overcome the problems described above by combining semiconductor devices with the material properties from different fields and/or any devices with different principles.

An object of this public collection is consisted of new material exploitation, new process development, and device creation technologies in the semiconductor field. Also the challenging proposals based on a novel approach or an original idea will be welcome as this public collection object, even if relating the same material and process as the adopted subjects before. Relating to the research execution, we attach importance to the research mind, which aggressively challenges to commercialization through collaboration with universities and industries.

Applicants are asked to present a 5-year milestone in their research proposals. It is intended that a path toward commercialization should become visible within approximately three years considering the evaluation in a research, such as the midterm evaluation. A review of the research items and budgets will be conducted in the light of the result.

Research area in the strategic sector:
"Search for Breakthrough by Mathematical / Mathematical Sciences Researches toward the Resolution of Issues with High Social Needs (Focusing on Collaboration with Wide Research Fields in Science and Technology)"

(14) "Alliance for breakthrough between mathematics and sciences (ABMS)"

Research Supervisor: Yasumasa Nishiura

(Professor, Research Institute for Electronic Science, Hokkaido University)

Please refer to P.96

【PRESTO】

Research area in the strategic sector:
"Creation of fundamental technologies for harmonization of information environment with human"

(1) "Information environment and humans"

Research Supervisor: Toru Ishida
(Professor, Department of Social Informatics, Kyoto University)

<u>Outline of Research Area</u>

The goal of this research area is to conduct advanced research on intelligent functions where interaction with people is essential, to provide those functions in the form of sharable services embedded in the information environment, and to further form the composite functions based on provided services through networking with other services created both inside and outside of the research areas.

More specifically, the research area includes ubiquitous computing, ambient intelligence, intelligent robots, advanced research on intelligent functions to support communication and group activities; evaluation research on intelligent functions for users such as usability testing, ethnography, and statistical analysis; and further networking research on intelligent functions using services computing to provide research results to society.

<u>Research Supervisor's Policy on Call for Application, Selection, and Management of the Research Area</u>

Human society in the future will face versatile problems, such as those related to medical care, nursing care, foodstuffs, transportation, energy, and collision of different cultures. For intelligent functions that are conducive to such problems, interactions with people in the real world are essential. On the other hand, in the information environment as represented by Web sites, formation of collective intelligence by sharing services has already started in addition to the sharing of content. However, there has been no sufficient interaction among research and development work on intelligent functions in the real world and the information environment, and the fusion of such work is now an issue. The research area is intended to share intelligent functions in the real world by using cyberspace, and calls for proposals concerning the research challenges stated below. It should be noted that any remarkable research plans will be actively adopted even if they are not covered by the specified categories. We appreciate the many participants.

1 . Advanced Research on Intelligent Functions

We call for radical and advanced research challenges that provide key technologies for realizing ubiquitous computing, ambient intelligence, intelligent robots, and support functions for communication and group activities. In particular, research on intelligent functions is important, which actively recognizes, analyzes, and adapts to the real world, to support and guide humans for adequate decision making and action. In addition, we call for research that expands their own capabilities by sharing content and services in the information environment and proactively and organically collaborates with other intelligent functions . It should be noted that, among individual research subjects, the research area does not require the level at which the research goal is realized in society, but its result should be offered in the form of services that can be used by others, through demonstration of the research results in user environments by drafting application scenarios that is formed with the research result as its components.

2. Evaluation Study of Intelligent Functions

The research area calls for proposals that theoretically and experimentally evaluate acceptability and the potential of new technologies in society by usability testing, ethnography, and statistical analysis. In particular, research is important when based on theories of cognitive processes and communication that explain humans' decision making, actions, and other factors.

3. Study on Networking of Intelligent Functions

The research area calls for proposals that realize composite intelligent functions by the "Web of services." Once many services are accumulated in the information environment, research on actively providing services harmonized with humans in the real world will then become important. For this purpose, it is necessary that the research should have firm assumptions in the fields (medical care, welfare, education, disaster prevention, agriculture, commerce, residence, office, public space, intermediate and mountainous areas, oceans, and so on) where intelligent functions are utilized.

Since the PRESTO should be studies of individuals , no team is formed in advance for the research. However, in the research area, community formation through interaction among researchers will be promoted while taking advantage of indivisual studies; therefore, we appreciate applications by researchers who aspire to collaborate with other researchers.

Research area in the strategic sector:
"Creation of natural light energy conversion materials and utilization of basic technologies through the interaction of various research fields"

(2) "Photoenergy conversion systems and materials for the next generation solar cells"

Research Supervisor: Shuzi Hayase

(Professor, Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology)

<u>Outline of Research Area</u>

This research area will lead to proposals for next generation solar cells. The aim is to build new basic technology for the future practical use of solar cells by promoting the fusion of different areas through the participation of researchers from a wide range of areas, such as chemistry, physics, and electrical engineering.

Specifically, it targets dye-sensitized, organic thin film, and quantum dot type high performance solar cell research, and research on silicon and compound solar cells with approaches that differ from the conventional. At the same time, basic research, such as surface control technology, membrane and crystal growth, development of new materials, new processes, and new device structures that lead to creation of solar cells based on completely new principles, is also included. With an emphasis on the creation of next generation solar cells, a wide range of research from theoretical studies to process research for practical use is included in this research area.

<u>Research Supervisor Policy on the Call for Applications, Selection, and Management of the Research Area</u>

There are great expectations regarding solar cells as an energy source for the future. Currently, silicon and compound solar cells are in practical uses, and are beginning to form a large market. From the viewpoint of the required diversification of material sources and efficiency in the future, expectations for a next generation that achieves high efficiency, long life, and low cost are growing increasingly strong. Currently, research for the realization of next generation solar cells, such as dye-sensitized, organic thin film, quantum dot type solar cells, is being conducted individually, but in order to achieve high efficiency, longer life, and lower cost and lead to practical use, original ideas must be added to existing research. There must be a fusion of research on theoretical calculations, new material syntheses, device creation processes, new device structures, and device analyses all combined for a single purpose; a creation of solar cells based on completely new principles. In this area, the emphasis is on the basic research essential for the main goal of creating a next generation solar cell. We will promote goal-oriented basic research and solution-type research that returns to the principles through creative approaches to solutions to the issues of current solar cells such as higher efficiency, longer life, and the search for optimum materials, not through an extension of existing research areas or research themes. In order to achieve this goal, we will combine the efforts of researchers from the many academic fields of physics, chemistry, electrical engineering, and light theory. Additionally, by promoting the active participation of researchers from different areas, our goal is to bring about interactive innovation through the fusion of material research and device physics research, solar cell research and organic light-emitting device research, and inorganic solar cell research and organic solar cell research.

In order to achieve higher efficiency, it is necessary for all stages from light management, light absorption, (exciton diffusion), charge separation, and charge collection. For example, in order to dramatically raise the efficiency of organic solar cells (including dye-sensitized solar cells), it is necessary to exponentially improve the photoelectric conversion efficiency of near-infrared and infrared areas. For this to be achieved, the conduction band level control of metal oxide semiconductor, HOMO-LUMO control of long wavelength dyes and organic semiconductors, hybrid cells with low electron collection loss, new tandem structures, the novel charge collection process, new light confinement structures, and process research to create these technologies will be necessary. In order to increase charge separation efficiency, surface control technology, surface analysis technology, crystallization technology, and the development of new material are necessary. In the area of silicon and compound solar cells, which are already in practical uses, new methods for higher efficiency, such as interface control technology, crystallization technology, new device structure, and new processes through embrocation are also included in this area.

PRESTO is for individual research and seeks original ideas from individual researchers, mainly young and mid-career, and for proposals that will lead to a new era in solar cell technology through passion that does not fear risk. The program will be operated so that researchers with such enthusiasm can discuss and connect in an effective way towards the single goal of creating a completely new next-generation solar cell.

Research area in the strategic sector:
"Creation of natural light energy conversion materials and utilization of basic technologies through the interaction of various research fields"

(3) "Light energy and chemical conversion"

Research Supervisor: Haruo Inoue

(Professor, Dean of Graduate Course of Urban Environmental Sciences, Tokyo Metropolitan University)

Outline of Research Area

This research area involves innovative and challenging investigations which aim to realize the highly efficient conversion, storage and utilization of light energy into useful and clean chemical energy by harnessing solar light as the ideal energy resource for mankind.

Specifically, this research area includes investigations in light-induced hydrogen evolution using semiconductor catalysts and/or metal complexes, the photoreduction of carbon dioxide, highly efficient light harvesting・electron transfer・charge separation・and electron relay systems, design and control of photochemical reaction environments, redox systems involving water molecules, photoelectric conversion incorporating advanced nanotechnologies, technical application of plants, algae, and bacteria with high photosynthetic properties, photo-assisted energy production from biomass, and the elucidation of the mechanisms involved in photosynthesis.

From such diverse fields as photochemistry, organic chemistry, materials science, nanotechnology and biotechnology, this research project explores the development of future energy systems through innovative technologies based on new and original approaches and concepts.

Research Supervisor Policy on the Call for Applications, Selection, and Management of the Research Area

When considering the energy resources available to mankind, at present, we are forced to rely on fossil fuels and nuclear energy for short-term sources of energy. In spite of this situation, from a long-term perspective of several decades or more, solar energy is strongly desired as the main energy resource, although many issues yet remain to be resolved before its realization. However, the future of mankind and society depends on the ability of scientists to realize clean solar energy systems since a failure to address such concerns will lead to a global energy crisis. Scientists who, therefore, apply for the PRESTO program should have the determination and resolve necessary to face the daunting challenge of saving mankind from such a looming energy crisis.

This research area focuses on creative and challenging investigations that reach beyond the technologies thus far integrated or accumulated in order to address scientific approaches or proposals which, at this point, seem inaccessible but which offer the possibility of achieving significant breakthroughs to solve future energy issues. We would like to invite talented young researchers who may not yet have experience in the field of energy conversion but who are able to apply their own scientific methodologies and expertise into finding solutions to such energy problems with flexibility and creativity.

As history has shown, scientific breakthroughs are usually the result of unexpected discoveries. This project will utilize the advanced methodologies of such diverse research fields as botany, biochemistry, biophysics, structural biochemistry, photochemistry, organic synthetic chemistry, catalytic chemistry, interface chemistry, physical chemistry, ultra-fast transient spectroscopy, coordination chemistry, nano-materials chemistry, and electrochemistry in order to explore light energy conversion technologies from the perspective of materials, principles and structural design so that they can be usefully integrated into future social systems.

In selecting researchers, greater importance will be placed on “the individual” rather than research experience, i.e., on young researchers who demonstrate creativity and the determination and focus that will make significant discoveries possible. Management of this research area will emphasize international cooperation, discussions and collaborations in methodologies across diverse scientific fields, and the integration of different scientific concepts and approaches in order to promote open and unrestricted research.

Research area in the strategic sector:
"Clarification of the control mechanisms of neural circuit operation and its formation"

(4) "Formation of and information processing by neural networks, and control"

Research Supervisor: Fujio Murakami
(Dean, Graduate School of Frontier Biosciences, Osaka University)

Outline of Research Area

This research area will include research aimed at comprehensive understanding of how brain works via elucidation of the principles of the formation and functions of neural networks, as well as the control mechanism from a novel viewpoint.

Specifically, this research area includes research on the formation of neuronal networks, nuclei and layer structures that constitute the functional units of the brain; regionalization/arealization of the brain and specification of neurons; information processing by a single neuron; communication between neurons and synaptic plasticity; development and plasticity of neural network functions; the principles of information processing by complex network assemblies; and controls mechanisms. This research area also includes research on the role of glial cells and other non-neuronal cells as well as the mechanism of maintenance of the number of neurons. Furthermore, this research area includes creation of innovative platform technology that contributes to dramatic progress in the elucidation of the formation of neural networks and the principle of information processing.

Research Supervisor Policy on the Call for Applications, Selection, and Management of the Research Area

Human mental activity is based on brain activity. Brain activity is based on neurons and their electrical activities. In the brain numerous neurons form networks via synapses to send and receive signals. Thus, elucidation of the mechanism of higher brain functions requires investigation of neuronal networks and information processing achieved by them. This, however, has not been easy because of structural complexity and diversity of the nervous system. The morphology of single neurons and the functions of neural networks, neurotransmitters, receptors, and ion channels are all so complex and diverse. Because of their complexity, some researchers previously took the approach of recording the activities of unidentified neurons and analyzing data from such recordings. However, research in neural networks has entered a new era because of recent advances in a variety of research technologies that enables precise analyses of neuronal activities and related research areas: This includes improvement in technology for measurement of electrical activities, introduction of molecular biological techniques, development of light microscopic measurement technology, and applications of live-imaging technology combined with these advances. Advances in developmental neuroscience, for example, are paving the way for an approach toward elucidating the principle of the construction of the brain as well as the principles of information processing by neuronal networks. With genetic engineering that includes introduction of modified genes, and live imaging, it is becoming possible to monitor neuronal network activity four-dimensionally at the cellular level. The development of a variety of technologies for the creation of animals with conditional gene modification is associated with steady progress in the elucidation of the relationship between the molecules required for the construction of neurons and neural networks and mental activities. Explosive advances in research on these neuronal network functions will help to elucidate the mechanisms of the brain function and open new possibilities for clarification of the pathogenesis of brain diseases and the development of appropriate therapy. In this area, I would like to promote understanding of the brain by strongly supporting research, with new viewpoints and technologies, on neuronal network formation, information processing by the network, and their control mechanisms.

Because there is no established approach for elucidating the principles of neuronal network formation and information processing, any research theme is welcome as long as it is related to the research issues described above. Ambitious young researchers are encouraged to propose research projects on the basis of creative, ingenious methods and ideas.

Research area in the strategic sector:
"Creating fundamental technologies for advanced medicine through generation and regulation of stem cells, based on cellular reprogramming"

(5) "Epigenetic control and biological functions"

Research Supervisor: Tsunehiro Mukai
(Trustee / Vice-President, Saga University)

Outline of Research Area

This research area includes research to elucidate epigenetic control and biological functions. More specifically, this includes elucidation of the mechanism of epigenetic control, investigation of the association of a variety of biological phenomena and epigenetics, and analysis of the diversity of epigenetics and diseases associated with abnormalities of epigenetics. In the research, the molecular basis of epigenetics as a biological function will be elucidated to create fundamental technologies for advanced medicine through generation and regulation of stem cells, based on cellular reprogramming

Specific research projects may include (1) multilateral investigation and elucidation of the mechanism of epigenetic control in a variety of model organisms, including animals and plants; (2) investigation of individual variability and diversity of epigenetics and analysis of diseases caused by epigenetic abnormalities; and (3) development of technology for analysis and control of epigenetics.

Research Supervisor Policy on the Call for Applications, Selection, and Management of the Research Area

Epigenetics is involved in a variety of biological phenomena, including the control of development, differentiation, and aging; stabilization of chromosomal structure; and gene dosage compensation. Recently, the importance of epigenetics is recognized in cellular reprogramming represented by iPS cells, production of clone cells by nuclear transfer, and cancer therapy, and its artificial control is also considered an important issue. Thus, involvement of epigenetics in a variety of biological phenomena suggests that research in this area will cover a wide range of areas and become an urgent issue.

This research area comprises innovative basic and applied research based on ingenious ideas to elucidate epigenetic control and biological functions. Thus, research to elucidate the control mechanism of epigenetics is expected. Research on the interaction bewteen DNA and binding proteins has recently been extensive, and it is necessary to comprehensively understand the regulatory mechanisms through crosstalk and a network of such factors as DNA methylation, a variety of histone modifications, and functional non-coding RNA including small RNA. Analysis of mutants in different organisms will contribute significantly to the elucidation of those mechanisms. In addition, multilateral approaches to the elucidation of the control mechanism will be needed to control epigenetics at will. Although epigenetic phenomena are inherited from cells to cells, research on monozygotic twins shows some individual variability and diversity. The frequency of diversity and its significance will also be elucidated. It has been reported that epigenetic abnormalities are associated with congenital diseases and that epigenetics are also involved in acquired diseases, such as cancer, schizophrenia, and lifestyle-related diseases, which are also urgent issues. Advances in epigenetic research also require technological development leading to a breakthrough. For example, technology for visualization of epigenetic marks in living cells will be helpful in medical area. The development of methods for artificially controlling epigenetics will also be considered in the treatment of diseases. Those methods may include the introduction or removal of epigenetic changes in specific areas. In fiscal 2009, high-impact type PRESTO will start. Challenging research themes on the basis of novel ideas are welcome.

Research area in the strategic sector:

"Creating fundamental technologies for advanced medicine through generation and regulation of stem cells, based on cellular reprogramming"

(6) "Understanding life by iPS cells technology"

Research Supervisor: Shin-Ichi Nishikawa

(Deputy Director, Center for Developmental Biology, RIKEN)

Outline of Research Area

This research area comprises several fields (including cellular reprogramming, transdifferentiation and stem cell biology) in which major breakthroughs are expected by use of the technology involved in establishing induced pluripotent stem (iPS) cells. Basic research on pioneering new approaches or having the potential for clinical medicine will be also involved.

Specifically included are 1) advancing and simplifying reprogramming technologies based on the molecular mechanisms of cellular reprogramming, 2) analysis and directed induction of stem cell differentiation and transdifferentiation processes, 3) elucidation of the molecular mechanisms underlying epigenetic alteration during iPS formation, 4) elucidation of pathogenesis of various diseases through the effective use of iPS cells, and 5) development of animal models for human diseases using iPS cells.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

The birth of Dolly — the world's first mammalian somatic cell clone — brought about significant changes in a number of fields including reprogramming, transdifferentiation, stem cell biology and regenerative medicine. The iPS cells generated from human somatic cells are nearly comparable to human embryonic stem (ES) cells, and iPS cells hold greater potential than ntES cells from cloned embryos, because of the technological feasibility. Human iPS cells technology developed in Japan has drawn international attention and become a global sensation. One year has passed, and many institutions in Japan are likely to be ready for research inspired by the discovery.

Scientifically, iPS cells are generated through a round of reprogramming process. However, in view of the worldwide expectations and attention that currently exist, research proposals specifically motivated by iPS cells technology will be recruited, rather than the relatively broad proposals seen in the ordinary-type PRESTO (Standard type) research programs.

Obviously, iPS cells have a great potential in diverse field of life sciences. Research on the process of the establishment of iPS cells and the control of reprogramming, iPS cell-based research on diseases, and research in areas we have not yet conceptualized are also possible. We do not intend to limit the target fields or target species to humans or mice. However, we do not want to select applications on the subjects that can be addressed without using iPS cells.

Finally, I will express my opinion on High-impact type that have recently been started. In PRESTO, everyone is encouraged to submit High-impact type. In previous review processes, past publications had to be considered to some extent in addition to the potential and novelty of the application. For the document review of High-impact type, however, I will select interviewees on the basis of the novelty of projects without consideration of past publications. Researchers who have had only a few papers published but are confident in conducting good research should submit High-impact type. I hope that many young researchers inspired by the establishment of iPS cells will submit unique, innovative research proposals.

Preliminary notes on proposing a subject in this research area

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) settled on the Total Strategy for Acceleration of Research on iPS Cells (induced Pluripotent Stem) ("Total Strategy") (approved by MEXT on January 20, 2009) to promote research on iPS cells nationwide in our country. As part of the program in 2008, MEXT iPS Cell Research Network ("Research Network"), which involves research institutes and researchers in projects relating to research on iPS cells supported by MEXT and JST, was established to comprehensively accelerate research on iPS cells. The Research Network will effectively function to comprehensively promote research on iPS cells by licensing intellectual property rights and utilization of tangible property, such as living organisms, free of charge within the Research Network according to common rules for intellectual property rights, publication of research achievements, and maintenance of confidentiality prescribed under rules of Research Network.

This research area is also a constituent of the Research Network; therefore, anyone engaged in the adopted research after selection, should be a member of the Research Network to follow the policy based on the Total Strategy ,in principle.

Research area in the strategic sector:

"Enhancing advanced materials science and life science toward innovations using new light sources, including state-of-the-art laser technology"

(7) “Innovative use of light and materials/life”

Research Supervisor: Hiroshi Masuhara

(Chair Professor, National Chiao Tung University Taiwan / Guest Professor, Graduate School of Materials Science, Nara Institute of Science and Technology)

Outline of Research Area

The objective of this research area is to deepen studies and to create the seeds of the innovative technology by exploring light-related phenomena from the viewpoint of new light source in areas such as information/communication, nanotechnology/materials, life science, and environment/energy.

Specifically, this research area focuses on the studies for understanding the nature of light, making maximum use of light, synthesizing/characterizing/functionalizing molecular materials only with light, and processing/controlling chemical and biological production with light, which will be performed by applying various lasers with high power, ultrashort pulse width, and/or super long wavelength, synchrotron orbital radiation, extremely weak light, and single photon light source. Cellular function closely related with light, biological tissue structure revealed with light, and biological activity controlled only by light are important topics, while photonic measurement and dynamic imaging of substances and organism are included.

Research Supervisor’s Policy on Call for Application, Selection and Management of the Research Area

Photon science and technology make it possible to control simultaneously energy, time, and space to measure, fabricate, and functionalize materials and biological systems in noncontact and nondestructive ways. Research in photon science and technology has contributed to development in the measurement and analysis of physical and chemical properties, chemical reactions, and functions of materials, nanoparticles, membranes, biological substances, devices, and chips; however, it is expected to go beyond this contribution and to provide insight into the concepts of dynamics and mechanisms of new material and biological systems and ideas for next-generation science and technology. The potential for exploring new phenomena and creating new understanding is considered to be remarkably higher than any other areas of science and technology, and there is a demand for research based on innovative ideas that reflect the characteristics of photon science and technology. Various proposals developing something original from the dimension of a new light source and having research results that present the necessity of a new light source are all welcome.

Currently, research in photon science and technology is attracting much attention, and a variety of research projects are being conducted not only in research areas from physics, chemistry, and biology to medicine, but also in environment, energy, and their related boundary areas. The scale of the research ranges from a single laboratory at a university to team research by several groups, and there are even major movements trying to create a new research area involving dozens of labs. Much of the research in photon science and technology require expensive and complex facilities, so that joint research is now not uncommon. However, leading and pioneering research is often dropped from these organizational research sites. With research proposals regarding photon science and technology, which possibly lead to innovation 10 years or longer in the future, our role is to find research that is true to the meaning of *sakigake* (pioneer) with a clear position as individual research. In addition to the existing Three-year

Type, proposals for a Five-year Type are being accepted, and the High-impact Type is started this year. There is a clear differentiation with the planning from other basic research funds or applied development research funds, and we are looking for proposals with convincing details for research targets that may be found in three years, or clues that may be discovered in five, and research that comes with a high risk but is worth the challenge.

In this area, the criterion is on developing research that is completely focused on light. Our aim is to have an impact on society, make the importance of photon science and technology more widely known, and evaluate research that expands the horizons of photon science and technology research. With the catch phrases, “research that uses light fully,” “research that pushes young researchers into the light” and “research that attracts citizens to the light,” we are working to promote such research.

Research area in the strategic sector:
"Creation of next-generation nanosystems through process integration"

(8) “Nanosystem and function emergence”

Research Supervisor: Yoshihito Osada

(Deputy Director, Advanced Science Institute, RIKEN)

Outline of Research Area

This research area focuses on challenging studies that aim at development of systems that will enable evolution of higher functions and serve as a key to the realization of next-generation nanosystems by promoting fusion of top-down and bottom-up approaches based on unique ideas. Specifically, this research area includes a wide range of studies to exploit operational and architectural principles of nanosystems that evolve higher functions autonomously, and to explore and expand elemental technologies including molecular self-organization systemic materials, adaptive three-dimensional nanoprocessing techniques, sensing/energy/motor function nanodevices, nano-assembly techniques, and nanosystem control techniques that will lead to the realization of such principles based on the every deepening nanoscience in interdisciplinary areas such as molecular science and biotechnology, nonlinear/nonequilibrium science, micro-electro-mechanical systems (MEMS), nano-electro-mechanical systems (NEMS), microfabrication, electronics, medical engineering, and intelligent information engineering.

Research Supervisor’s Policy on Call for Application, Selection and Management of the Research Area

Nanorobots are autonomously-acting minimal electro-mechanical systems with sensory and motor organs. These robots appear in science fiction as a symbol of nanotechnology to play a role of the ultimate medical machine that saves mankind or the evil object that proliferates without control. Although a long time will be needed before realization of nanorobots that reflect the artistry of nanotechnology, nanorobots encompass a variety of essential research subjects of nanotechnology that researchers should start dealing with. The important aspects of these subjects are bottom-up molecular mechanisms that support self-organization of advanced structural functions in organisms, and integration of top-down technologies such as MEMS (NEMS) and nanodevices.

This research area recruits proposals for unique solutions and innovative concepts that provide explicit awareness to gain insight into essential issues of nanotechnology and nanoscience on the road to nanorobots from unique perspectives, and to resolve these issues to realize next-generation nanosystems. Examples of proposals include, but are not limited to or focused on, devices that extract available energy from low-level energy dispersed in the environment or convert it to kinetic energy, molecular structures that can be restructured by external instructions, exchange of information between nanosystems and the outer world, efficient motion mechanisms based on physicochemical phenomena in the nanospace, and medical nanosystems that integrate these elements. This research area welcomes empirical and constitutive research proposals that aim to create actual, realized nanosystems, even partial ones.

For practical application of next-generation nanosystems, introduction of self-organization processes is indispensable. This research area emphasizes sophisticated self-organization and its applications to systems that can be programmed dynamically in both temporal and spatial dimensions beyond simple self-assembly phenomena. In the top-down area, various MEMS devices including swallowable endoscopes and IC tags have been developed and used at the practical level, although these devices are still at immature stages for nanosystems. In the study on processes, research and development of printable electronics are underway. Based on this situation, proposals in this research area are expected for nano/microsystems based on new concepts that enable functional evolution by the fusion of bottom-up processes, self-organizing materials, and biomolecular systems, as well as specific proposals for next-generation nanosystems that enable further downsizing, function emergence, and applications to new fields with a central focus on the top-down approach.

The "naoness" of the system will be defined by the significance of "nano" in the proposed system concept, rather than the size of the prototype at the research stage. Therefore, even if realization of the nanosystem is currently difficult at the physical level, proposals for which the principle can be demonstrated with a scale model or by simulation are welcomed.

The key word of this research area is "emergence." This word expresses expectation and conviction that excited interaction among researchers in this research area will lead to the dramatic expansion of the theme beyond individual research activities, as well as having the meaning of an important attribute expected for next-generation nanosystems. In this sense, this research area is perceived as a virtual nanorobot factory, and collaboration of participating researchers will be encouraged and voluntary expansion of joint projects aiming at substantiation of nanosystems will be strongly supported. Furthermore, active utilization of the nanotechnology network center of Japan (nanonet; Ministry of Education, Culture, Sports, Science and Technology) is expected for interdisciplinary alliance and prompt research and development.

［Notes for research proposals］

For research proposals with a period of 5 years, please specify the objective of the research subject at the completion and interim assessment on the proposal form. According to the result of the interim assessment, the research subjects may be discontinued or the plan may be changed.

Research area in the strategic sector:
"Creation of innovative fundamental technologies for utilizing information related to action and judgment in the brain"

(9) "Decoding and controlling brain information"

Research Supervisor: Mitsuo Kawato
(Director, ATR Fellow, ATR Computational Neuroscience Laboratories)

Outline of Research Area

This research area aims to create innovative technologies to exploit the brain information for motor control and decision-making. This subject covers areas of exploratory research and the development of technologies that is expected to greatly contribute to society and to connect basic neuroscience research and its newly emerging applied areas.

The main objective is to decode and control brain information from signals recorded from the brain so that extracted information is applied to areas such as brain machine interface (BMI), neurorehabilitation, neuromarketing, neuroeconomics, neurogenomics, and neuroethics.

From this perspective, this area includes various research approaches such as computational and experimental neurosciences, engineering, clinical medicine, biology, social sciences including economics, humanity sciences including psychology, as well as information science, which correspond with the expansion of brain science and its applied areas.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

As humans in society, we largely depend on brain functions for such daily activities as movement, cognition, decision-making, social behavior, and consumer behavior. Combined with the introduction of non-invasive brain activity measurement techniques, molecular biological techniques, and the advancement of computational theories, brain science is now establishing applied areas that enrich various aspects of life, not only in relation to clinical medicine but also to economics, ethics, law, marketing, etc. Furthermore, such new applications also provide triggers for the revolutionary advancement of basic neuroscience. For example, the sudden rise of "neuroeconomics," a new area that fuses economics and neuroscience, plays such innovative roles as the introduction of quantitative models of individuals who may behave irrationally, based on brain science applied to conventional economics. From the perspective of neuroscience, it also creates movement toward the construction of quantitative models for neural information processing in human social and economic activities, which has been difficult to research. Furthermore, causal relationships of information processing might be scientifically and objectively proved by introducing BMI techniques into system neuroscience, by decoding brain information, and controlling it directly. Therefore, advancement in the basic research of neuroscience and advancement in such applied areas as BMI, neurorehabilitation, neuromarketing, neuroeconomics, neurogenomics, and neuroethics do not mean a unidirectional flow of information and techniques from basics to application. Rather, both areas promote mutual revolutionary advancement by their close collaborative work. Basic research is expected to be more deeply explored; applied research will more greatly contribute to society. Over many years, mutually beneficial and indispensable relations, which must be established between physics, chemistry, and their applied areas, will also be established between brain science and neuroscience and their new applied areas.

To advance basic research and brain neuroscience applications in a mutually beneficial manner, research environments must be provided in which up-and-coming researchers can understand both the research areas and produce creative achievements. Such a research area will establish a neuroscience foundation of favorable coevolution and its applied areas by widely recruiting researchers with diverse backgrounds and values regarding both basic or practical disciplines. The purposes of application and the promotion of intellectual and fruitful exchanges among them will also be established without bias toward any of three axes: (1) such various disciplines as computational and experimental neuroscience, engineering, clinical medicine, biology, humanities, social sciences, and information science; (2) development of basic research and practical techniques; and (3) such applied areas as BMI, neurorehabilitation, neuromarketing, neuroeconomics, neurogenomics, and neuroethics (i.e., disciplines, basic research, applications, and applied fields). The field of learning from the brain in the new project for 2008 called the "Strategic Research Program for Brain Science" will organize a research base to strategically promote research and development and accelerate applications that address the needs of society. Unlike this field, this research area includes innovative and exploratory personal research and widely selects basic research and applied areas. Collaborative research or work is strongly recommended for applying achievement and techniques to return the achievements of the "Strategic Research Program for Brain Science" to society.

Examples of research projects in target applied areas, for example, BMI and rehabilitation, are listed above but they are not limited to these examples as long as the proposals adhere to the research aims described above. Since methodologies have not yet been established in the applied areas of brain science, and the development of human resources is crucial for advancement of this area, junior researchers must propose projects that fuse basics and applications, experimental science and theoretical science, or those based on original and creative methodologies. The research period will be either three or five years. Five-year research projects may be discontinued, depending on the results, especially the third-year interim assessment.

High quality, exploratory, and creative research proposals will be recruited for both exploratory research as a basis for new applied areas of brain science and the development of innovative basic technologies directly tied to applied cases. For project selection, the scientific standard will be evaluated for the former, and specificity of practical application for the latter. In 2009, especially, we had will two new advisors, one in the field of psychology and, one in molecular sciences, and will be eager to select project proposals regarding social and cultural sciences, including cognitive science, those in molecular sciences and also, those using simple model organisms. Investigations incorporating real-time feedback of neural activity will be also welcomed.

Research area in the strategic sector:

"Creation of fundamental technology for the generation and utilization of "knowledge" from diverse and large-scale information"

(10) "Synthesis of knowledge for information oriented society"

Research Supervisor: Hideyuki Nakashima

(President, Future University-Hakodate)

Outline of Research Area

This Research Area shall aim to develop fundamental technology for the generation of societally effective "knowledge" (useful information) from diverse and/or large-scale data.

Specific examples of research targets in this Area include: innovative technologies for the processing of large-scale data, technologies for analysis and modeling based on statistical and mathematical frameworks, technologies for extracting knowledge by structuralizing and analyzing diverse real-life data, and technologies for creating new knowledge from multiple resources (e.g. information acquisition through sensors and/or simulation results). In addition to these fundamental technologies, the Area includes research such as simulation and data visualization that support application of the obtained knowledge to real life; and that support the workings of the new information society.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

Various systems of contemporary society were basically consolidated before the advent of the computer and the Internet. The emergence of information technology opened up a new possibility of fundamentally altering these systems. In particular, since the processing of large-scale data is beyond human capacity; it can be regarded as a field that holds great promise in improving social systems. Trying to devise new systems for obtaining and processing large-scale data will enable us to create systems that had hitherto been impossible to implement, and thereby make society more efficient, resolve current problems, or even improve the quality or quantity of human intellectual activities.

This Research Area is set up to promote R & D proposals for new fundamental technologies that also embrace such real-world applications. We expect to receive innovative proposals on sensor utilization methods and other means of capturing information from the real world, reaching over and beyond the large-scale information already available.

As for the type of research, as with the previous year, we will accept proposals separately for the three-year and five-year projects. Basically, three-year projects are for development of fundamental technologies of "Synthesis of Knowledge" and five-year projects should include applications to "Information Oriented Society." However, if the R&D is on fundamental issues that is extremely challenging and can expect wide range of applications, the proposal may be submitted as a five-year project.

A new provision has been introduced this year: We will also accept High-impact Type proposals. If your project has low probability of success, but when successful, it's impact is large enough to change the world, then you may apply for this slot. Either three-year or file-year projects are accepted.

We expect proposals to have a good understanding of the spearheading quality of research that is already underway under PRESTO program scheme, and to submit proposals on themes that are challenging enough and yet basic enough to form the core of the Research Area, shaping its future direction. To this end, we wish to receive research proposals that point to technology seeds novel enough to create new needs that transcend the confines of contemporary social needs.

Research area in the strategic sector:
"Exploitation of materials and nanoprocesses for the realization of novel electronic devices with novel concepts, novel functions and novel structures"

(11) "Materials and processes for innovative next-generation devices"

Research Supervisor: Katsuaki Sato

(Emeritus Professor, Tokyo University of Agriculture and Technology)

Outline of Research Area

This research area is intended to create innovative next-generation devices with concepts beyond conventional silicon technology represented by CMOS, and is inviting challenging research proposals to develop novel materials and processes which enable realization of high-speed, large capacity, and highly advanced processing, storage, and transfer of information, with particular consideration to environment, resources, and energy consumption problems.

For example, as well as high-mobility wide-gap semiconductors, spintronics materials, strongly correlated materials including high temperature superconductors, quantum dots, nanocarbons, and organics, challenging and creative proposals on materials, structures and processes that have perspective to future device application will be included

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

We have been inviting original and challenging proposals for the development of novel materials, device structures, and fabrication processes that may lead to the realization of next-generation electronic devices beyond the extension of CMOS technology since fiscal year 2007. As of fiscal year 2008, we have selected twenty-one challenging proposals covering a broad range of research fields, such as wide-gap semiconductors, nano-carbon, semiconductor nano-structures, organic semiconductors, superconductors, strong correlated systems, thermo-electronics, and spintronics materials, and some of the achievements have already earned a high reputation from relevant societies.

For fiscal year 2009, we are thankful for the application of many proposals not only in the fields listed above but also for the organic and molecular materials for device application for which there were only a limited number of proposals during the last fiscal year.

In the selection of proposals, those with the potential for future industrialization will be regarded as important. Even those proposals for devices that would be difficult to realize using the technologies of today will be included among our objectives, if they offer the possibility of industrialization in the course of future innovation.

Finally, we cordially welcome application of researchers from industrial institutions in addition to those from academia. Please note that the PRESTO project shall be conducted by individual researchers, even though the person belongs to an industrial organization.

Research area in the strategic sector:
"Search for Breakthrough by Mathematical / Mathematical Sciences Researches toward the Resolution of Issues with High Social Needs (Focusing on Collaboration with Wide Research Fields in Science and Technology)"

(12) "Alliance for breakthrough between mathematics and sciences (ABMS)"

Research Supervisor: Yasumasa Nishiura
(Professor, Research Institute for Electronic Science, Hokkaido University)

Outline of Research Area

This research area is set up to promote such a research activity by mathematicians that is motivated by social needs, conducted in cooperation with scientists in non-mathematical fields, and is expected to make a scientific breakthrough. It may be viewed as attempting to integrate the rationalism of Descartes and the empiricism of Bacon in the 21st century.

The grant program will cover studies of the mathematical problems in diverse fields of science: materials science, life science, environmental science, information science, telecommunication science, financial engineering, etc. Research activities in other fields will also be within the scope of the program if those activities propose new research problems arising from social needs, and explore mathematical approaches to them.

Priority will be given to such a research activity that develops new mathematical ideas through the study of natural or social phenomena in a field of science while applying existing mathematical methods to that study. The program therefore emphasizes research activity which contributes to the integration of mathematical and experimental sciences.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

A distinguished feature of mathematics is that it works behind the scenes in a highly developed society. This does not simply mean that mathematics is basic to daily life. It is more important that mathematics functions in a sophisticated way when we handle problems that cannot be recognized with our ordinary senses. With mathematical knowledge, it is possible to open a new way to approach a problem, not by inventing a physical "tool," but by creating an innovative "viewpoint."

It is this point that modern mathematics contributes essential solutions to the many difficult problems of today's science and society. In the materials and life sciences, for example, it is possible to use mathematical concepts to analyze a large amount of space-time data obtained by advanced measurement techniques; mathematical concepts also help us to understand hierarchical and network-type self-organizing dynamics. Mathematics provides the framework for quantitative descriptions of the common problems faced by human beings in the different areas of today's complex and uncertain society, i.e., for the environment, economy, information, transportation, services, healthcare, and psychology. Mathematics also serves as a tool for discovering fundamental problems and the relationships between seemingly unrelated problems. With its universal characteristics, mathematics creates the chance to shed light on a group of problems that have been heretofore intractable.

Mathematics is essentially open and cannot be isolated from the other sciences. In the last century, however, the resolutions of crises in mathematical logic opened the way for mathematics to deepen autonomously by its own movement. Since then, there has been the tendency to conduct mathematical research independently of other sciences. In this situation, this program offers a unique opportunity for mathematicians to provide a fresh insight into an enormous amount of accumulation of mathematical knowledge for novel applications. Furthermore, the program encourages mathematicians to become involved in research in other sciences and cooperate with experimental scientists in creating new mathematical ideas beyond the application of existing mathematical knowledge.

In the academic year 2009, grants will be awarded to two kinds of research programs. One is a research program conducted by an individual (called PRESTO). The other is a program conducted by a team (called CREST). In a PRESTO program, the researcher is expected to explore the possibilities of creating new fields of mathematics, while in the CREST program, a cross-disciplinary team of top-level scientists is expected to conduct cooperative research. The budget size of a PRESTO program and that of a CREST program are not necessarily comparable to those in the past. Proposals with smaller budgets can be accepted if they are appropriate for the goal of the research area. For a CREST program, it is more important that the research subject is conducted with full information exchange and cooperation among the team members so that it can achieve more than joint papers.

●Individual type research (PRESTO)

The program offers junior and mid-career mathematicians an opportunity to tackle a challenging research topic, even in the embryonic stage. Thus, they are encouraged to propose a research subject that promotes interaction between mathematics and experimental sciences or a creative subject that takes a novel approach to the problems described above from an innovative mathematical viewpoint. Total-immersion type research proposals are also welcomed for PRESTO. This is a research subject where a junior theoretical scientist participates in research outside the scientist's research area staying for a certain period of time at a laboratory or an experimental facility in an academic institute or an industry. The standard duration of a PRESTO program is three years.

●Team type research (CREST)

The program encourages mathematicians to take an integrative and empirical approach to their research subjects. In addition, they are expected to cooperate with researchers in a variety of different fields of science, e.g. experimental sciences, to create a new field of mathematics or a new mathematical concept or to develop a novel mathematical viewpoint or methodology for solving problems common to all humankind. A research subject is supposed to be conducted by a small team. The program also supports a subject with a larger team if the research subject is exceptionally promising and requires a larger team organization. In this case, the team leader is required to provide strong leadership to organize an effectively working team. (The team should not simply be a circle of researchers in a field.) The program supports only those research subjects that are appropriate for the goal of this research area. Thus, the number of subjects supported by this program will be determined by the number of applications of appropriate proposals. An international team should be organized as appropriate for the research subject. It is in particular required that the post-doctoral members of a CREST team should be selected through an international and open recruitment process.

The standard duration of a CREST program is five years. The research director will cooperate with the leader of the research team for flexible management. The size, duration, membership, and topic of the research subject can be modified if necessary. The interim assessment of progress for a research subject will be carried out in the third year. Unsatisfactory results from this assessment may lead to termination of funding.

The research director enthusiastically invites mathematicians and mathematical scientists to apply for the program with an excellent research proposal demonstrating a pioneering spirit.

Research area in the strategic sector:
"Elucidation of the dynamic mechanism of biological system and establishment of fundamental technology"

(13) "Innovative model of biological processes and its development"

Research Supervisor: Nanako Shigesada

(Professor, Faculty of Culture and Science, Doshisha University)

Outline of Research Area

This Research Area supports research projects that aim at establishment of a novel model which can promote the understanding of mechanisms underlying diverse biological processes. The model is expected either to have a high predictive power or to be likely to gain such an ability in near future, which eventually contributes to medical treatment, epidemic control, environmental preservation.

More specifically, this Research Area invites innovative and fundamental studies to construct and analyze a model that promotes conceptual, integrative and mathematical understanding. The models can cover diverse aspects of life systems that function in a manner adaptive in their environment. Examples of these aspects include gene expression, cell functioning, development and morphogenesis, immunity, brain, formation of biological societies, ecosystem functioning; as well as disfunctioning, such as aging and illness. The outcome of the research should help us to solve diverse pressing issues faced by human being.

Research Supervisor's Policy on Call for Application, Selection and Management of the Research Area

Rapid progress in molecular biology in the last quarter of a century, particularly the recent development of techniques of measurement and analysis, has made much information accumulated, and thereby revealed the bases of various biological processes. It has been increasingly realized that theoretical research on the essential aspects of biological processes through modeling, mathematical analysis, and computer simulation in collaboration with empirical research, is going to lead an explosive progress of life science.

In the past, there have been attempts to develop theoretical research in biology, but breakthroughs were not made very often, because we did not have sufficient knowledge of the fundamental mechanisms of biological processes. However, this situation has changed dramatically thanks to the success of molecular biology. Now it is the time for us to establish innovative models for biological systems, which will reveal the basic principles of life.

From this perspective, this Research Area supports research projects that grasp the essence of the mechanism of biological processes and build an innovative model for the basic principle of its role. Specific candidate targets of research projects can range over a wide variety of scales, such as genes, proteins, cells, tissues, organs, individuals, and populations; and diverse phenomena such as development and morphogenesis, brain and neural systems, behavior, societies, ecology, and evolution. Striking similarities are often observed among models which have vastly different target phenomena. It will be very useful for researchers working on different subjects to learn modeling from each other, which will provide an opportunity of novel and groundbreaking approaches to be discovered.

Models for particular phenomena are expected to be testable in a broad sense, by experimental or observational data in the future, and bring about a clear biological insight. We invite research proposals that aim at establishing a unified view of biological processes through modeling of particular phenomena. Research projects that can contribute to medical science or environmental science are also welcome.

Training of young scientists is extremely important for development of this research field. We would like to have participation of researchers of careers with various backgrounds not only in biology, medical and agricultural sciences but also in mathematics, physics, and engineering, who propose research on new subjects or by original methodology.

IV. Strategic Sectors

Strategic Sector: "Creation of fundamental technologies for harmonization of information environment with human" (Set in FY2009)

1. Title

Creation of Fundamental Technologies for Harmonization of Information Environment with Human

2. Content

Information and communication technology is being used in every facet of our daily lives, connecting people and things, and research and development is under way to create a ubiquitous network environment that anyone can benefit from anytime, anywhere. However, it is still necessary for people to initiate the action to use telecommunications equipment, and a conscious effort is required on the part of the user in order to obtain the information that is needed. In the future, as we move towards an aging society with a declining birthrate, what is needed is a more harmonious environment for the use of information and communication technology where people of all levels of proficiency can reap the benefits of the technology.

In order for this to happen, information and communication technology must blend in to the living space, causing interaction between the information environment and people, and we must create information environment intelligence that naturally transitions to an appropriate state whenever people require, and one that is in harmony with people. In doing so, as a post ubiquitous network society, we can create a society where everyone can truly benefit from information and communication technology, and the safety and security of our daily lives, our well-being, convenience, and the intellectual productivity of society will improve dramatically.

This strategic sector aims for an adaptive, affiliative, and active interaction of the information environment with people and creation of an environment that provides individuals with the necessary and optimal interaction and effect.

With this strategic sector, anticipating future forms of use and application of technology,* we will conduct research and development aiming for the organic intersect and integration of series of component technology consisting of *cognition and acquisition of human behavior and actual spatial context, contents processing and realization as a service*, and a *human interface to conduct these affiliatively*.

Some examples of issues in research and development include explaining the cognitive process behind human behavior, information processing to recognize and analyze human behavior and intent and actual special context and an information environment that provides information service in harmony with people.

* Conduct research and development anticipating specific forms of use and application of technology are in areas such as homes, welfare and medical care, natural environment, offices and stores, street corners, and security.

3. Policy position

(1) The research and development to be implemented with based on the strategic sector corresponds to the following major research issues of the Third Science and Technology Basic Plan Field Specific Promotion Strategy (Information Communication Field). In the ubiquitous area, utilizing the devices of a ubiquitous environment, research and development of a lifestyle support infrastructure that leads to safety and comfort in society is considered to be very important. To be specific, behavior support technology for people including socially disadvantaged people is necessary.

In the area of human interface and contents, strategic investment in human interface technology and contents technology that tries to accelerate the coordinated activity cycle that searches and analyzes, shares, stores, edits, makes into structures the knowledge created from the ability to put out information and manufacture things, and crystallizes them into the transmission of more information and manufacturing of more things is considered very important. Specifically, what is necessary is technology that supports dialogue communication between machines and people. And, information analysis technology and higher-order context technology are also necessary.

In the area of robotics, research and development of devices such as robots for smooth and intuitive communication, interaction technology that connects humans and robots in order to make the behavior of robots more affiliative and reliable and technology that allows natural dialogue with people by storing a history of situations and activities of people are considered to be very important. Furthermore, with the rising need for observation of human behavior and interpretation of intent, technology that makes the behavior of robots more affiliative for people is necessary.

In the area of life sciences, technology that recreates life function units as a system by using information technology, as can be seen in "Life Program Reproduction Science Technology," may be the key to making contact between humans and information more affiliative.

Additionally, the philosophy of the Science and Technology Basic Plan is *protecting health and* *safety, realizing a safe and secure country with a high quality of life*, and to promptly resolve social issues, it has been pointed out that *it is important to integrate knowledge, which is becoming increasingly specialized and segmented, across all fields including humanities and social sciences*. In order to create a safe, secure, and comfortable living environment, it is necessary to develop technology that envisions the actual field and combines and integrates various sciences and technology.

(2) Of the urgent issues in the policy roadmap for our long-term strategic policy Innovation 25, chapter 5 "Innovation Nation," the one that is raised is *strengthening efforts in the improvement of productivity in service areas based on the viewpoint of the ordinary person*. In order to utilize and promote *the building of an infrastructure where information about places and things can be obtained by anyone, anytime, anywhere, putting into consideration the needs of ordinary citizens*, the research and development that will be conducted through our strategic sector is very important.

(3) The strategic sector promotes basic research that contributes to *further utilizing ubiquitous technology and robot technology using IT, promoting the creation of a society that is a good place to live for the elderly and people with disabilities*, which was proposed in the item on innovative strategy technology of the Basic Economic and Fiscal Policy Reform Program 2008 (Large-boned Policy 2008). Specifically, the technology group, which is the product of our strategic sector, can be applied to the Lifestyle Support Robot Technology, which is an innovative technology.

Additionally, from the viewpoint of safety and security, *further development of technology to secure the safety and security of the citizens, removal of constraining factors in growth, and while trying to strengthen the global competitiveness of our country's industry, contributing to the world with this technology at the core are the main strategic sectors*.

4. Position of this research project, differences in content and political effectiveness from other related projects

In the area of human interface, in the Ministry of Internal Affairs and Communications' Comprehensive Research and Development of Network Human Interface, in the five-year plan starting from fiscal year 2004, research and development of themes such as network robot technology are being implemented. These are research and development in component technology regarding behavior, situation cognition and robot communication technology, and therefore do not overlap with our strategic sector.

In the area of robotics, Science and Technology Coordinated Policy Group's Next-Generation Robot —Establishing a Common Platform Technology and the Ministry of Economy, Trade and Industry's Next-Generation Intelligent Robot Technology Development Project are being implemented. The former is research and development for enabling robots to structuralize space and the environment and the latter is research and development of intelligent technology necessary for the sophistication of functions for robots to act autonomously with certainty, therefore the connection with the strategic sector that focuses on the interface between information space and people is remote.

In the area of information search technology and contents processing technology, the following four policies can be raised as policies that have a connection.

(1) With the Science and Technology Coordinated Policy Group's enormous integration of information and use and application of basic technology development, it is possible to swiftly find valuable information, the credibility of which can be determined, from a large volume of information, and it builds basic technology for information integration utilization、 which can be used as an infrastructure for various information services.

(2) There is the specific field research in the new IT infrastructure technology for the information-explosion era of the Ministry of Education, Culture, Sports, Science and Technology's Grant-in-Aid for Scientific Research; however this research is focused mainly on collection and analysis that comes from the rapid increase in information on the internet, such as information search and natural language processes, and is a basic research of individual component technology. As it is regarding information on the internet and because it is based on the free thinking of one researcher, the technological phase differs from our strategic sector.

Additionally, the central aim of the Ministry of Economy, Trade and Industry's Information Grand Voyage Project is developing new markets, and development of information utilization technology for a variety of services is being conducted, differing greatly from our strategic sector, which conducts strategic basic research in order to realize an information environment that is even more affiliative to people.

(3) Under the 2008 strategic sector aiming at the creation of basic technology to produce and utilize knowledge from diverse and massive information, the creation of knowledge and an information

society that the Japan Science and Technology Agency (JST) is conducting from 2008 as part of the strategic creation research promotion project (Sakigake) aims to realize technology for obtaining and processing knowledge based on large volume of data and make it possible to use that technology to make society more efficient, solve problems and improve the quantity and quality of human intellectual tasks. On the other hand, our strategic sector is for conducting research and development on technology groups for making the dialogue of people and information space (information communication devices) affiliative and adaptive. Though the sectors differ, it is possible to implement them in cooperation under a mutually complementary relationship, using results of decisions regarding presented information based on situation analysis.

(4) Under the 2005 strategic sector for the creation of advanced integrated sensing technology to realize a safe and secure society, JST is implementing *advanced integrated sensing* in Core Research for Evolutional Science and Technology (CREST) and aims to conduct high sensitivity and high accuracy sensing of mainly physical abnormalities in hazardous/toxic substances, structures such as buildings and bridges and humans, then promptly communicate the information through advanced integrated sensing technology. Meanwhile, this strategic sector differs in that it mainly focuses on human intent and sensing of situations.

Additionally, researches (genetic algorithm, neural networks, etc.) that are oriented toward biomimetics that consider the inner working of the phenomenon of life to be a black box and copy the input/output have been conducted, however, researches focusing on measuring and manipulating the inside of real life systems have not been conducted. With our strategic sector, those kind of researches may be included as they mutually interact with each other.

5. Achievements and goals expected

By achieving this goal, it is anticipated that an information environment infrastructure where it is possible to break free from a situation where the user uses the information devices while controlling peripheral devices is created. Further, as environment that is directly corresponding to users` hopes and therefore bringing a transition to more natural and comfortable applications of information technology would be achieved. Finally, it is anticipated that the intellectual production activities of human will be supported by information environment, realizing an even more creative activity.

Without people initiating it (without using a keyboard or a mouse), sensors, GPS, IC tags connected to the network can obtain information from the user or environment, and mobile devices and information communication devices installed everywhere can tacitly support users' intent and actions from children to the elderly and can contribute to realizing a safe, secure, healthy and comfortable lifestyle environment within actual society.

For example, the following cooperative information providing services can be created.

- Improving quality of life by tacitly supporting human intent and behavior
- Ensuring security in society through automatic cognition of abnormal situations (including suspicious individuals)
- Self-support for the elderly (strengthening mobility, work ability, sensory functions)
- Home medical care ・Health management services
- Safe monitoring services for children and the elderly
- Learning support services that provide information according to the individual's learning process

6. Scientific justification for the research and development goals

Research and development in sensor technology for sensing things like human behavior has been driven by needs, and consequently, research and development in sensors used for medical, welfare and nursing care purposes have intensified. Additionally, trends in research and development to be emphasized are data stream processing technology that handles surveillance data from the real world through devices such as sensors, and further development is expected in the near future for technology that deals with sense information. <International Comparison of Science and Technology, Research and Development 2008 (Field of Electronics, Information and Communications) (February 2008, JST Center for Research and Development Strategy) [Sensor Technology]>

As for component technology in this field, the development of technology such as image recognition technology for the separation of people, analysis of whole body actions and sensor technology to measure biological data is highly anticipated. Science and technology of recent years aims to create machines that can interact with people more diversely, more flexibly and with no stress, and communication technology and interface technology are the bedrocks of such technology. As something that goes beyond the existing linguistic information and superficial understanding of humans, research is being conducted on understanding humans including estimating intent and emotions and on multi-modal communication using the physical functions of the robot in addition to sensor functions such as sight, hearing, and touch. You can see from the top-class research results presented in this field at international conventions on Human Robot Interaction that the level of research conducted in our country is very high. As for improving human interface, our country had produced results that come second only to the US. As for visual media, free point of view image technology which makes it possible to using images that were taken and see them from various angles, is expected to accelerate interactive functions of digital media in the near future, and active research and development is being conducted at Tokyo University, Kyoto University and Nagoya University. In voice recognition, cooperation among domestic research institutions such as the Interactive Speech Technology Consortium (ISTC) is becoming active. <"International Comparison of Science and Technology, Research and Development 2008 (Field of Electronics, Information and Communications)" (February 2008, JST Center for Research and Development Strategy) [Human interaction], [Communication]>

As for component technology in this field, development in areas such as voice recognition technology for non-routine noise and multiple speakers, user information, understanding intent and technology to adapt to user's intent from sensing information are anticipated.

Additionally, under the strategic sector, our country leads the world in display technology that shows optimal information and robot technology, which is important to reflecting information from information space into the real world. Therefore, all researches are envisioned to be used in combination with the technology that is to be researched and developed through this strategic sector. By making it possible to use these to realize a next-generation information environment, a gain of significant advantage in the world is also expected.

In order to achieve this strategic sector, it is more efficient to conduct research and development by putting together the various component technologies that each field is currently working on individually and conduct them under an integrated, cooperative system. At the same time it is desirable to bring about the creation of basic technology by collecting and generalizing knowledge gained from handling several real-life problems. However, implementation by companies is a difficult issue as it is hard for them to provide know-how, so it is important for the country to take on the key role in promoting this type of research.

7. Considerations in achieving the research and development goals

In promoting research and development, instead of each research issue developing individual component technology, under the research director, what is desired is a research method and system in which integration and verification can be conducted systematically even between issues. For example, research should be conducted with an eye on things like a system that works to integrate and share the wide variety of sensing data collected for research among the research issues or the construction of a common infrastructure such as platform technology for the building of an information environment that is in harmony with people.

Additionally, coordination of research areas conducted under the 2005 strategic sector of the creation of advanced integrated sensing technology to realize a safe and secure society and the 2008 strategic sector of the creation of basic technology to produce and utilize knowledge from diverse and massive information is desired.

Strategic Sector: "Creation of natural light energy conversion materials and utilization of basic technologies through the interaction of various research fields" (Set in FY2009)

1. Title

Creation of natural light energy conversion materials and utilization of basic technologies through the interaction of various research fields

2. Content

(1) The significance of this strategic sector

In the Strategy for Innovative Technology that the Council for Science and Technology Policy coordinated in May 2008, the development of high efficiency solar power generation technology was selected as an issue that needs to be pursued by the entire nation. And, in the Environment Energy Technology Innovation Plan (May 2008, Council for Science and Technology Policy), it is stated, "in order to put into practical use the seeds of new technology, it is necessary to overcome many technological issues. In order to realize a breakthrough in these issues, we must promote research for basic technology to develop new catalysts and material." The Plan acknowledges the extreme importance of basic research to resolve issues facing existing solar cells. However, though further improvement in efficiency and cost reduction is being conducted mainly by solar cell manufacturers for the silicon solar cells in the mass production stage, in order to build a power generation system to support the infrastructure of the next-generation society, there are still many issues remaining. Additionally, the government Action Plan to Create a Low-Carbon Society (July 2008, cabinet decisions), raised goals such as (1) a tenfold increase in the number of solar power generation introduced by 2020 (14 million kW), and 40 times by 2030 (53 million kW), (2) a reduction in the price of a solar power generation system to half of what it is now in three to five years and, with the

Emergency Comprehensive Measure to Realize Security (August 2008, coordinated by the government and the ruling parties) for the drastic introduction of new energy technology in order to realize a low-carbon society, the expansion of the introduction of solar power generation to homes, business sites, and public facilities has been ranked as a priority. In November 2008, with cooperation between the Ministry of Land, Infrastructure, Transport and Tourism, the Ministry of Economy, Trade and Industry, the Ministry of Education, Culture, Sports, Science and Technology, and the Ministry of the Environment, the Action Plan for the Expansion of the Introduction of Solar Power Generation was released, strengthening cooperation with related government ministries, deepening and substantiating the efforts of this action plan.

To substantiate the Strategy for Innovative Technology, the Ministry of Education, Culture, Sports, Science and Technology established an investigative commission and coordinated the plans for research and development in environmental technology utilizing future nanotechnology (July 2008), which stressed the necessity of research and development for breakthroughs looking ahead 10 to 15 years by making policies to draw remarkable human resources from places, such as universities, to environmental technology development. In order to achieve the practical use of environmental technology, it also emphasized the need to build projects that are all-Japan made and conduct diversified research support through combinations utilizing the advantages of each fund.

Of the variety of natural energy sources, solar light utilization technology is the most effective technique for obtaining energy from natural energy, and it is highly expected as a future source of energy. Based on this understanding, the United States is also promoting a strong research and development structure from basic research (HELIOS project) and Germany has maintained its position of producing the world largest share of solar cells. Therefore, considering the national interest, the government should place its highest priority on solar light utilization technologies.

(2) Specific research development issues

The ultimate goal for implementing solar light utilization technology is to reduce global warming. Therefore, it is necessary to create solar cell manufacturing technologies with which the energy generated by a solar cell is significantly larger than the total amount of energy required to produce the solar cell. If this is realized, it will become possible to supply the entire world with power through solar power generation without using fossil fuels and contribute to curbing carbon dioxide emissions.

With solar cells, those using silicon (crystal and amorphous) or compound semiconductors are already in the stage of practical use, and projects operated by the industry as well as the Ministry of Economy, Trade and Industry and New Energy and Industrial Technology Development Organization (NEDO) are promoting ways to make the systems have even higher efficiency and lower costs. However, there are many challenging issues, such as searching for a solar cell that does not use indium, a scarce element, while maintaining high efficiency. Even though it is much expected from the new high efficiency solar cells and solar light utilization hydrogen generation, such as organic thin film solar cells, dye-sensitized type solar cells, quantum dot solar cells, it is necessary to greatly improve energy conversion efficiency and increase durability before it can be put to practical use, and the development of new material technology is eagerly required. Additionally, more breakthroughs will be triggered by clarifying physical principles and proposing new structures based on new material technology. For this reason, it is necessary to resolve issues on the level of basic research, such as developing photoelectric conversion material, catalyst material and dye material, energy band design, surface interface control, verifying the theoretical maximum efficiency and then, pave the way from making devices to creating energy systems.

Compared with silicon-based solar cells and compound semiconductor solar cells, though there is a big difference in the progress of research for other types of solar cells, there is a mutually complementary relationship from the viewpoint of the utilization of solar light. Therefore, it is necessary to promote research and development in various ways to ensure future expansion on a wider scale. Under the current situation, however, considering the technologically preceding silicon solar cells and compound semiconductor solar cells, research and development focused on cost reduction aiming to expand diffusion in the market is mainly promoted, and there is a trend of not laying emphasis on basic research items, such as interface control, thin film/crystal growth, and new material development. On the other hand, considering organic thin film/dye-sensitized type solar cells, new high efficiency solar cells and systems that realize both solar light utilization hydrogen formation and power generation simultaneously, research has not reached the stage for considering dissemination to the market, and therefore at least, the development of materials, processes and structures that contribute to a drastic improvement in energy conversion efficiency is crucial. Further, by utilizing the technology developed from solar cell technology, it is expected that innovative improvements in hydrogen generation and power generation technology are made, and this will lead to active utilization of solar light energy.

Furthermore, our strategic sector can be regarded as one form of technological interaction between related fields. For example, it promotes the utilization of scientific knowledge and technological experience from the advanced silicon solar cell and compound semiconductor solar cell technologies in the dramatic improvement of efficiency (new high efficiency solar cells, solar light utilization hydrogen generation for organic thin film/dye-sensitized type solar cells and quantum dot solar cells).

At the same time, it promotes research on a surface and interface control, which is a common technological issue with silicon solar cells and compound semiconductor solar cells and proposes new concepts and structures.

Additionally, the research area indicated by the strategic sector is an interaction of the fields of material science and device physics. Currently, the number of domestic researchers studying solar light utilization technology is very small, so the important point in this research project is drawing out interactive innovation and triggering breakthroughs through the interaction of various fields by gathering together the wisdom of researchers in the various fields of physics, chemistry, and electronic engineering and promoting cooperative research under the same issue—the utilization of solar light.

The following are the specific examples of research fields and the interaction of various fields that are promoted under the strategic sector.

[Research fields]

① Solar power generation technology
- Silicon type, compound thin film type
- Dye-sensitized type, organic thin film type
- Novel super high efficiency type (such as III-V group, quantum dot type, multi-junction type)

② Useful material/energy creation technology through solar light utilization
- Creation of useful materials such as hydrogen, formic acid
- Simultaneous creation of useful materials and energy

[The interaction of various fields expected from our strategic sector]

①From the researchers in the related fields of semiconductors and organic EL displays, we expect research on applications of solar cell materials, clarification of deterioration mechanism and power generation efficiency improvement.

②From researchers of interface phenomenon, we expect searching for material that efficiently separates electrical charge.

③From researchers of crystal physics and thin film growth, we expect research on defect control for silicon thin film.

④From researchers of light control by photonic crystal, we expect research on light collection and quantum confinement control.

⑤From researchers of photo catalysts, we expect research on efficiency improvement of power generation from active solar light energy utilization.

3. Policy position

At the G8 Heiligendamm Summit held in June 2007, our country took a leading role in the statement in which countries aim to halve the amount of greenhouse gas (GHG) emissions by 2050.

In the Third Science Technology Basic Plan, as a goal to realize the principle to create the source of national power and to become a country that has international competitive strength and achieves sustainable growth, the "Goal 3 Balance between environment and economy – Balance the environment and the economy and realize sustainable growth (4) Overcoming global warming and energy problems" has been established.

Our main strategic points in the nanotechnology and material as well as energy fields are as follows: (1) developing technology with "True Nano" and innovative materials that makes dramatic cost reductions for green energy possible and, therefore, helps to overcome difficult social issues and (2) developing innovative methods to achieve higher efficiency and lower costs for the dissemination of solar power in order to be free from society of transport industry that heavily depends on oil.

The promotion of research and development technology as measures against global warming (April 2003), which was coordinated at the Council for Science and Technology Policy, emphasized the importance of actively and intensively working on research and development issues that have a greater impact on measures against global warming. Additionally, in the Strategy for Innovative Technology, Measures Against Global Warming, high efficiency solar power generation technology has been selected, and it has been pointed out that the organization and structure necessary for development are the promotion of cooperation among government, industry, and academia; cooperation among ministries; and the promotion of the interaction of various industries and fields. Further, in the environmental energy technology innovation plan, solar power generation and hydrogen generation were selected as items that are related to strategic sector. In particular, of the statements regarding solar power generation, the third generation solar cells that realize a dramatic increase in efficiency and reduction in cost by utilizing new materials and structures such as multi-junction and quantum nano-structure are closely related to the specific issues of our strategic sector. Concerning the hydrogen generation, in the roadmap, photo-catalysts are listed as an example of innovative hydrogen manufacturing technology that will make possible a dramatic reduction in costs.

Furthermore, in the aforementioned report organized by the Ministry of Education, Culture, Sports, Science and Technology, solar cells are positioned as the major environment technology for generating energy, and it proposes a future energy flow system that utilizes solar light and circulates it. Additionally, as mentioned before, through the cooperation of the four ministries, the action plan for expanding the introduction of solar power generation has been submitted, and this is an important time for Ministry of Education, Culture, Sports, Science and Technology to propose a policy that focuses on solar power generation.

4. Position of this research project, differences in content and political effectiveness from other related projects

This research project aims at solar power generation technology for converting solar light energy to electric energy, hydrogen generation technology that produces chemical fuel using solar light energy and technology for the simultaneous production of electric energy and chemical fuel.

The Center for Research and Developmental Strategy (CRDS) of the Japan Science and Technology Agency (JST) held a workshop in December 2007, proposing the future direction of R&D in this area where the Ministry of Education, Culture, Sports, Science and Technology and JST as well as the Ministry of Economy, Trade and Industry and NEDO had focused their efforts.

Among them, public funds for solar power generation were used through the Ministry of Economy, Trade and Industry and NEDO for issues that focus specific numerical goals, such as improving the efficiency of the devices or cost reductions. However, it is still necessary to further accelerate basic research in device physics and material science and the challenging research for new materials in order to realize future high efficiency and low cost solar cell technology. For example, the Innovative Solar Light Power Generation Technology Research and Development Project by NEDO is based on an innovative solar cell international base improvement project setting development goals targeted for 2050 with a long term viewpoint and is promoting a seven year project. Nevertheless, it is still necessary that those basic research should be carried out by universities and independent administrative institutions.

The 2008 budget request by the Minister of Science and Technology and the expert assembly members of the Council for Science and Technology Policy for the judgment of priority for science technology related measures (October 29, 2007) and NEDO's new energy technology research development (solar light・wind power) stated that "for issues of next-generation technology, especially for the promotion of basic research such as material development, active cooperation between the Ministry of Education, Culture, Sports, Science and Technology and universities is necessary. Furthermore, in order for Japan to continue to lead the world in the future, it is important to improve our international research bases while investigating improvement of systems and standardization for promoting dissemination." In addition, this request is clearly identifying the necessity and significance of cooperation between the Ministry of Education, Culture, Sports, Science and Technology and JST as well as the Ministry of Economy, Trade and Industry and NEDO.

In the strategic sector for the "Creation of Nano Materials/System for Realizing Environmental Conservation and Advanced Energy Recycling to Minimize Stress on the Environment" is an example of one that includes the use of solar light. However, the JST's CREST, "Development of Advanced Nanostructured Materials for Energy Conversion and Storage," which was based on this, has already been completed in fiscal 2007. Furthermore, the strategic sectors set after this, in response to the "Creation of Innovative Technologies Related to Reducing Global Warming in an Effort to Realize a Sustainable Society," CREST, "Creation of Innovative Technologies to Control Carbon Dioxide Emissions" began in 2008 with the goal of innovative technology development that could contribute to carbon dioxide emissions. Therefore, solar light utilization may be included as a measure for reducing carbon dioxide. In this research area, in fiscal 2008, research for Investigation of Highly Efficient Organic Thin Film Solar Cell was adopted with light and inexpensive plastic solar cells as its goals. However, as this solar cell research is only a part of a much wider issue of measures to reduce carbon and focuses mainly on higher efficiency for organic thin film solar cell, it might be not sufficient for developing the basic technology for solar cells. From the standpoint of effective distribution of resources, starting from fiscal 2009, it is necessary to put together all the issues regarding a solar cell in our strategic sector and maximize cost effectiveness.

Moreover, the basic research for higher efficiency in lower cost next-generation solar cells conducted at the National Institute for Materials Science (NIMS) is research focusing specifically on dye-sensitized type solar cells, and the organization of this project is not sufficient from the standpoint of innovative technology through the interaction of different fields. Furthermore, the environment technology development utilizing nanotechnology that is scheduled to be implemented starting from fiscal 2009 as well as the aforementioned CREST, "Creation of Innovative Technologies to Control Carbon Dioxide Emissions" sets its goal at reducing carbon dioxide, and though this includes solar cells as a research item, the main purpose is to build research bases for solutions to issues, and so the purpose of the measures differs from this strategic sector.

In the research and development of next-generation solar cells, competition with Europe and the United States is escalating, and from the standpoint of steadily implementing Strategy for Innovative Technology and maintaining and improving our country's international competitive strength, it is important that the government join in prioritizing research and development. For example, large-scale power generation could be realized with silicon thin film and small-scale special use power generation- with new solar cells, and it will be extremely important to consider that form of utilization while clarifying the mechanism of operation scientifically for several types of technologies that are expected to be the mainstream for the next-generation solar cells. Because of Germany's measures, Q-Cells AG overtook Japan's Sharp and became the world leader in solar cell production volume. With solar cell technology, which is positioned as a core technology, it is important to develop basic technology to promote dissemination as a national measure.

5. Achievements and goals expected

Due to the rapid growth of the electronics industry, it is well known that power consumption has been enormously increasing worldwide. Currently, Japan consumes about 5% of the global annual power consumption of 17 trillion kWh, (900 billion kWh a year, generating 4 hundred million tons of carbon dioxide). It is forecasted that power consumption will keep growing and by 2020 the global annual power consumption will reach 25 trillion kWh. The aforementioned government action plan for creating a low-carbon society declares a domestic attainment goal, and the Ministry of Education, Culture, Sports, Science and Technology should implement global warming reduction measures on a world scale.

From this perspective, for example if a solar cell with a power generation efficiency of 20% is used, in order to supply 25 trillion kWh, an area (120,000 km^2) that is more than 30% of Japan's land area is necessary. In order to provide power for the entire world, a relatively large area of solar light power generators will be needed. Therefore, securing a stable supply of all materials and resources used to make solar cells is inevitable. As a result, it is necessary to make solar cells that are as thin as possible and, at the same time, have high conversion efficiency. However, even though a single crystal silicon can achieve close to 30% conversion efficiency, approximately 100 μm-thick silicon film is required because of the small light absorption coefficient. If we were to create 80,000 km^2 solar cells to power the entire world, more than 18 million tons of silicon would be necessary, which is apparently not realistic. Currently, silicon ICs are being produced in large quantities around the world, but the amount of silicon crystals produced annually is several tens of thousands of tons. Amorphous silicon has a large light absorption coefficient and can be effective in thicknesses of around 0.5 μm. Furthermore, from the resource point of view, it has an overwhelming advantage. However, the present amorphous silicon solar cell conversion efficiency does not reach 10%. Also, amorphous silicon thin film used in volume production has a high defect density, so the electrons and holes that are generated by solar light disappear because of the flaws before they can contribute to power generation. In order to manufacture defect-free, super high quality amorphous silicon solar cells at extremely high productivity, it is crucial that new manufacturing equipment, new manufacturing processes, and new materials are created. According to the reported theoretical investigation, if defect-free super high quality amorphous silicon solar cells were made, the conversion efficiency would exceed 20%. If this were to be realized, the amount of silicon required to manufacture enough solar cells to power the entire world could be reduced to 140,000 tons, which is extremely realistic. If the desalination of seawater using this power is realized, it can contribute to greening the world's deserts and provide a solution to the food crisis. And if electric cars that are recharged using this power become widely used, as they do not produce carbon dioxide, all the cities in the world could become extremely clean and quiet.

In addition to large-scale power generation by silicon solar cells, by realizing new types of solar cells such as organic thin film types and quantum dot types that are smaller and lighter with a power generation efficiency that exceeds 50%, portable electronic devices that run not only solar light but on finer light, such as fluorescent light, could be realized. Further, through the development of high efficiency hydrogen generation technology and energy creation technology utilizing solar light energy, we could realize a power generation system in the future that is mutually complementary with power generation from solar cells.

It is expected that achieving these goals will contribute to the building of future energy flow systems that utilize solar light as described in "Promoting Research and Development of Environment Technology Utilizing Future Nanotechnology" (July 2008) prepared by the Ministry of Education, Culture, Sports, Science and Technology. This energy flow system would be based on the following: (1) energy generation, which is the conversion of natural energy, mainly sunlight, to electric energy in order to minimize environmental load, (2) storage and transport with minimal loss of energy utilizing secondary batteries and super conductivity technology, (3) energy utilization that reduces carbon dioxide emissions through the use of fuel batteries, and (4) energy conservation through the development of insulation material. Of these, solar cell is positioned as a major environment technology for energy creation, and hydrogen generation technology is expected as a key technology for storage and transport.

Japan becoming a pioneer in developing technology to convert solar light energy to secondary energy and to provide fuel at a low cost, will contribute to the halving of emissions of greenhouse gases by 2050 (G8 Heiligendamm Summit) and lead to converting to a low-carbon society that realizes both global warming countermeasures and economic development. Furthermore, as international competitiveness of new energy related industries is be emphasized, we will no longer be dependent on imports from overseas. As a result, we will be able to establish a sustainable, environmentally friendly energy system and contribute to the economic development of Japan, maintaining of the environment, safety assurance, and standard of living.

6. Scientific justification for the research and development goals

Concerning solar cells, practical applications are focusing on the crystal silicon types. In Japan, the technology level and penetration rate were at the top level in the world, but in recent years, because of Germany's pioneering measures for promotion, we have lost the leading position in the penetration rate. Concerning silicon types, it is predicted that other countries will soon be catching up Japan in the rapidly growing solar cell markets. Finally, in the area of novel solar cells, Switzerland is in a strong position for dye-sensitized type, and the United States is in the lead for organic thin film types. For the development of high efficiency low cost solar cell technology, it is necessary to solve a vast number of basic research issues. For silicon and compound solar cells that are already in volume production in solar systems, it is necessary to go back to the basics and conduct research on interface control and thin film growth or research that could clarify the deteriorating mechanism of absorbed light for further improvement in efficiency. And the development of new material for numerical targets other than efficiency and the development of a solar cell without rare elements, such as indium, are strongly required. With organic thin film type solar cells, a significant improvement in conversion efficiency from the emerging research materials, such as adapting fullerene to N-type molecules, is expected with the following explanations of the mechanisms and proposal for new structures, in addition to the significant improvement in power generation efficacy and longer life for dye material. From the explanations of the principles and proposal for new structures, however, there are issues to solve in the development of new processes for the manufacture at low temperatures with large areas, the high functioning of the organic PN active layer (such as N-type molecule search and development of self-assembly process for PN layer manufacturing), and the explaining of the conduction transport phenomenon in the PN active layer. We also need to work on the explanation of the analytic explanation of light deterioration feature of thin film silicon solar cells, and investigations into cutting back on silicon for single crystal silicon type solar cells are necessary.

Japan is also at the top level in the world for hydrogen generation using solar light. However, as the present light energy conversion efficiency is about 1%, a significant improvement in this conversion efficiency is a major issue. Designing a novel nano-catalyst and clarifying a detailed mechanism of hydrogen generation are major issues to study.

At the "International Comparison of Science and Technology & Research and Development 2008 (nanotechnology and material field)" (February 2008 JST Center for Research and Development Strategy: CRDS), in section 2.2.3 "Energy and environment fields 2.2.3.2 comparison by class hydrogen generation by (1)solar cell and (3) solar light," the R&D trends both domestically and internationally are provided for each class. At the CRDS workshop (December 2007) cited above, both the fields of dye-sensitized solar cells and hydrogen generation by solar light hydrolysis share basic principles (positive/negative carrier excitation, charge separation, organic material/inorganic material interface), and if researchers of both fields collaborated on the issues, both sides could expect much progress in these fields. However, it became clear that in Japan, there has hardly been any interaction between the two fields. This research project actively adopts issues that are common to both areas. In order to bring about interactive innovation, collecting the potential power for research in a wide variety of fields, such as chemistry, physics, and electronic engineering, while focusing on nanotechnology and nano-material field is required.

The number of domestic researchers on organic thin film solar cells, which is a central issue in our strategic sector, is less than that in Europe and the United States; however, there are many researchers, including those in the industrial world, for basic fields of related devices, such as organic EL displays and field-effect devices. As this strategic sector was set, there is a high possibility of strategically directing proposals from related researchers that are eccentrically located to the energy field.

7. Considerations in achieving the research and development goals

The real purpose of our strategic sector is to create interactive innovation and thus the visionary leadership and flexible R&D management by a research supervisor is strongly required. Based on the suggestions of the Council for Science and Technology Policy mentioned in section 4, in promoting this strategic sector, it is expected that we should work together as an all-Japan team, including the Ministry of Education, Culture, Sports, Science and Technology and JST, as well as the Ministry of Economy, Trade and Industry, and NEDO. And as for research projects, instead of developing various applications based on seed-technology, the focus will be on pursuing issues from the viewpoint of system applications. It will include everything from synthesizing new material through strategic searching to validating operational mechanisms of devices using new material and structures.

Under the strong initiative of the research supervisor who can conduct the overall research program, we will need a specific system for effectively obtaining results from research investments through close cooperation between groups, the use of a common interface, having a clear division of roles within a group, applying interactive theory with experiments, and promoting exchange between human resources research investment. In Japan, the facilities for conducting cooperative research has not been sufficiently prepared, and it is therefore expected that by effectively connecting them to the nanotechnology network project the projects related to this strategic sector will be promoted.

Strategic Sector: "Clarification of the control mechanisms of neural circuit operation and its formation" (Set in FY2009)

1. Title

Clarification of the control mechanisms of neural circuit operation and its formation

2. Content

The brain is the most characteristic in that many nerve cells composing it act as a network (neural circuit) by communicating with each other but not acting individually. A neural circuit, which consists of nerve cells connected plastically thorough a synapse, has flexibility that varies in degree and quality depending on the developmental stages of the host, enabling adaptation to the external environment and experience of the host.

Therefore, the mechanism through which the nerve cell recognizes the appropriate partner to which to bind (target recognition control), the mechanism that controls the intensity of signal transmission among nerve cells (synaptic control), and the mechanism that controls the behavior of nerve cells as a network (network control) play a definitive and important role in cerebral function. In addition, beyond the neural circuit, to understand the mechanism for the formation of a larger region or area as the consortium (region/area control) as well as the mechanism ensuring the appropriate number of nerve cells (apoptosis control) are also essential for normal brain function and understanding in a total system.

The strategic sector is the integrated understanding of the brain in which a system with very high totality is constructed through high level interdependency and interaction, including the formation of a region or area with apoptosis control and neural circuits (target recognition, synaptic, network controls), among functionally differentiated elements through research using current techniques of molecular cell biology and behavioral science.

Specifically, this strategic sector may contribute to the clarification of mechanisms that potentially lead to the early diagnosis and treatment of psychoneurosis and measures to treat dementia due to aging through synergistic effects with other specialized research in the pathological brain, clarification of mechanisms leading possibly to development of technology to improve and/or assist cerebral functions through synergistic effects with other research using the systems neuroscientific approaches, and the unfolding of the cause of abnormal human social behavior (sociality disorder) and developmental disorders, as well as clarification of cerebral functions possibly leading to language acquisition and well-rounded interpersonal communication through synergistic effects with other research using the approaches of social brain (cognitive) science that merges with cultural and social sciences.

3. Policy position

The strategic sector is closely related to "Science and technology for reconstruction of complex systems of life" and "Research for bridging to clinical research and practice" in life science in the Third Science and Technology Basic Plan. Through both fundamental research into the principle of action of the brain and development of relevant technology based on resulting understanding, this strategic sector will contribute to the development of medical technology for humans (relating to "Research for bridging to clinical research and practice") by comprehensively understanding higher cortical function (relating to "Science and technology for reconstruction of complex systems of life") and developing procedures for the early diagnosis and treatment of psycho-neuronal developmental disorders.

In the context of the Innovative Technological Strategy developed by the Council For Science and Technology Policy in May 2008 with the goal of constructing a healthy society, intensive implementation of the Assistive Technology for Aged and Disabled People (BMI) as part of medical engineering, significant expansion of technology to improve and assist cerebral functions, and the subsequent development of next-generation BMI is expected through R&D focusing on this strategic sector to methodologically complement the brain machine interface (BMI).

4. Position of this research project, differences in content and political effectiveness from other related

projects

Against the background that, in October 2007, TOKAI Kisaburo, the then-Minister of Education, Culture, Sports, Science and Technology referred the “Basic Concept and Promotive Action of Research in Brain Science as a Long-term Prospect” to the Council for Science and Technology, the Brain Science Committee (the chief examiner: KANAZAWA Ichiro, chairman of the Science Council of Japan) was newly established within the Council and is in the process of discussing the matter prior to submission of a report.

The Brain Science Committee submitted a progress report in August 2008 and, currently, is in the process of discussing the first report (interim report) scheduled for submission in June 2009, in which, to meet society’s expectation for research in brain science, three research areas: (1) brain and society/education, (2) brain and psychophysical health, and (3) brain and information/industry are listed as areas that should be promoted in order to contribute to society aiming at realizing “Brain Science Contributing to Our Society,” and it was pointed out that further reinforcement of basic research is required for research in order to contribute to our society. Also, strategic basic research was identified as important in focusing on politically important research areas. In the road map, clarification of the mechanism controlling the formation and behavior of a neural circuit is listed as one of the strategic targets of basic research directed toward future application along with the policy.

This strategic sector against this political background, which can lead to clarification of the interactive relationship between human social behavior and the environment and cerebral function, represents basic research beneficial to R&D in the area contributing to the realization of a well-rounded society, having something in common with the strategic sector “Elucidation of a human life-long learning mechanism based on knowledge of brain science with an intention to provide a solution to the problems in education” launched in 2003. Also, this sector, which can provide refinement of technology to decode information in the brain through the development of a network controlling technology, represents the basic research beneficial to R&D in the area useful for safety, security, and comfort, having something in common with the strategic sector “Creation of innovative fundamental technologies for utilizing information related to action and judgment in the brain” launched in 2008. Moreover, this sector, which can lead to clarification of the mechanism of psychoneurosis attributed possibly to neural network disorders, represents the basic research beneficial to R&D in the area supporting a healthy life, having something in common with the strategic sector “Creation of innovations toward the development of diagnosis and treatment of psychiatric and neurological disorders based on elucidation of complex and higher brain functions” launched in 2007.

In the initial report draft under discussion, the need for further reinforcement of basic research to avoid hastening the research toward contribution to our society based on a weak foundation as part of natural science is proposed because there are increasing hopes for and interest in the brain science research in our society, while the benefit of brain science research is just beginning. Against such a political background, this strategic sector, which represents basic research strongly related to research areas to possibly clarify how the brain is formed as hardware and expresses functions as software, underlies the various harmonizing research on brain science and may be highly desired in terms of policy. The results will contribute to the development of many relevant areas, as well as brain science, and will spread beyond medicine and biology to the materials and life sciences of pharmacology, engineering, chemistry, and physics, as well as the cultural and social sciences of psychology, pedagogy, sociology, ethics, and economy. Therefore, this strategic sector will lead basic research to the development of the whole brain science research by providing the scientific foundations to resolve the various contemporary social issues.

“Strategic Research Program for Brain Sciences” has been started from 2008, which is to give back the results of brain science research to society focusing on the outlets toward contribution to our society, and covers different research areas with different purposes for projects from this strategic sector. Also, the results of this strategic sector will contribute to the development of projects.

5. Achievements and goals expected

This research will possibly provide the following results:

1) The neural circuit is the source of cerebral functions, therefore, as this research progresses, understanding of the formation and functions of neural circuits will lead directly to an understanding of the brain.

Examples:

- Regarding network control, this research will provide the development of research on how the neural circuit (local circuit), consisting of a relatively smaller number of nerve cells, works as a functional unit of information processing in the brain by communicating with each other in the cerebral cortex, hippocampus, and cerebellum. In addition to conventional electrophysiology, the mode of action of local neural circuits in various sites in the brain will be demonstrated by combining various novel technologies such as visualization of nerve cells using specifically expressed molecular and fluorescence proteins, measurement of coincidence activity of many nerve

cells using calcium signals as an index, and single nerve cell stimulation with caged compounds.
- The function of local neural circuits is expected to be clarified based on changes in information processing in the brain and animal behavior resulted from manipulation of activities of local neural circuits with light using molecular candidates expressed in given nerve cells that excites (channelrhodopsin) or depresses (halorhodopsin) nerve cells in response to the light.

2) Progression of this research will lead to early diagnosis and treatment of developmental disorders and psychoneuroses due possibly to abnormal target recognition and synaptic control.
Examples:
- Although some molecular candidates, including Wint-7a, neuroligin, SynCAM, EphB, FGF22, and cbln1, which generate and maintain synapses (synapse organizer), have been identified in the 2000s and investigated for their mechanisms, construction of complicated and minute cerebral networks is far from being explained with such a small number of molecular candidates. In this research, the new synapse organizers and molecular investigation of their mechanisms will be actively explored, providing a significant level of understanding.
- In the context of understanding molecular candidates that can palliate abnormal behavior by accelerating synapse formation in the brain of animal models with abnormal synapse formation (e.g. cbln1), it is expected that similar animal studies will be conducted with various types of candidate molecules as the synapse organizer to determine hopeful molecular candidates that can be clinically applied in the future with a view toward human pathology such as synapse hypoplasia during the developmental period and reduction in synapses with aging through this research,.

3) As this research progresses, understanding of the memory and learning mechanisms and clarification of the mechanism to maintain synapse function in the mature brain will contribute to implementing measures to treat dementia along with aging.
Examples:
- Many transcription factors and signaling systems have been identified in the formation of regions and areas, such as the cerebral cortex and nucleus that consist of cumulated local neural circuits as a functional unit, which is still far from sufficient to explain the process of formation of the minute brain. For example, the molecular mechanism of formation of the cerebral cortex, which can be divided into 50 or more areas in primates, is not well understood. This research will provide significant advances in the investigation of the formation of regions and areas in the brain and the molecular mechanisms of development, differentiation, and migration of nerve and glia cells composing them, leading to identification of many genes involved in human developmental disorders.
- For modification of synaptic transmissions and sustaining the function in mature animals, functional expression at the network and system levels has been clarified in animal models as the research on relevant molecular basis progresses mainly in the hippocampus, cerebral cortex, and cerebellum. This research will significantly accelerate the understanding of how change in the synaptic function could lead to learning, memory, and memory loss. Since 2000, changes in the dendritic spine (spinous process of the dendrite contacted with the anterior synapse in which the receptors that accept neurotransmitter and various signaling molecular are aggregate) of the nerve cells have been shown to correlate with synaptic function. Also, an abnormal dendritic spine was shown to exist in certain mental retardation and psychoses. This research will significantly accelerate the investigation of the molecular mechanism of dendritic spine function as a structural base for learning, memory, and memory loss, providing basic data important to clarifying the cause of human mental retardation and psychoses.

4) This research will clarify the mechanism during the critical period (sensitive period) depending on the important roles of environment and experience, which can be applied to education in the future.
Examples:
- Investigation of the reconstruction of neural circuits depending on experience during postnatal envelopment and the critical period will significantly progress mainly in the cerebral cortex, cerebellum, and thalamus. Maturation of certain suppressive neurons has recently been demonstrated and is important in the determination of the critical period in the visual area of the cerebral cortex, accelerating clarification of the molecular mechanism of reconstruction of the neural circuits. Putting off or advancing the critical period has been possible in animal experiments. This research will provide clarification of the molecular mechanism of reconstruction of neural circuits in various regions, such as the somatosensory and auditory areas, in addition to the visual area in the cerebral cortex and advancement of the investigation of functional expression at the network and system levels. In animal models, the critical period can be controlled as this research progresses.
- Mechanisms of synapse pruning (synapses exist abundantly in the animal brain immediately after birth, and, depending on the environment and experience after birth, only the required synaptic

connections are reinforced and survive, while the remaining connections are removed) has been investigated in the cerebellum and thalamus. This research will provide significant understanding of the molecular mechanism and critical period, leading to the capability to accelerate and inhibit pruning in animal models. In addition, the functional significance of pruning will be shown at the level of the network.

- The molecular mechanism of reconstruction of the neural circuits and the critical period has been shown to vary depending on the site in the brain, leading to research on techniques to control the critical period corresponding to each part of the brain, as well as basic research "to rejuvenate the brain" by inducing a second critical period in mature animals after the critical period.

6. Scientific justification for the research and development goals

In brain science, there has been significant progress in the past 10 years in the clarification of the mechanisms of memory and learning in the brain and the pathogenesis of psychoneuroses, development of technology for communication between the brain and computer, and analysis of the molecular process of cerebral development and the sensitive period (critical period). Also, starting by the complete sequencing of the human genome, research projects have been conducted on the genome, genes, RNA, and proteins, providing a sequence of molecular novel biological results. There has been remarkable progress in techniques to measure the activities of nerve cells, networks, and regions/areas with imaging. Research on brain science now has the potential to advance unprecedentedly effectively using powerful tools such as molecular biology and imaging.

Research on the functions of neural circuits for memory and learning has progressed with a high level of originality only in Japan mainly in the area of electrophysiology and molecular biology, providing clarification and the computational theory of long-term depression of the cerebellum and its mechanism as the basic process in motor learning; clarification of the critical period of development of neural circuits in the cerebral cortex and cerebellum; and clarification of the structure and mechanism of the receptor for the transmitter glutamate, which has a central role in the memory mechanism. This research will address issues, such as cerebral hypoactivity due to aging, that we face in contemporary society by making use of our high potential from a scientific point of view.

"2008 International Comparison of Science and Technology and R&D (Life Science) (February 2008, the Center for Research and Development Strategy of the Japan Science and Technology Agency)," lists treatments and rehabilitation for diseases, including developmental disorders and cerebrospinal injuries, that rest heavily on individuals and society as urgent important issues in the area of the cranial nerve and requires a comprehensive research capacity, promptness, and development capacity from basic molecular research to drug discovery and clinical trials. This strategic sector is exactly the molecular basic research that can contribute to these important issues and will steadily accelerate the comprehensive research capacity, promptness, and capacity for the development of applied research.

7. Considerations in achieving the research and development goals

For this strategic sector, a framework of implementation should be constructed based on the discussions by the Brain Science Committee of the Council for Science and Technology and clearly assigning roles between this and other research projects.

Strategic Sector: "Development of innovative technologies for realizing sustainable water management by mitigating water problems intensified by climate change" (Set in FY2009)

1. Title

Development of innovative technologies for realizing sustainable water management by mitigating water problems intensified by climate change

2. Content

In 2007, the Intergovernmental Panel on Climate Change (IPCC) released the Fourth Assessment Report (AR4), which described the scientific basis that warming of the climate system is unequivocal and very likely due to the observed increase in anthropogenic greenhouse gas concentrations.

There is a worry that air temperature rise impacts water cycle. Long-term trends from 1900 to 2005 have been observed in precipitation amount in many large regions, and increased precipitation or more intense drought has been observed over wider areas. A climate-related warming of lakes and rivers influences the thermal stratification and internal hydrodynamics and deteriorates the water quality. According to "Summary for Policymakers" by IPCC Working Group II, current knowledge about future impacts on water resources expects the following: drought-affected areas will likely increase in extent; heavy precipitation events, which are very likely to increase in frequency, will augment flood risk; and sea level rise will cause decreased freshwater availability due to saltwater intrusion in coastal areas. In general, the conditions of regional water resources are expected to go through major changes around the world in the future.

Since water is closely related to agriculture, food, ecosystems, biodiversity, resources, energy, and health, changes of water cycle due to global warming could directly and indirectly cause serious problems that affect human beings on a global scale. Aggravating global water problems caused by population fluctuation, population concentration in urban areas, and lifestyle changes are further accelerated by global warming, and they may cause problems directly linked to the slowdown in economic growth in both industrialized and developing countries, a food crisis, and the security of humans involving disputes and conflicts over water.

IPCC AR4 indicated that even the most stringent mitigation efforts cannot avoid further impacts of climate change of the next few decades, which makes adaptation essential, particularly in addressing near-term impacts. In Japan, problems that threaten security and the stability of people's lives are anticipated to occur in the future in terms of the quantity and quality of water; for example, extremely low and high precipitation associated with climate change are expected to occur and lead to the increased risk of drought and flooding, and deterioration of water quality in rivers and lakes is anticipated. To counteract water problems caused by changes in the water environment that occur along with global climate change, it is important to locally establish water utilization and management plans that take into account long- to mid-term water demand and supply balance based on highly accurate water cycle forecasts. At the same time, it is necessary to develop technologies that mitigate and adapt to water problems and to effectively incorporate the technologies into society.

This strategic sector aims to develop new water-related technologies and technologies that integrate multiple highly developed technologies based on specifically anticipated cases of water problems that exacerbate global climate change with sufficient consideration of adaptability to society. The strategic sector also targets efforts to solve local problems in Japan, while the emphasis is on efforts in which the research implications include universal applicability that could be adapted to solve water problems around the world, even when the research is focused on local problems in Japan.

3. Policy position

The Leaders Declaration from the G8 Hokkaido Toyako Summit in July 2008 recommends integrated water resource management and *good water governance* through knowledge and technologies related to water and necessary actions of cooperation with developing countries and adaptation to global climate change. In the Chair’s Summary of the G8 Science and Technology Minister’s Meeting in June 2008 in Okinawa, it was pointed out that one of the research fields in which scientific and technological cooperation were to be emphasized in the future was the development of a sustainable water supply, which is especially important in developing countries.

In addition, “Toward the Reinforcement of Science and Technology Diplomacy” (Council for Science and Technology Policy, May 2008) includes implementation of water-related efforts in developing countries using Japan’s advanced scientific technologies as one of the issues Japan should be involved in to promote scientific and technological diplomacy.

Such efforts correspond to the individual policy goal of the Third Science and Technology Basic Plan (FY2006-FY2010) of Japan, (3)-11: “Realize Good Water Cycle and Sustainable Water Utilization," and are categorized in the “Water cycles and solute transport in watersheds research field," in the Environmental Science Area of “Promotion of R&D in Prioritized Areas”, as well as "Comprehensive Management of Water and Material Circulations," which is an important research and development issue in the Social Infrastructure Area

“Promotional Policy on Research and Development of Earth and Environmental Science and Technology” (Subdivision on Research and Development Planning and Evaluation, Council for Science and Technology Policy, August 2008) states that it is important to promote research and development of advanced technologies that observe changes in local and global water cycle and water resource management as basic and fundamental research and development to evade or mitigate the negative effects that unbalanced water resource availability from global-scale changes of water cycle will have on human society.

4. Position of this research project, differences in content and political effectiveness from other related projects

The role of environmental science and technologies is to improve the social environment in order to solve environmental problems as well as searching for truth or developing advanced technologies. To do so, even basic and fundamental research must involve factors that lead to environmental improvements. Also, it is necessary to tackle the issues comprehensively and strategically while taking into account the various aspects including the accumulation of scientific knowledge on the investigation and resolution of problems, development of essential technologies, policy of applying technologies in the society, and social system designs.

Core Research for Evolutional Science and Technology (CREST) had several projects to be related with the field of the Earth and Environmental Science and Technology: “Social Systems for Better Environmental Performance," which started in 1995; “Mechanism of Global Change,” which started in 1997; “Research and Development of System Technologies for Resource Recycling and Minimum

Energy Requirement," which started in 1998; and "Hydrological System Modeling and Water Resources System," which started in 2001. Research to investigate the mechanisms of climate change and water cycle and technological developments for sustainable and efficient water utilization system in the society have been carried out under "Hydrological Sytem Modeling and Water Resources System."

In order to establish a foundation to realize a new society that successfully deals with water issues, it is necessary to go beyond the boundaries of development of counteracting technologies that are carried out in relevant government agencies and research institutions and influence assessment research, which is individually conducted in different fields. It is crucial to promote interdisciplinary and comprehensive research and development that involves fields from natural science and technological development to humanities and social science. Thus, the efforts to investigate the process of water cycle and research and technological development of effective water utilization systems conducted under the previous projects of CREST will be further expanded. Simultaneously, research and technological development will be promoted to realize a society that can overcome the expected and dire water problems based on scientific knowledge of global warming identified in the IPCC AR4 and social circumstances.

5. Achievements and goals expected

To solve water problems that society faces, an optimal combination of innovative technologies and multiple existing technologies capable of solving problems based on proper understanding of the background of the issues is required, along with effective application in society.

This strategic sector will promote the development of innovative technologies that will solve problems associated with quality and quantity of water, such as the following:

- Technologies to solve problems of water quality such as water production and purification technologies that use membranes and biological treatment and sanitation technologies in order to use treated water which is reproduced from unusable water or wastewater, as safe water, and
- Technologies that solve issues of water quantity such as unprecedented water storage technology, water recirculation and utilization technology, water retention improvement through greening, agriculture and cultivation technologies that use less water in order to alleviate problems associated with uneven water distribution due to changes in water cycle pattern that occur along with climate change.

Also, the expected outcome of this strategic sector is to create innovations to realize a society that can overcome water problems, which will be further exacerbated in the future due to climate change, through the promotion of research and technological development to integrate essential technologies whose emphasis is on effective utilization in society. Innovative water resource management will thus be realized in Japan ahead of the world. Also, it allows Japan to assume a leadership role in international society by contributing to developing countries and the world, which face dire water problems, using Japan's advanced scientific technologies and to support Japanese water businesses to expand inside and outside the country.

6. Scientific justification for the research and development goals

Japan used to suffer serious water pollution in the past but developed technologies related to water quality improvement and treatment to solve such problems. "International Comparison of Scientific Technologies and Research and Development, 2008 edition" (*Environmental Technology*) (February 2008, Center for Research and Development Strategy) provides a detailed report of the current comparative status of water quality improvement and treatment technologies in Japan and the world. According to the report, Japan's water treatment businesses have high standards of technological development and industrial technologies because strict regulations and local agreements are often applied to industrial water discharges. Researches in specific fields for the analysis of microbial flora in biological wastewater treatment are active in universities and national research institutions. Research in the treatment of sewage and domestic wastewater is being conducted. In particular, Japan leads in the share of manufacturing reverse osmosis membranes that utilize nanotechnologies in the field of membrane filtration materials related to water treatment.

Japan has advanced technologies to observe and forecast water cycle, such as precipitation and water availability. Such technologies can be utilized to overcome water problems associated with climate change by improving accuracy and standardizing them. On the other hand, in terms of groundwater, which is an important part of water cycle and used as a valuable water resource, the conditions are still insufficiently understood; thus further research on groundwater is considered necessary.

Japan has many excellent technologies that provide solutions to water problems. We will be able to overcome the water problems that will exacerbate in the future along with climate change and transform the styles of social activities by continuously improving Japan's excellent technologies, promoting scientific technologies to solve water problems, and interdisciplinary cooperation with the fields of humanities and social sciences, as well as implementing research and technological development to establish and spread technological systems that are compatible with targeting water problems.

7. Considerations in achieving the research and development goals

Among the various water problems, this strategic sector will be implemented with a focus on problems of higher importance and urgency for society that require development of innovative technologies as solutions. Development of progressive technology is necessary to create innovations to realize a society that can overcome water problems. In addition, it is necessary to go beyond simple technological development and move forward while distinguishing how individual technologies will be applied to society. Thus, researches under this strategic sector must be carefully carried out so as to avoid focusing on pursuing technological development that is confined to individual themes.

Strategic Sector: "Creating fundamental technologies for advanced medicine through generation and regulation of stem cells, based on cellular reprogramming." (Set in FY2008)

1. Title

Creating fundamental technologies for advanced medicine through generation and regulation of stem cells, based on cellular reprogramming

2. Content

Cellular reprogramming that can turn differentiated cells into pluripotent stem cells draw attention as potential means to realize pioneering advanced medicine. A Japanese researcher brought about major breakthroughs in this field in 2006 and 2007. The strategic sector aims at advancing and simplifying the reprogramming technologies, based on molecular biological mechanisms of the reprogramming process. In addition, using the technologies, stem cells that could be generated from somatic cells of patients or healthy persons will be given to elucidate pathological mechanisms and to establish fundamental technology such as new therapy strategies and methods to detect and test side effects of drugs.

3. Policy position (relationship with "Science and Technology Basic Plan" and "Strategic Prioritized Science and Technology")

The strategic sector is relevant to "Science and technology for reconstruction of complex systems of life" within the "Strategic Prioritized Science and Technology" field of life sciences in the plan. Specifically, this strategic sector is also relevant to "Research for understanding higher-level control mechanisms in living organisms," listed in the content of Research and Development.

4. Position of this research project among research promotion measures in relevant research fields, differences from other related measures, and differences in effects of policy

This strategic sector focuses on research aiming to develop the cellular reprogramming technology, followed by applying the technology to elucidation of pathological mechanisms of congenital diseases and development of detecting and testing methods for side effects of drugs. Research subjects under the strategic sector are different from those of other projects, the "Project for realization of regenerative medicine (Ministry of Education, Culture, Sports, Science and Technology, since 2003)," which aims to establish cell therapies and tissue transplantation using stem cells. The research phase of this strategic sector is different from that of a project supported by Grants-in-Aid for Scientific Research (Grant-in-Aid for Specially Promoted Research "Molecular basis of nuclear reprogramming"), which focuses on scientifically elucidation of the molecular mechanism of reprogramming by 4 essential factors.

5. Achievements and goals expected; and reasons, urgency, and need for priority from specialists and industries over other Strategic Prioritized Science and Technology

The objective of the strategic sector is to establish fundamental technology which can help elucidating pathological mechanisms of congenital diseases, studying new therapy strategy and detecting and testing side effects of drugs through advancing and simplifying the cellular reprogramming technology and establishing disease model from patients' somatic cells. Concrete goals are as follows:

[Examples of short-term goals]

- Establishment of a reprogramming technology with less genomic stress, by precisely introducing the pluripotency factors into genome, or by using of chemical compounds
- Elucidation of pathological mechanisms through disease model from somatic cells of patients or healthy persons

[Examples of medium-term goals]

- Identification of candidate compounds for drug discovery by using the above-mentioned disease model cells, and establishment of fundamental technology for gene therapy
- Finding of methods for detecting side effects of drugs, such as arrhythmia, using pluripotent stem cells from healthy persons

By 2006, 132 stem cell institutes had been established worldwide. At present, researchers in these institutes are trying to establish human induced pluripotent stem (iPS) cells after the success in Japan, bringing severe competitions in the field. It is thus necessary for Japan to keep the position as one of the world's leader in the filed by steady implementation of these research themes.

6. Scientific justification for the research and development goals

The importance of human disease model cells has been recognized so far, even in the stages of basic research prior to clinical research. Progress in stem cell biology prompted research and development of reprogramming technologies in Europe and the United States that generate disease model cells from patients' own cells, namely "therapeutic cloning". However, this research is confronted with some obstacles, including ethical controversy concerns due to the use of human embryonic stem (ES) cells and low efficiency of generation by nuclear transfer or cell fusion techniques.

In 2006, a Japanese researcher succeeded in establishing iPS cells that are close to ES cells from murine fibroblasts by introducing 4 defined factors, and in 2007, successfully established human iPS cells. These achievements reduced the aforementioned ethical problems, and brought a major breakthrough in reprogramming research. Japanese stem cell research, conducted mainly in universities, maintains internationally-recognized high levels of researchers, equipments, and publications through Grants-in-Aid for Scientific Research and the "Project for realization of regenerative medicine".

Utilizing the high potential of stem cell research in Japan, this strategic sector will enhance the development of new therapies and preventive medicines required in an aging Japanese society through promoting the basic research based on the reprogramming technology. In addition, stem cell research itself is expected to develop as a major research field, comprising — based on the view of stem cells — all areas including developmental and regenerative biology, pathology, and age-related tissue impairment.

7. Considerations in achieving the research and development goals (research team organization, etc.)

To achieve the goal of this strategic sector, it is advised to take a team-oriented research approach in which a team consist of researchers with abundant clinical findings of diseases and researchers with excellent cellular analysis technologies such as flow cytometry. In addition, individual research will also be necessary to effectively develop cellular reprogramming technologies based on molecular biological mechanisms. Individual research projects will be conducted mainly by young researchers who have new ideas, such as direct induction of stem cells or progenitor cells of various tissues from skin cells or tissue stem cells without necessity of iPS cell stage.

Advances are made quickly in the field of stem cell research worldwide, and the competition to acquire intellectual property rights is fierce. Although Japan currently holds the second-largest number of patents concerning stem cells after the U.S., the number of acquired patents has tended to decrease recently. In the researches implemented in this strategic sector, attention should be paid to patent acquisition as well as patent quality, in view of the stem cell patents applied in the U.S. and other countries. Moreover, it will be necessary to pay attention to bioethical appropriateness of each research project, because human cells will be used.

(Reference) Political goals to be achieved in this project

More recently, iPS cells have been obtained by reprogramming of human somatic cells via introduction using retrovirus vectors of 3 factors, Oct3/4, Sox2, and Klf4.

In the strategic sector, research on targeted introduction of genes and control of the number of genes to be introduced into single cells will be conducted at first, through genomics, chromosome structure, and especially epigenetics analyses of the cellular reprogramming mechanism. High-throughput screening of reprogramming-inducing compounds will also be conducted to achieve precise control of introduction factors as well as simplifying of generation methods. With effective use of advanced reprogramming technologies, iPS cells will be generated from somatic cells of patients with congenital disease and will be differentiated into disease model cells for elucidation of pathological mechanisms. On the basis of findings obtained from these activities, fundamental technologies for identifying candidate compounds for disease-controlling drug and detecting side effects of drugs using iPS cells derived from healthy persons.

Strategic Sector: "Enhancing advanced materials science and life science toward innovations using new light sources, including state-of-the-art laser technology" (Set in FY2008)

1. Title

Enhancing advanced materials science and life science toward innovations using new light sources, including state-of-the-art laser technology

2. Content

Optical and Photo science is a fundamental research field at the forefront of research and development (R&D) that has achieved breakthroughs in prioritized areas such as information and communication, nanotechnology/materials, life sciences, the environment, and energy.

Traditionally, a number of researchers have been conducting individual research using light. However, those researches have not been leading cutting edge science, because there has not been an appropriate system to promote unique research in which researchers or developers with profound knowledge about light source performance and metrology can cooperate closely with a broad range of researchers who utilize laser and other light sources.

The purpose of this strategic sector is to lead to advancements in science in prioritized areas and to stimulate innovation, such as creation of new materials and detoxification of toxic byproducts by alteration of the binding state of atoms with light energy, and actualization of noninvasive medicine by development of technologies that allow detection of foreign matter or tumors on a distinct fluoroscopic image without exposure to radiation. The purpose will be achieved by concentrating on R&D projects that meet conditions described below.

① Research should make full use of available state-of-the-art light source technology by modifying existing light sources independently or devising new usage.

② Research should aim to make world-leading achievements in science using light in each prioritized area by embracing completely new ideas.

3. Policy position

In the "Third Science and Technology Basic Plan," is stated "it is necessary to nurture environments that promote intellectual inspiration and fusion among different areas for creation of new wisdom by accelerating R&D that allows flexible orchestration of knowledge necessary for problem solving across the existing boundaries between research areas." Photon science and technology is truly the one that leads to creation of new innovation by fusing the areas of information and communication, nanotechnology/materials, and life sciences, across the boundaries with basic science including optics, quantum mechanics, and electromagnetics.

In relation to this strategic sector, "Measurement, Processing, and Production Technology with Advanced Usage of Quantum Beams," is listed as one of the fundamental technologies in the field of nanotechnology/materials in "the prioritized fields" and the key R&D theme in the areas of information and communication includes light-related subjects such as "Subject 7: Fusion Technology (Terahertz Devices, Medical IT, and Advanced ITS Technology)" and "Subject 9: Future Devices (Advanced Optical Devices, Post-silicon, MEMS Applications, and Flux Quantum Circuits)." In addition, photon science technologies are indispensable and fundamental in pursueing key R&D themes, including bioimaging and molecular imaging, which are listed among the "prioritized fields".

4. Position of this research project among research promotion policies in relevant research fields, differences in content and political effectiveness from other related projects

In some areas of optical and photo technology, theoretical and embryonic research has been conducted with reliance on Grants-in-Aid for Scientific Research and basic budget of research institutions. Moreover, researches are undertaken to accelerate R&D in the research areas of optical science such as "Photonics and Quantum Optics for the Creation of Innovative Functions" (CREST), "Evolution of Light Generation and Manipulation" (PRESTO), and "Photons on Soft Materials" (PRESTO) since 2005 under the strategic sector "Ultimate and Local Control of Photon and Applications".

However, optical science research funded by Grants-in-Aid for Scientific Research has been conducted using traditional light sources based on the personal ideas and interests of individual researchers.

In CREST started in 2007, creation of new functions and materials is at the core of the research goal, with a focus on the development of new materials and new functional devices, and therefore basic optics and photoscience research that makes full use of new light sources and metrology has not been conducted. In PRESTO, basic research subjects related to the nature of light such as interaction between light and materials are selected and some pioneering studies are ongoing; however, theoretical research is still predominant and joint or fused research with light source or metrology developers, which is necessary for expansion to applications, has not been conducted.

This program dramatically improves the effort for collaboration and fusion among light source developers, researchers of light fundamentals, and researchers of utilizations of light, which has not been satisfactory. Unlike the conventional approach, in this program research of light fundamentals and applications that make full use of the properties and nature of new light sources will be conducted with support from light source developers who are familiar with the generation principle, performance, and metrology of new light sources. Therefore, the program is expected to lead to creation of world-level research findings and innovations in each key area.

5. Achievements and goals expected; and reasons, urgency, and need for priority from specialists and industries over other strategic priorities in science and technology

By urging researchers who utilize light to jointly conduct researches with light source developers under this strategic sector, organic cooperation and fusion between seeds in the field of optical and photo science and needs in other areas that have not been satisfactory are promoted and the following innovative outcomes are expected:

- Not only high-quality papers in each research field using light, but also innovative scientific findings such as establishment of a completely new idea can be obtained.
- The use of new light sources can make the seemingly-impossible possible, and allow solution and conquest of important technical subjects in each field.
- Expansion to industrial technology as a result of drawing more attentions from industry and initiating joint and contract research with new light sources.

Specific examples of expected accomplishments of individual research are listed below:

1) Research related to quantum control of atoms and molecules with ultrashort pulse light
Application to selective chemical reactions through regulation of amplitude and phase information of optical pulses, design of high temperature superconductors and elucidation of the mechanism of superconductivity based on the Bose-Einstein condensation (BEC) phenomenon, utilization of optical lattice clocks as the frequency standard, etc.

2) Research using irradiation energy of ultrashort pulse light
Creation of new materials or conditions using irradiation energy of ultrashort pulse light, ultrasensitive and time-resolved analyzers using quantum beams such as X-ray and proton beams generated from plasma by irradiation of ultra-short pulse light, etc.

3) Research related to high-contrast and high-sensitivity imaging using light in unexplored wavelength regions
Continuous observation inside living cells using coherent soft X-rays in the water window region, actualization of high-resolution imaging and optical CT using wavefront compensation optics in the terahertz range, etc.

6. Scientific justification for the research and development goals

Advances in related fields of individual research are summarized as follows:

1) Research related to quantum control of atoms and molecules with ultrashort pulse light
Current research includes the following subjects: basic research related to pulse shaping for selective alteration of electron transition state and measurement of dynamic processes of chemical reactions in solution or on surfaces necessary for focused chemical reactions; control of BEC using thin gas; one-dimensional optic lattice clocks with a frequency precision of 15 digits.

2) Research using irradiation energy of ultrashort pulse light
Current research includes the following subjects: metamaterials and plasmonic devices using surface plasmons by irradiation of ultrashort pulse light, reforming of compositions inside or on the surface of materials, and acceleration of electrons and generation of quantum beams by ultrashort pulse light.

3) Research related to imaging using light in unexplored wavelength regions
Coherent X-rays with discrete wavelengths up to several tens of nanometers have been generated. Light in the wavelength region of 0.1 to 40 THz can be generated, and studies using the wavelength selectivity of such terahertz light are currently ongoing.

7. Considerations in achieving the research and development goals

This strategic sector focuses on application research that makes full use of new light sources in each prioritized area. To advance the achievements obtained in such application research further, research center-type projects for actualization of a completely new light source or metrology should be conducted in parallel under the auspices of the Ministry of Education, Culture, Sports, Science and Technology.

For efficient operation of these two different yet complementary research projects, the following research management systems should be established:

① The manager of this project (application research) should operate and manage the research in collaboration with the above mentioned project.

② Evaluation should include not only existing quantitative parameters such as the number of published papers and patent applications, but also emphasize the ripple effect on other fields and impacts on the society and economy.

(Reference) Policy goal to be achieved in this project

The goal of this project is to allow researchers of each prioritized area who use specialized light (user researchers) to challenge the exploitation of a completely new direction and new area by using new light sources in a unique way. Therefore, user researchers promote research by making full use of distinctive light with support from light source developers who are familiar with the generation principle,

performance, and metrology of new light sources.
<Examples of research>

1) Research related to quantum control of atoms and molecules with ultrashort pulse light
2) Research using irradiation energy of ultrashort pulse light
3) Research related to high-contrast and high-sensitivity imaging using light in unexplored wavelength regions

With research using these kinds of light-related tools, this project aims to create innovation using the state-of-the-art laser technology and obtain research achievements unique to Japan. Furthermore, groups of user researchers familiar with the characteristics of new light sources are expected to be formed and be trained by promoting this project.

Strategic Sector: "Creation of next-generation nanosystems through process integration" (Set in FY2008)

1. Title

Creation of next-generation nanosystems through process integration

2. Content

This strategic sector aims at creation of next-generation nanosystems including microelectromechanical system (MEMS), such as those in which biotechnology and electronics are fused, systems using nanostructured chemical reaction fields, and molecular systems that function autonomously, by promoting sophistication and integration of processes that use nanotechnology.

Until now, acceleration, integration, and downsizing of various devices and systems have been supported by progress in top-down process technology. The most conspicuous example is silicon complementary metal–oxide–semiconductors (CMOS), which have been highly integrated by progress of photolithographic technology.

Although minimum dimension produced by photolithography has reached 45 nm as of 2007, it is necessary to reduce minimum dimension further to several nanometers for development of nanosystems with innovative functions as described above.

With bottom-up processes represented by self-organization, molecule-size formation accuracy less than 1 nm is feasible, but the current technology only enables alignment of molecules. It is therefore necessary to improve self-organization technology to a level at which molecular alignment and structure are regulated dynamically in a spatiotemporal manner to construct nanostructures freely, and achieve self-functioning that allows autonomous evolution of functions with combinations of these nanostructures.

This strategic sector aims at creation of next-generation nanosystems as described above by sophisticating top-down processes (in which technology has been accumulated) and bottom-up processes (in which future advancements are expected) and by attempting various combinations of these process technologies.

3. Policy position

This strategic sector aims at settlement of demanding problems that are difficult to solve without innovative materials development in the "True Nano" area, and others that must be solved to ensure superiority in international competition in relation to the key technologies described below:

○ Creation of innovative material and process technology that plays a central role in making innovation
○ Development of innovative nanotechnology and material technology that supports safety and security of the people's health and life.

4. Position of this research project among research promotion policies in relevant research fields, differences in content and political effectiveness from other related projects

Similarly to this strategic sector, three other strategic sectors with relevance to nanoprocesses have been established previously, as described below. All of these aim at accumulation of fundamental wisdom, understanding of basic principles and phenomena, and elucidation of function theory of processes.

- Creation and Application of Innovative Nano-interface Technology that Achieves High Performance from Materials and Substances in Different States
- Development of Technologies for Highly-Efficient Manufacturing of Nanodevices and Nanomaterials, and Innovation in Manufacturing Technology Based on Nanoscale Science
- Elucidation of the Dynamic Mechanisms of Biological Systems and Establishment of Fundamental Technology

This strategic sector is radically different from the strategic sectors listed above in that it focuses on studies on the development of next-generation nanosystems through evolution of bottom-up processes that have not yet matured, and on further integration of top-down processes that are necessary for construction of nanodevices.

5. Achievements and goals expected; and reasons, urgency, and need for priority from specialists and industries over other strategic priorities in science and technology

The specific goal of this strategic sector is the development of next-generation nanosystems, as follows:

- Systems with new interconnect structures using self-organization of proteins and DNA
- High-power ion cells consisting of electrodes prepared using viruses as template.
- Establishment of nanosystems for medical use in which top-down processes and biotechnology are fused
- Artificial muscle from self-functioning organic material
- Self-cleaning systems in which photofunctional molecules are self-organized

In order to develop such systems, it is necessary to advance top-down processes to the "True Nano" area, as well as to create innovative bottom-up processes. These processes enable nanostructures to be autonomously organized as programmed based on findings from mimicking biomaterials and elucidating charge separation and conduction mechanisms in microscopic elementary processes.

The establishment of bottom-up processes and integration with top-down processes will boost the Japanese superiority in the field of manufacturing technology, and is thus of foremost importance.

6. Scientific justification for the research and development goals

Japan is a world-leader in photolithographic etching technology, which is a representative example of a top-down process. Machining resolution can be improved further using shorter-wavelength extreme ultraviolet (EUV) as the radiation source, and EUV radiation sources has been the focus of a project of the Ministry of Education, Culture, Sports, Science and Technology. Moreover, machining resolution can exceed the diffraction limit of light significantly by using the characteristic behavior of entangled photons with quantum correlation. For ion-beam machining, development of ion sources using noble gases is expected to reduce damage during machining considerably. In addition, machining accuracy can be improved to several nanometers by introduction of spherical surface and chromatic aberration correction technology. For this aberration technology, development of systems unique to Japan is being promoted as a project of the Ministry of Education, Culture, Sports, Science and Technology.

At the same time, Japan also has excellent elemental technologies for reclamation of bottom-up processes. In particular, Japanese technologies in polymer engineering and organic chemistry lead the world. The following subjects are relevant to this strategic sector:

- Studies on nano-space controlled polymeric materials such as dendrimers and self-structuring nanotubes
- Studies on virus-enabled synthesis of hybrid gold-cobalt oxide wires at room temperature to provide thin and flexible lithium ion batteries by two-dimensional control methods
- Studies on hybrid connections between differing materials such as artifacts and biomolecules
- Studies on self-structuring of nanosized particles using surface tension
- Studies on machining processes of patterned media by micro-phase separation of block copolymers

The use of more sophisticated top-down processes in these studies will lead development of next-generation devices with more complex structures and greater functionality.

7. Considerations in achieving the research and development goals

The research areas should be promoted in express consideration of the fact that this strategic sector focuses on studies aiming at development of next-generation nanosystems, rather than pure process studies. In addition, intensive investment on fundamental technologies that require further scientific exploration and establishment of meaningful cooperative network with relevant organizations are necessary.

This strategic sector requires creation of new scientific fields based on the integration of existing scientific fields such as material engineering, molecular engineering, surface engineering, protein engineering, and fluid science; as well as improvement of hard technologies such as nanoscale microfabrication, observation of atomic and molecular behaviors, and precise manipulation of biomolecules; and advancement in soft technologies such as data processing/analysis and simulation. For these purposes, universities and independent corporations should play a central role with assistance from business enterprise.

Clear organizational structure will be necessary to obtain fruitful results with clear division of roles within a group, fusion of theory and experiment, and research investments including personnel exchange while strengthening cooperation among groups and using common infrastructure under comprehensive and strong initiatives of the research supervisor who has knowledge and experiences in process research from top-down to bottom-up and provides a wide and deep overview of the entire area to establish nanosystems using such knowledge and experiences. Promotion of cooperation with existing research sites and other organizations should also be considered.

(Reference) Political goals to be achieved in this project

This strategic sector aims at development of next-generation nanosystems such as those in which biotechnology and electronics are fused, those that use nanostructured chemical reaction fields, and molecular systems that function autonomously. For this purpose, it is essential to increase the refinement of top-down processes represented by photolithography and ion-beam machining and to evolve bottom-up processes from self-organization to self-functioning.

With top-down processes, it is necessary to increase the machining accuracy from the current level of several tens of nanometers to one nanometer by using shorter wavelength light sources in photolithography. For ion-beam machining, usually conducted by irradiation of gallium ion, the machining accuracy is about 50 nm. However, after-treatment processes are often required to compensate for property degradation due to the deterioration of the machining surface caused by the impact of the gallium ions. It is necessary to develop processes that allow damage-free machining as well as to improve machining accuracy to several nanometers.

In contrast, bottom-up processes aim not only at studies on self-organization, but also contribution to establishment of nanosystems that evolve functions ultimately by reclamation of innovative process technologies that enable high-throughput, low-cost, energy-saving manufacturing. For these purposes, it is essential to establish technologies that regulate nanostructures including organic molecules with various structures represented by a variety of inorganic material nanoparticles and dendrimers that regulate dynamically in a spatiotemporal manner. Moreover, it is important to consolidate a design guide for self-functioning by extracting and analyzing quantitative information obtained by the behavior of biological molecules for self-structuring, self-replication, and self-repairing.

In the current manufacturing industry, top-down process microfabrication plays a central role. However, it is not an exaggeration to say that the integration of more advanced top-down processes and more practical bottom-up processes is indispensable for the nanotechnology industry in Japan to achieve international success.

Strategic Sector: "Creation of innovative technologies related to reducing global warming in an effort to realize a sustainable society" (Set in FY2008)

1. Title

Creation of innovative technologies related to reducing global warming in an effort to realize a sustainable society

2. Content

The Intergovernmental Panel on Climate Change (IPCC), co-winner of the 2007 Nobel Peace Prize, published its Fourth Assessment Report (AR4), backed by scientific evidence published in its Working Group I Report (WG1). The assessment of the IPCC is that "warming of the climate system is unequivocal" and that "most of the observed increase in globally averaged temperatures is very likely due to the observed increase in anthropogenic greenhouse gas concentrations."

This Assessment Report proposes necessary action in view of this assessment, referring to "Impacts, Adaptation, Vulnerability" in the Working Group II Report (WG2) and "Mitigation" in the Working Group III Report (WG3). To respond to these recommendations, it is greatly expected for basic research to play an important role in exploiting leading-edge science and technological breakthroughs to achieve control and reduction of CO_2 emissions (dramatic improvements in environmental load such as energy efficiency and CO_2 emission levels, durability, price, condition of use, etc.) to maintain a sustainable society in addition to the on going efforts on establishing and improving existing technologies already in use.

This Strategic Sector will promote research and development designed to produce innovative technology seeds for CO_2 emission control and for CO_2 reduction, with the assumption that the resulting technology will be commercialized and widely used in society to contain global warming.

Specific examples of such technologies are listed below. These technologies will enable CO_2 emission control and reduction using new concepts or fundamental improvements in efficiency.

- Technological development of a new-generation solar cells with highly efficient energy exchange, long life, performance unaffected by weather conditions, and other dramatically advantageous functions while generating minimal amounts of CO_2 in their manufacture; development of easy-installation energy production and storage technologies, for example using coated solar cells and chips-size solar cells
- Development of innovative technologies that aim to utilize tidal power, wave power, tidal stream power, and other such potentials in ocean energy

- Technological development that aims to utilize bio-energy, for example microorganisms with outstanding photosynthetic capacity
- Improvement of CO_2 recovery technology and development of an innovative, effective utilization technology of CO_2

3. Policy position

One of the three concepts espoused by the Third Science and Technology Basic Plan is to "maximize national potential – to create a competitive nation achieving sustainable growth." To this end, the major policy goal is "economic growth & environmental protection – achieving sustainable economic growth based on environmental protection. A medium priority goal is to "overcome global-warming and energy problems"

What is more, the basic stance in executing the Third Basic Plan is to promote areas of science and technology that are supported by the public and which deliver positive results. With reference to the promotion of R&D to tackle global warming, the Council for Science and Technology Policy in its April 2003 session pointed to the importance of basic research in R&D, particularly technology to combat global warming, so that we may achieve drastic reduction of greenhouse gases by creating more innovative technology. Indeed, the very significance of this projects in the JST Basic Research Programs designated in this Strategic Sector is to fulfil the Basic Plan: projects must aim to return to the public the results of basic research through innovation so as to deal with the global warming issue.

Stated as one of the four strategies of Strategic Prioritized Science and Technology (S&T) of the promotion strategy for the environmental sector is the "tackling of global warming." Together with a global-scale observation and climate change prediction system, the aim is to develop S&T that enable the design and realization of a future society that can deal with global warming.

In addition to these promotion plans included in the Science and Technology Basic Plan and the Promotion Strategy for Prioritized Areas, the declaration by heads of states at the Heiligendamm Summit last year focused strongly on action against climate change. Technologies that yield practical keys to controlling climate change must be widely adopted. For this purpose, more activities are needed in research and technological innovation and implementation of strategic plans to tackle climate change. The Fourth Assessment Report of IPCC (ref. Content section, Paragraph 2 above), the awarding of the Nobel Peace Prize, and the discussions held at the 13th Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change served as propellants to making climate action a prominent agenda for the world.

4. Position of this research project among research promotion policies in relevant research fields, differences in content and political effectiveness from other related projects

Ongoing discussions in the international arena within organizations such as the IPCC point out the importance of mitigation in the face of exacerbating global warming. R&D of technologies for tackling global warming is being undertaken under the auspices of relevant ministries and agencies.

The Japanese Ministry of the Environment and the Ministry of Economy, Trade and Industry are undertaking R&D principally of technologies that would deliver results in a short range of time, with commercialization/product manufacture possible within the first commitment period of the Kyoto Protocol (2008-2012).The basic R&D being undertaken by the New Energy and Industrial Technology Development Organization (NEDO) is private-sector based and is aimed at creating new industries and strengthening industrial competitiveness.

To achieve the outcome of reducing global greenhouse gas emissions to half the current level by 2050, Japan, as a developed nation, has to reduce emissions by a greater proportion than less developed nations, that of around 80%. Consequently, ideas are needed that would outperform anything that is envisaged by existing climate action technologies and whatever extensions they may lead to. To generate such ideas, the Ministry of Education, Culture, Science, Sports and Technology must promote R&D that is the convergence of innovative basic research knowledge and technology belonging to academia and beyond.

The Ministry of Education, Culture, Science, Sports and Technology has published a document called "Plans to promote Research and Development on Global Environmental Science and Technology" (S&T and Academic Council, Research Planning and Evaluation Sub-committee, July 2006). In this document, measures that bring about mitigation are suggested as future research themes in the climate change sector. However, activities on mitigation measures are insufficient compared to activities in progress on the observation, prediction, and evaluation in climate change research. The Strategic Sector Projects here in question play an important role in deploying the findings of basic research through innovation to achieve climate change mitigation, keeping the aim of near-future application in mind while upholding a longer-term vision.

Research themes include energy technology that makes effective use of natural sources of energy such as photovoltaic cells, ocean energy, and bio-energy. Although these are regarded as highly promising in reducing CO_2 emission, they need to match up competitively with existing power sources such as thermal and nuclear power generation in costs of generation and in costs as electricity, while they also need to achieve higher power generation efficiency. Regarding carbon fixing and utilization technology, which will also lead to CO_2 reduction, issues remain such as those of energy consumption and cost in the separation and recovery processes and assessment of the environmental impacts of the storage process. In this regard, there are many more bridges to cross before the realization of these technologies. Thus, expectation is great for findings of basic research that can be put to work on achieving breakthroughs in each field.

Projects of this Strategic Sector will promote basic research into totally new concepts and technologies that will solve problems that hinder the control and reduction of the emission of CO_2, which is the primary cause of global warming. They will promote technological innovation that would make CO_2 emission control and reduction technologies part of everyday life in ten or twenty years' time.

5. Achievements and goals expected; and reasons, urgency, and need for priority from specialists and industries over other strategic priorities in science and technology

The Heiligendamm Summit highlighted climate change action as a major agenda. The 2007 Nobel Peace Prize was co-awarded to IPCC for its warning activities on climate change. In the G8 Summit to be held in July this year in Toyako in Hokkaido, Japan, environmental issues and climate change are major topics for discussion. Japan purports to exercise its leadership as a nation that stakes its future on the environment

This Strategic Sector aims to develop revolutionary technology that would bring innovation to current industrial structures and energy infrastructure by using totally new approaches so as to create new technologies and breakthroughs. The final goal is to possess leading-edge technology fitting for an environment-oriented nation, Japan.

6. Scientific justification for the research and development goals

In both qualitative and quantitative terms, Japan excels in standards of research, technological development, and industrial technology for controlling global warming. Nevertheless, as diversity is desirable for technologies that curb global warming, it is important for technologies based on new concepts that break old molds to be pursued as well as for existing technologies to continue to be advanced and improved.

The photovoltaic cell, which converts sunlight into electricity, is promising as an energy source that can be used almost anywhere on earth even on a small scale despite some limitations such as daylight hours. The form in which photovoltaic cells are to be used is either in large-scale power generation installations or multi-installation on-site power generation systems. However, there are a number of issues to be resolved before this becomes a practical proposition, for example, power storage technologies, and transmission technologies, optimization of storage/transmission systems, and creation of materials that would dramatically improve component performance. Future progress in these areas is eagerly awaited.

One environmentally low-impact power generation system using sunlight is hydrogen energy production. This technology is only at the verification stage of its theoretical principles. To achieve commercialization and to create a hydrogen-powered society, work is needed on basic research on photocatalysts and new materials to improve energy exchange efficiency, on R&D of hydrolysis in combination with solar cells, and on hydrogen storage, transport, and safety measures.

The ocean holds vast amounts of energy in various forms. Japan is a country surrounded by the sea, and as such effective utilization of ocean energy to replace fossil fuels is potentially an extremely effective technological route for the future. At present, research is underway on wave power, tidal stream power, ocean thermal energy conversion, and other uses of marine energy, but these are yet to have reached the commercialization stage. Further promotion of R&D is necessary so as to achieve breakthroughs in the future.

Biomass energy derived from biological resources are promising as alternative sources of energy to coal and petroleum. Currently, Europe and America are taking the lead in producing bioethanol and biodiesel from food-based biomass. New problems have arisen as a consequence - skyrocketing of cereal prices and deforestation due to the expansion of crop-growing farmland. One means of solving these problems is a switch to the use of non-food based resources. To realize the use of non-food based biomass as resource, R&D promotion is needed in technologies for turning cellulose and lignin into biomass such as: highly active new enzymes, breeding, cultivation technology, gene modification technology, harvesting , transport, and pre-processing methods.

Technological development has begun on extracting energy from aquatic (micro)organisms. This is a new area of R&D with high biomass yield that uses "water" resources. Research areas include: increase in cell multiplication capacity through improved photosynthetic capability and increase in production capacity of fuel-yielding materials, bacteria that produce hydrogen gas, and energy capture through fermentation and gasification carried out by algae and plankton. Currently, scientific knowledge is being gathered in these areas and promotion of further R&D is needed to determine commercialization potential as innovative technologies for the future.

The separation and recovery of CO_2 involve chemical absorption, physical absorption, or membrane separation methods. In Japan, a demonstration plant using chemical absorption has been created, which is witness to the country's high technological standard in the world. More research in pursuit of low-cost low-energy endeavours is desired. Hopes for future research achievements are in the creation of efficient separation and recovery technology using separation membranes such as polymer and ceramic membranes.

The geological storage of CO_2 is already in its demonstration stage as regards technological development. As for ocean sinks for CO_2, the impact on the marine environment is not fully understood, so this area of research is still in an infant stage. In Japan, because of its distinctive geological character, the selection of appropriate sites is difficult. This means that environmentally friendly ocean sink technology is very much a future agenda. What is needed perhaps is the exploration of how to arrive at isolation technology that works in conjunction with fields of materials technology.

Besides work in these areas, basic research will be promoted into the effective utilization of CO_2, known as the chief culprit of global warming, in an effort to build a sustainable society that can overcome the problems of global warming.

7. Considerations in achieving the research and development goals

Technological development aimed at creating a low-carbon society ranges over extremely wide areas, from control and reduction of CO_2 emission to CO_2 fixing and effective utilization. The danger is that technological development may become sporadic. Effective and efficient development must be pursued, by projects focused on effective technologies with suitable targeting and clearly stipulating specific goals when calls for proposals are announced. For example, the real-life applications of the technologies should be mapped out and the actual degrees of CO_2 reduction envisaged by the introduction of the technologies should be stated.

Global warming is a problem that has to be tackled on a worldwide level. Thus, Japan must stay alert to new developments around the world and determine the course for R&D in an appropriate way in policy terms.

(Reference) Political goals to be achieved in this project

Japan was hit by the two oil crises in the 1970s, which impelled R&D into non-fossil fuel energy resources. Japan now has high standards of technology in new energy development and promotion of energy efficiency and renewable energy. All these hold promise in CO_2 emission reduction. CO_2 recovery and storage technology, which relates to the fixing and utilization of CO_2, is among the key mitigation technologies and is expected to be commercially available by 2030, according to the IPCC's Fourth Assessment Report.

Nevertheless, new energy and renewable energy technologies still require numerous leaps in technological innovation before commercialization is possible. The fixing and utilization of CO_2 likewise face many problems ahead of commercialization, such as the huge amount of energy and cost involved in CO_2 separation and recovery and the incompleteness of assessment of the impacts of stored and isolated CO_2 to the surrounding environment. These problems must be solved by sowing new technological seeds produced from new concepts.

This Strategic Sector aims to create the infrastructure for innovative technologies within the next decade or two, so that we may build an innovation-based society that can achieve the control and reduction of CO_2 emission. To this end it will promote basic research that uses new concepts to bring about technological innovation and basic research that leads to breakthroughs in existing technological development. Examples of research areas are: new-concept solar cell development using innovative thin-film solar cell, organic solar cell, and quantum dot as well as other energy production and storage technologies that aim to achieve fundamental performance improvement; new solvents or polymer membranes that can achieve low-cost, low-energy separation and recovery of CO_2; energy production technologies using ocean energy and bio-energy; and CO_2 utilization technologies.

Strategic Sector: "Development of medical technology using immunoregulation to overcome allergic and autoimmune diseases including pollinosis" (Set in FY2008)

1. Title

Development of medical technology using immunoregulation to overcome allergic and autoimmune diseases including pollinosis

2. Content

This strategic sector aims to develop innovative medical technologies addressing diseases such as allergic diseases (e.g., pollinosis, an increasing nationwide health issue in Japan) and autoimmune diseases (e.g., rheumatoid arthritis) that are caused by excessive immune responses. The key element of the technologies is to control immunoregulatory cells (regulatory T-cells, etc.), which have been found to have functions to stabilize overall balance of the immune response. The technologies will form a scientific basis for prevention, diagnosis, and treatment of many intractable diseases (e.g., graft rejection associated with organ transplantation) as well as the diseases mentioned above. They can also contribute to reducing the national cost of medical care.

3. Policy position

This strategic sector corresponds to "Research for understanding higher-level control mechanisms, including,the immune system in living organisms" listed as a research and development theme within "Science and technology for reconstruction of complex systems of life" under "Strategic Prioritized Science and Technology." The research outcome will be used in "Translational research to clinical studies" to lead to another research and development theme under "Strategic Prioritized Science and Technology," called "Diagnostic methods and drug discovery for immune and allergic diseases."

4. Position of this research project among research promotion policies in relevant research fields, differences in content and political effectiveness from other related projects

Relevant measures include "Promotion of general research on immune and allergy" (RIKEN) and "Research on prevention and treatment of immune and allergic diseases" (Ministry of Health, Labor and Welfare). RIKEN conducts research on the elucidation of intracellular mechanisms and cellular response processes involved in the immune system and on the identification of the causes of diseases attributable to disturbances in the immune system. On the other hand, this strategic sector aims to develop medical technologies that control immunoregulatory cells from an integrated approach, focusing on regulation of overall immune response. Researchers in close association with clinical practitioners are currently working on the development of such medical technologies in universities around the country. To increase research efficiency, a research and development system that collaborate with not only RIKEN but also existing research institutions in universities such as affiliate hospitals will be developed in this strategic sector, with the aim of effective translational research.

In addition, effective immunotherapies are expected to be established by combining the achievements of this sector with various existing therapeutic methods associated with the immune system. Goals of this strategic sector and those of previous immunology researches by institutions including RIKEN are considered complementary.

The Ministry of Health, Labor and Welfare conducts researches that contribute to prevention, diagnosis, treatment, and other control measures of immune and allergic diseases mainly from a clinical standpoint, which differs from the research stage of this strategic sector.

5. Achievements and goals expected; and reasons, urgency, and need for priority from specialists and industries over other strategic priorities in science and technology

Allergic diseases, including pollinosis and autoimmune diseases, and many intractable diseases significantly lower the quality of life (QOL) and cause discomfort in many Japanese people. However, aggesive treatment tend to be avoided because the conditions are nonlethal and because of the availability of non-radical palliative therapies. If this strategic sector can establish medical technologies that appropriately control the immune response, innovative treatment and preventive methods (e.g., vaccine against pollinosis) can be established.

1) Pollinosis affects at least 17 million (16%) Japanese (Nasal Allergy Medical Care Guideline, 2005) and the number of patients tends to increase annually. Allergic diseases, including food allergy and pollinosis, affect one third of Japanese (The Epidemiological Survey on Allergic Disease, 1992-1994). Allergic diseases affect people from infancy to adulthood. Although not life-threatening, a great burden in daily life exists because patients must avoid allergenic substances (e.g., selection of special school lunches for children with food allergy). Development of effective treatment is desired because few effective treatment methods are available.
2) About 5% of Japanese are affected by chronic autoimmune diseases (e.g., rheumatoid arthritis due to disruption of patients' own tissues by autoreactive lymphocyte, multiple sclerosis, autoimmune gastritis, and type I diabetes). Only palliative treatments that include immunosuppressive drugs are available, and these present problems of side effects including increased susceptibility to infection as well as heavy public financial burden due to the high drug cost.
3) Clinical studies of next-generation immunoregulatory therapies in which immunoregulatory cells suppress graft rejection associated with organ transplantation are about to be started in Germany and the U.S.A. In Japan, the importance of immunoregulatory cell function has been shown in the area of a liver transplantation from a living donor. The development of innovative medical technologies utilizing immune regulation is about to be realized in other fields.

Important diseases that need to be overcome in the 21st century, such as allergy and rheumatism, are targets of the "Strategic Priority for Science and Technology." Traditionally, research and development of prevention and treatment methods based primarily on the causes of those diseases have been promoted. In contrast, this strategic sector aims to develop technologies that utilize patients' own immunoregulatory function. The establishment of both of these technologies plays a complementary role; therefore, this strategic sector has high urgency and high social need.

6. Scientific justification for the research and development goals

As for immunoregulatory cells, it was shown in March 2007 that Foxp3, a protein specifically expressed in regulatory T-cells (an immunoregulatory cell type) suppresses T-cell function by directly binding to the transcription factors necessary for the function of T-cells (Nature, 2007). This result opened a path for the development of drugs that appropriately control the regulatory T-cell function by not only regulation at cell-level but also at molecular-level (inhibition or enhancement). This work was conducted by Japanese researchers.

As for applications to medical care, it was reported in the U.S.A. that tumor regression was frequently observed in patients after clonal repopulation with antitumor lymphocytes.

In Japan, the efficacy and safety of an immunotherapy utilizing regulatory T-cell function were confirmed in large animals last year. This immunotherapy successfully induced immune tolerance status in which the immune response to transplanted organs was specifically regulated and no rejection was observed without immunosuppressive drugs.

In general, immunology, including the research on immunoregulatory cells, is based on a clear and concrete theory and competitive research funds can effectively promote research in this field. For example, excellent research results, including the achievement mentioned above, were obtained through Grants-in-Aid for Scientific Research on Priority Areas, "The maintenance and disturbance of immune system homeostasis (2001-2005, Area representative, Shimon Sakaguchi, a Professor at Kyoto University)" and JST "Translational Research for Intractable Immune Disorders and Infectious Diseases (2001-2008, Research supervisor, Prof Tadamitsu Kishimoto, a Professor at Osaka University)" (completed or nearly completed). Special Coordination Funds for Promoting Science and Technology, "Molecular mechanisms of construction and action of the immune system and development of control technology for the mechanisms (2000-2005, Representative, Prof Kiyoshi Takatsu, a Professor at The Institute of Medical Science, The University of Tokyo)" nurtured young researchers. In view of these research outcomes, an environment that leads to new innovations from Japan, "Evolution of immune control therapy" is considered to have already been created.

As mentioned above, a lot of research results have been obtained on the elucidation of intracellular mechanisms and cellular response processes involved in the immune system and the elucidation of the causes of diseases attributable to a disturbance in the immune system. On the other hand, fewer researches have been conducted on the development of medical technologies aiming at clinical applications of new research findings. Therefore, it is necessary to intensively promote the translational reseaches in the future, in order to benefit the public.

7. Considerations in achieving the research and development goals

To achieve the goals of this strategic sector, universities should play a major role. In order to connect the results to innovation, it is important to communicate closely with researchers conducting other relevant researches in institutions such as RIKEN, as well as clinical research institutions. When good results are obtained, it is also important to rapidly move the project to the next phase (clinical research and research for business development) even during the research period of this project. In particular, it is expected that this strategic sector will extend far beyond basic research, because researchers in close association with clinical practitioners who are engaged in actual medical care will participate in this sector.

In addition, when excellent achievements are found, it will be necessary to establish the communication loop between the developmental and the basic research.

(Reference) Political goals to be achieved in this project

Examples of the basic technologies leading to the goals are given bellow. Their aims are to establish methods that appropriately control, from inside or outside the body, the amount and activity of immunoregulatory cells to enhance or suppress the immune response and to develop treatment methods for allergic diseases (e.g., pollinosis) and autoimmune diseases (e.g., rheumatism).

1) Development of drugs aiming to increase or decrease the amount of immunoregulatory cells and enhance or reduce their suppressive action
2) Development of treatment methods that utilize immunoregulatory cells, with a focus on immune response active tissues, such as mucous membranes
3) Development of pioneering new vaccines based on co-regulation of natural and acquired immunity

Strategic Sector: "Creation of innovative fundamental technologies for utilizing information related to action and judgment in the brain" (Set in FY2008)

1. Title

Creation of innovative fundamental technologies for utilizing information related to action and judgment in the brain

2. Content

Brain-Machine Interfaces (BMI) decode information in the brain when bodily movement or judgment is made, and enable mental control of external devices to aid in physical functions. Research in BMI contributes to creation of innovations for recovering or supplementing physical functions limited by disability, etc.

Accordingly, this strategic sector aims at creation of unconventional, innovative fundamental technologies necessary for development of BMI: e.g., a technology for retrieving information from brain activities and decoding brain information, a device control technology for controlling external devices based on the obtained information in the brain, a technology for feeding external information back to the brain, and other technologies.

3. Policy position

This strategic sector is closely related to "Science and technology for reconstruction of complex systems of life" and "Research for bridging to clinical research and practice" in life sciences and "World-leading core robot technology useful for daily life at home and outdoors" in information and communication in the Phase 3 Basic Program for Science and Technology.

From the aspects of basic research into the fundamental principles of brain activity, as well as development of key technologies based on its expansion and understanding, this strategic sector is directly involved in development of human healthcare technologies (Research for bridging to clinical research and practice) through integrated comprehension of complex and higher brain functions (Science and technology for reconstruction of complex systems of life) and development of neuroprosthetic limbs. Moreover, this strategic sector is important for development of control technologies incorporated with human judgment (World-leading core robot technology useful for daily life at home and outdoors) and is closely related to such strategic prioritized science and technology.

"Innovation 25," a guideline for long-term strategy, and reports such as "New frontier for health" also advocate that technologies similar to those included in this strategic sector should be developed for supplementing or expanding lost physical functions.

4. Position of this research project among research promotion policies in relevant research fields, differences in content and political effectiveness from other related projects

There are two brain science-related projects: the FY 2007 Strategic Sector, "Creation of innovations toward the development of diagnosis and treatment of psychiatric and neurological disorders based on elucidation of complex and higher brain functions," and a new project for 2008, "Strategic promotion program for brain science research."

The FY 2007 Strategic Sector, "Creation of innovations toward the development of diagnosis and treatment of psychiatric and neurological disorders based on elucidation of complex and higher brain functions," promotes research contributing to development of prevention, diagnosis, and treatment of psychiatric and neurological disorders. Therefore, the FY 2007 strategic sector differs from this strategic sector, which will promote research in innovative basic technologies contributing to external device control etc. utilizing information for bodily movement and judgment in the brain.

The new project for 2008, "Strategic promotion program for brain science research," aims to ensure that the research results obtained so far will be integrated into our healthcare, welfare, education, and industry to address needs of society. To strategically promote research and development, this new project will include organization of a research base (consisting of a core institution and participating institutions) by publicly inviting universities, independent administrative institutions, private enterprises, and others that have made excellent achievements or have capacity to support other institutions in applied technologies for decoding information in the brain and connecting devices, computational neuroscience, and the field of "learning from the brain" involved in development of the brain information system. Therefore, the new project for 2008 also differs from this strategic sector, which aims at creation of unconventional, innovative basic technologies.

For implementation of research in this strategic sector, a promotion system will be constructed while clarifying roles shared by other research projects based on the above-described views, taking into account the results of the meeting of the Brain Science Committee, Council for Science and Technology.

5. Achievements and goals expected; and reasons, urgency, and need for priority from specialists and

industries over other strategic priorities in science and technology

Technologies for controlling an external device utilizing biosignals obtained from the human body such as, for example, a biometric authentication technology for identifying individuals and a robot suit based on myoelectric signals, are achieving social recognition. Under such circumstances, BMI for decoding information in the brain and controlling external devices etc. has been rapidly developed, mainly in the U.S. in recent years.

With advancement of aging in our society, BMI as a technology for aiding or recovering decreased physical functions is a challenge that Japan should address as a priority, and a research area in which Japan can lead the world by taking advantage of our strengths in computation theory and robotics.

With innovative basic technologies created through research and development in this strategic sector, high-performance devices that move as desired on mental command, such as prosthetic limbs, will be developed. For example, such devices will enable patients with spinal cord injury to walk or recover from one-sided paralysis due to cerebral stroke etc. by neurorehabilitation. Thus, it is thought that these technologies will aid patients to overcome physical disabilities caused by diseases etc. from which they cannot recover with currently available technologies. At present, the number of patients with spinal cord injury alone as research subjects is about 100,000 in Japan, and there are about 5000 new patients with spinal cord injury each year (data from "Japan Spinal Cord Foundation").

The technologies for supplementing/enhancing physical functions also relate to technologies for supplementing physical functions that have naturally degraded with aging, and contribute to alleviation of the heavy social burden of nursing care. Furthermore, these technologies are expected as measures for not only aiding movement of limbs, but also for supporting clear conversation or realizing communication by patients with general paralysis.

6. Scientific justification for the research and development goals

Technologies for retrieving signals from brain activities have been developed. As a noninvasive information-retrieving technology, significant progress is seen in development in combination with near-infrared measurement technology in addition to electroencephalographic measurement.

As a means of decoding necessary information from obtained signals, a technology of decoding signals from functional MRI using Bayes estimation is being realized. It is expected that such estimation methods can be applied to other measurable signals from the brain.

As a means of controlling external devices based on obtained information in the brain, development of a technology for controlling robots that carry out hand movement or walking for patients, in particular, would appear to contribute to achievement of the aim of this strategic sector. It is also expected that results of basic research regarding kinesiology and functional electric stimulation will be utilized.

As a means of feeding external information back to the brain, development of a technology for measuring plastic change in the brain is in progress, and basic findings are being accumulated. Research on technologies for measuring sensory information (the senses of hearing, sight, touch etc.) with high sensitivity and processing as usable information is also being promoted.

If this strategic sector induces research and development that elicit pioneering ideas, it is expected that not mere improvement of existing technologies but development of original technologies will be promoted. A great number of researchers are involved in each area of basic research in Japan, and it is anticipated that these researchers will submit many proposals for innovative research and development based on their unconventional ideas.

7. Considerations in achieving the research and development goals

To achieve the goals of this strategic sector, cooperation among researchers in many fields such as clinical medicine, basic medicine, biology, engineering, and information science is essential, and multidisciplinary coordination is crucial. In promotion of research, harmony with social implications will be needed, including consideration of ethical aspects. Further, to efficiently operate this strategic sector, overall management of the research needs to be done in coordination with the "Strategic promotion program for brain science research."

(Reference) Political goals to be achieved in this project

This strategic sector covers technologies for creating innovations for recovering or supplementing human physical functions limited by disability etc. These technologies include a technology for retrieving information from brain activities and decoding brain information, a technology for controlling external devices based on obtained information in the brain, a technology for feeding external information back to the brain, and so forth. The research and development goal of this strategic sector during the research period is creation of innovative fundamental technologies for realizing the above-mentioned technologies that will be required for practical use of BMI.

Strategic Sector: "Creation of fundamental technology for the generation and utilization of "knowledge" from diverse and large-scale information." (Set in FY2008)

1. Title

Creation of fundamental technology for the generation and utilization of "knowledge" from diverse and large-scale information

2. Content

Advances in infrastructure such as sensing technology and the Internet have facilitated access to vast amounts of information. The acquisition and accumulation of such large volumes of information are not only ongoing in the cyber world of the Internet but also in ordinary aspects of life. The discovery and obtaining of information useful to areas including academic learning, health care, finance, disaster prevention, and the service sector are becoming increasingly important agendas for us all.

The Japanese Government's long-term strategy initiative, "Innovation 25," predicts "an explosive advance in knowledge-based society/network society and globalization." Expedited and pertinent acquisition of useful information will lead to the strengthening of international competitiveness for Japan in each and every sector.

The Strategic Sector described here aims to establish an infrastructure for intelligent information that would advance and streamline different sectors including academic, health care, finance, disaster prevention, and service sectors, in accordance with their diverse needs. The project sets out to create the basic technology required in generating and utilizing "knowledge" from diverse and large-scale information clusters that have been generated and accumulated in different sectors. "Knowledge" as referred to here denotes useful information needed for the purposes of human activities in society. This knowledge is created by such means as information processing technology using computers.

In order to generate and utilize knowledge that meets the diverse needs of society, we need information technology that can flexibly process diverse and large-scale information according to the differing purposes at hand. Such technology cannot simply be derived from improvement in the processing capacity of computers; it can only be arrived at by creating new technologies that can accommodate the distinctive needs and nature of individuals and organizations that require and use knowledge.

Thus, in order that innovation may be generated in a continuous stream, this Strategic Sector sets out to create fundamental technology for the generation and utilization of knowledge from diverse and large-scale information. More specifically, this signifies that research and development will be conducted into technologies that generate knowledge through analysis of diverse and large-scale information that have been organized and structured. The R&D will be designed to attain resolution of real-life issues confronting applied areas by harnessing information science, statistical and mathematical sciences, and cultural and social sciences. The result will be implementation of research and development of information processing technology for the generation of knowledge, alongside the development of technology that enables the utilization of this knowledge in various areas of application. This will make possible the discovery of new knowledge that will bring resolution of issues and greater competitiveness in sectors including the academic, health care, finance, disaster prevention, and service sectors.

3. Policy position

① The Third Science and Technology Basic Plan: Promotion Strategies for Individual Sectors – Important Research Themes: 5. Human Interface & Content, Issue 5 – Mass Accumulation of Information and Its Use

② Strategic Prioritized Science and Technology: Content Creation and Information Utilization Technology for the Sharing of Emotion with the World

③ Long-term Strategy Initiative, Innovation 25: Chapter 5. Policy Road Map for Becoming an Innovation-based Country, 2) Improving and strengthening investment in next-generation technology

4. Position of this research project among research promotion policies in relevant research fields, differences in content and political effectiveness from other related projects

In July 2006, the Japanese Ministry of Education, Culture, Sports, Science and Technology prepared a document entitled "Promotion Policy for Research and Development Relating to Information Science and Technology" in response to the Third Science and Technology Basic Plan: Promotion Strategies for Individual Sectors. Of relevance to the Strategic Sector discussed here are: "the development of advanced computer science and technology required in realizing database super computing," "technology that organizes semi-structured and continuous multimedia content and accumulates and manages as an advanced function database," and "utilization technology for putting to use the generated content to research and education."

Basic research that relates to this area is the "Research on New IT Infrastructure Technology in Preparation for the Information Explosion." This was a specified-domain research project with research funding from the Ministry of Education, Culture, Sports, Science and Technology. The research studied individual component technologies in information science, such as information search and natural language processing. It differs from the research to be conducted under this Strategic Sector, in which the research aims to create new technology by integrating academic fields such as information science, statistical and mathematical sciences, and cultural and social sciences.

Moreover, in "The Development of Basic Software for e-Society," research is underway into "platform-building technology for Internet knowledge convergence," which is to develop technology for the automatic gathering and search of the latest information from among the vast amounts of information available on the world-wide web, and also into "advanced storage technology and web analysis technology," which are to develop means of analyzing individual web information over time. These are ongoing R&D projects on basic technology dealing with Internet information, which are due to be completed in Fiscal Year 2007.

In addition, a Ministry of Economy, Trade and Industry technology development project is underway for the search and analysis of large volumes of information, called the "Great Information Navigation Project." This project involves R&D into technology to assist the private sector in utilizing various types of information relating to customer needs and service quality and demonstrating new model services.

There is a clear difference in the specific content of the R&D to be undertaken by this Strategic Sector and R&D already being undertaken by existing R&D projects.

5. Achievements and goals expected; and reasons, urgency, and need for priority from specialists and industries over other strategic priorities in science and technology

(1)Need

Recent years have witnessed the generation and accumulation of diverse and large-scale information. Such information is a resource that can be the mainspring of new economic and social values that meet the diverse needs of society. It is Japan's national policy to become the world's foremost nation in the area of IT. Technologies that would enable the country to utilize information resources are extremely important. Meanwhile, data mining, web searching, and other information technologies that are currently in use in generating knowledge have limitations regarding the attributes of the information that can be handled (e.g. text, image, sound) and the volume of information. Therefore, when handling data of a size or diversity (attributes) that go beyond a certain level, differences in data format lead to difficulty in computation or to difficulty in processing due to the massive amount of computational time necessitated by the exponential amounts of computation involved. The problem should not be dealt with by improving the capacity of computers alone; new information technology (systematic provision of theory and methodology) is required. If new information technology can be used for the benefit of knowledge generation to harness the large amount of information resources that are not being used at present because of their diversity and complexity, the knowledge we can thereby acquire would be much richer.

In many sectors, simulation using supercomputers is now being established as an important method alongside theory and experimentation. In a successful combination, the utilization of real world and cyber world information and the predictive powers available through simulation can form the basis of an unprecedented ultra-high precision, wide-reaching prediction technology that can bring on innovation that impacts a wide range of sectors and is "made in Japan." The building of such a basic infrastructure technology cannot be easily accomplished by merely improving the processing capacity of computers and advancing the capacity of information technology. An efficient way forward is to conduct R&D with awareness of the needs and special attributes of individuals and organizations that need and use knowledge. Knowledge gathered from case studies of several real-life problems should be collected and used in establishing a universally applicable theory. Projects such as those involving the creation of basic technology do not lend themselves easily to implementation by the private sector. Here, it is important that the Government takes the lead.

(2)Urgency

In Europe and America, projects of this kind are already underway. If large-scale information is left unattended, without recourse to its utilization technology, Japan might well lose international competitiveness in all sectors.

The following is a list of the relevant key projects now in progress in the USA and in Europe:

In the USA, highlighted in the National Coordination Office for Networking and Information Technology Research and Development (NITRD)'s FY 2008 budget request is the Cyber-enabled Discovery and Innovation (CDI) project. This is a research program relating to "Computational Thinking" conducted by the NSF. It plans to promote research into technology that extracts

knowledge from heterogeneous data, understanding of complex systems that comprise interacting elements, and building of virtual environments. Proposals for projects are already being invited.
In Europe, under the Framework Programme *1) of the European Commission, the Advancing Clinico-Genomic Trials on Cancer (ACGT) have been implemented as a five-year plan starting in 2006. This plan aims to achieve speedy diagnosis of cancer and its effective treatment by combined use of clinical information daily generated in medical care practice and genome information generated in the research lab. It is developing and providing data processing methods, analytical tools, and various metadata sets.

*1) A five-year program that supports joint research by researchers of member nations. Its aim is to promote research activities that strengthen the scientific and technological foundations of industry, improve international competitiveness, and support EU policies.

(3)Achievements and Goals Expected

This Strategic Sector will provide new basic technology for the generation and utilization of knowledge in applied areas including drug development, risk management, weather forecasting, the service sector, and robot control. The following achievements are envisaged:

① In drug development, discovery of the molecular structure of the functional components of organic compounds; prediction of diagnosis and optimal treatment methods surmised from millions of patient records; establishment of treatments of intractable diseases by studying the processes in which genes within cells are involved; prevention of drug-induced damage by speedy identification of side effects of pharmaceuticals.

② High-precision prediction of breakdown and malfunction of important infrastructure such as the power supply system; proposal of an efficient guideline for productivity improvement in factories.

③ Accuracy improvement in local weather forecasts through sensing data and simulation; accuracy improvement of prediction of earthquakes and tornados.

④ Establishment of technology applicable to the production floor by systematizing into knowledge the experience, intuition, and instinct of skilled workers.

Sectors that had been treated separately in terms of research such as information science, statistical and mathematical sciences, and cultural and social sciences will be merged to form a new technology sector and research community. This should lead to continuous fostering and development of human resources useful in streamlining various services handling real-life data.

6. Scientific justification for the research and development goals

The following is a list of R&D projects currently in progress and topics that are likely to see future development:

- Ultra-high speed algorithms that would enable the processing of large-scale and diverse data within a pragmatic time limits
- Prediction technology combining web information, sensor information, and large-scale simulation
- Correlation analysis technology and modelling technology used in statistical and mathematical sciences
- Basic technology in information analysis by means of structural and time series analysis of information
- Technology for the acquisition, sharing, and integration of information useful to people and organizations in effectively creating a problem-solving scenario
- Technology for extracting knowledge from multiple resources (sensor information, statistical data, web information, simulation, information accumulated within an organization, etc.)
- Technology that can collectively manage and handle data in differing formats such as text, image, and sound data

7. Considerations in achieving the research and development goals

The execution framework of research should be such that multiple case studies would be accumulated in the process of addressing real-life problems in applied areas; in so doing, universal methodologies would be sought while encouraging increased liaison among different R&D sectors.
Attention should be given to creating an environment in which human resources useful in streamlining various services handling real-life data would be fostered and developed, in the context of sectors that had been treated separately in terms of research, such as by merging information science, statistical and mathematical sciences, and cultural and social sciences to form a new technology sector and a new research community.

(Reference) Political goals to be achieved in this project

In this research project, in the course of conducting R&D into technology for knowledge extraction through the analysis of organized and structured diverse and large-scale information, the aim is not merely the advancement of constituent technology; it aspires to create technology that leads to knowledge extraction that would contribute to the resolution of real-life problems in applied areas. Specifically, this means the conducting of research related to real problems that occur in society. The research in universal methodologies based on these problems will be undertaken by combining knowledge from information science, statistical and mathematical sciences, and cultural and social sciences.

Listed below are examples of technologies that may be subjects of this R&D project:

(a) Correlation analysis technology and modelling technology used in statistical and mathematical sciences, etc.
(b) Infrastructure technology for information analysis by means of structural and time series analysis of information
(c) Prediction technology combining web information, sensor information, large-scale simulation, etc.
(d) Technology for the acquisition, sharing, and integration of information useful to people and organizations in effectively creating a problem-solving scenario
(e) Technology for extracting knowledge from multiple resources (sensor information, statistical data, web information, simulation, information accumulated within an organization, etc.)
(f) Technology that can collectively manage and handle data in differing formats such as text, image, and sound data

Strategic Sector: "Creation of innovations toward the development of diagnosis and treatment of psychiatric and neurological disorders based on elucidation of complex and higher brain functions" (Set in FY2007)

1. Title

Creation of innovations toward the development of diagnosis and treatment of psychiatric and neurological disorders based on elucidation of complex and higher brain functions

2. Relationship with the relevant strategic priority for science and technology

This Strategic Sector is relevant to "Science and technology for reconstruction of complex systems of life" in the Strategic Prioritized Science and Technology in the field of life sciences in the 3rd Science and Technology Basic Plan. It is described in promotion strategies that "the major trend in life science researches is going toward the integrated researches of more complex and higher functions, such as cellular, brain and immune systems" and "researches for understanding the higher level control mechanism in the brain or immune systems" is listed as a concrete example of the R&D.

It is also relevant to "translational researches to clinical studies", another pillar of the Strategic Prioritized Science and Technology. The achievements of this strategic goal occupy a fundamental place in the promotion of prevention and treatment of psychiatric and neurological disorders and researches for preventing deterioration of quality of life (QOL) due to sensory and locomotor disorders as well as in the response to children's mental problems, such as developmental disorder, social withdrawal in adolescence, sudden aggressiveness and antisocial behaviors.

3. Reasons, urgency, and needs from specialists and the industries for the priority over other strategic priorities for science and technology, etc

The search for genes related to psychiatric and neurological disorders is rapidly progressing worldwide utilizing the results of human genome analysis. However, only disease-related gene information cannot produce new social or economic values, and in order to create socioeconomic values such as prevention, diagnosis and treatment of psychiatric and neurological disorders, it is essential to verify techniques, seed compounds, etc. utilizing models, to establish development concepts and to secure the intellectual properties. In the research field of brain science, such R&D projects as to connect the knowledge on genes related to disease obtained from basic researches to medical care have seldom been carried out in Japan so far. Meanwhile, R&D to utilize the basic knowledge on brain science for innovations is also becoming active in the U.S. and Europe, leading to intense international competition. Dementia and mood disorders are main mental diseases among elderly people, and the disability-adjusted life year (DALY) is ranked fourth among all diseases, and is presumed to be ranked second (15%) in 2020. It is important for Japan, which is about to become an aging society without parallel in the world, to address this research project intensively as a Strategic Sector before the rest of the world.

4. Image of innovative achievements expected to be achieved under this goal (expected innovative outcome with specific examples), background, and social and economical imperatives.

In Japan, the number of people who are treated for mental disorders, such as schizophrenia and mood disorders, exceeds 2,000,000, and the death toll from suicides a year is more than 30,000. Furthermore, with the rapidly advancing aging society, how to cope with neurological disorders including Alzheimer's disease has become an important issue, but there is no radical treatment for many neurological disorders, which are considered as intractable diseases. The economic burden involved in medical costs and nursing care for these psychiatric and neurological disorders and the economic loss from decrease in workforce, social-infrastructure improvements, etc. are extremely great, and the achievements leading to the development of their prevention and treatment can be a great step toward a change in the future vision of Japan which is going into a super-aging society with fewer children.

Meanwhile, problems of bullying, truancy, suicide, high school dropouts due to maladjustment to school life, NEETs and job-hopping part-timers as well as antisocial behaviors including serious juvenile delinquencies are becoming big social problems in recent years. The elucidation of emotion and sociality of children which are considered to be behind bullying in classrooms, drive impulse, etc. is recognized as an important issue to be addressed promptly in Japan now. From the elucidation of higher brain functions such as cognition and emotion, the achievements leading to innovations that would give an impact on economic society, including industry and education, such as the development of systems that support optimal human involvement, lack of attention, fatigue, etc. in advanced and complicated operation processes from outside, the development of devices with human interface, the development of devices that prevent deterioration of QOL due to sensory or locomotor disorders, and the development and marketing of products for consumers who seek for a life filled with spiritual richness, as well as the innovations leading to the development of education curriculum and support method for children with developmental disorder, can be expected.

5. Research and development goal to be achieved during this strategic project (creation of knowledge as the source of innovation, technology seeds, technology concepts to be demonstrated etc.)

In basic researches on psychiatric and neurological disorders and cognition/emotion, the analysis cases have rapidly increased reflecting the results of recent genome decoding as seen in the generation of a series of genetically-modified animal models, and resources are being accumulated both at home and abroad.

R&D carried out under this Strategic Sector aim at those lead to understanding of cognition/emotion and prevention, diagnosis and treatment of psychiatric and neurological disorders by searching for and identifying molecules and functional markers involved in higher brain functions.

Specifically, the followings can be listed as examples: To generate animal models in which changes in human brain functions are partially reproduced by giving them gene mutations/polymorphisms, environmental factors, etc. involved in psychiatric and neurological disorders or cognition/emotion and to verify molecular markers and functional markers which are difficult to be verified directly in humans; to develop biochemical assessment methods and noninvasive functional analysis methods of molecular neural mechanism involved in psychiatric and neurological disorders or cognition/emotion utilizing these models and keeping mathematical models and algorithms in mind; and to develop technology for diagnosing and assessing psychiatric and neurological disorders or cognition/emotion by confirming the markers found in humans with animal models.

6. Scientific justification for research and development goal to be achieved during this strategic project (progress status of related research, potential for development of this field in the future and prospect that many outstanding research plans are proposed)

Identification of gene mutations/polymorphisms involved in psychiatric and neurological disorders is rapidly progressing, starting with discovery of schizophrenia-related gene DISC1. In addition, interactions between serotonin transporter and nurturing environment and stress, or epigenetic mechanism by which nurturing creates stress vulnerability, are also being elucidated. Furthermore, with the progress of noninvasive measuring technology, etc., the knowledge on human brain function analysis has rapidly been accumulated.

It is highly possible that this field may make a great progress by directing the research results on generation of useful animal models by these basic and clinical life sciences researchers and on function analysis utilizing the models toward technological development leading to clinical studies.

Moreover, analyses of function of psychiatric and neurological disorder-related molecules and brain-imaging studies to assess brain functions are also progressing in Japan recently, and these remarkable various research results are being utilized.

7. Specific issues to be overcome in achieving this research and development goal, points to be cared , and any overlapping with existing policies, projects, etc.

In order to carry out purposeful R&D and to aim at creation of knowledge as the source of innovations under this Strategic Sector, the development of prevention, diagnosis and treatment of psychiatric and neurological disorders requires researches aiming at bridging studies, so that it may not be completed only in "the elucidation of the mechanism of the models themselves."

RIKEN Brain Science Institute is promoting comprehensive R&D on brain science in four areas of research: "Understanding the Brain," "Protecting the Brain," "Creating the Brain," and "Nurturing the Brain." Many researches carried out at present, however, are in the so-called bottom-up research areas in which researches are developed from biomolecules that individual researchers regard as important based on basic knowledge in nervous activity, developmental processes, etc., which is different from the so-called top-down research areas based on evidences with which the biological association was shown in human brain functions, which is the essential feature of this goal. In order to effectively promote such research areas with top-down characteristics, it is necessary to invite researchers with experience of the development of mouse model, etc. and with visions and ability to act in connecting the results to medical practice or industrial application from various universities and research institutes and to carry out R&D under definite policies and plans.
In addition, in promoting this goal, it is necessary to give consideration to ethical aspects in research promotion and on social impact, and it is desired to cooperate with activities on ethics at the Research Institute of Science and Technology for Society in JST.

Strategic Sector: "Development of fundamental technologies for the large-scale integrated-circuit system that can guarantee high reliability and high security" (Set in FY2007)

1. Title

Development of fundamental technologies for the large-scale integrated-circuit system that can guarantee high reliability and high security

2. Relationship with the relevant strategic priority for science and technology

Advanced miniaturization/low power technologies and design/manufacturing technologies for next-generation semiconductor that competes with the global competition

3. Reasons, urgency, and needs from specialists and the industries for the priority over other strategic priorities for science and technology, etc

1) Priority

Large-scale integrated-circuit system is today a fundamental building block for information communication, computer, automobile, medical instrument, and other systems, and has become a basis of the social life. Electronic products have currently so closely knit into our life so that we depend on them without being conscious of their presence. Such being the nature of invisible pervasiveness of electronics, however, a problem somewhere in a large-scale integrated-circuit system may cause a serious social damage once it happens whether by accident or by intention.
Ever since a transistor was invented, the development of integrated-circuit system has been aimed at miniaturization, large-scale integration, and higher functionality. However, with progress in miniaturization, problems never experienced before have been brought about. They include the increase in statistical variation of device characteristics, which is an intrinsic limitation of the semiconductor. The circuit operation error caused by cosmic rays is another example. Human errors in the integrated-circuit design, manufacturing and testing are the source of another family of problems. Human aggression can be a threat to the information security. Errors could be introduced when combining more than one chips that worked properly alone are connected each other into a system. Production problems can multiply by increased number of process steps. To conclude, our country's competitiveness in the international market of electronics equipment could be lost, and our social infrastructure itself could become vulnerable, unless reliability/security of very large scale integrated system is maintained, or rather, improved.

2) Urgency

In Europe, "SecureIST (Information Society Technology)" project is being promoted, especially on the research for pursuing the high reliability/high security in information and communication fields, in preparation for the "7th Framework Program for Research (FP7: 2007-2013)" established by the European Commission.
In addition, the first EU-US Summit Series: Workshop on System & Security was held November, 2006, in Dublin, jointly sponsored by NSF (National Science Foundation) and EU, and discussion on reliability and security of information system is proceeding at the initiative of Europe and the United States. Although Japan has taken a position as one of the most-advanced IT countries as national policy, Japan may be left behind if our country does not participate in this discussion aggressively.

3) Needs from specialists and industries

Recently, a guarantee for reliability/security has been regarded as more important than pursuing higher performance in developing information systems, and it is getting widely considered that a level of guarantee for reliability/security primarily decides the value of the information system. A lot of projects related to a guarantee reliability/security of information systems are adopted in Europe and the United States, and reliability/security draws more and more attention. However, physical errors are addressed mainly and human errors are only partially addressed in general because it is difficult to take an approach of coping with human errors and their interaction. In these circumstances, universities/research institutions in our country begin to recognize to the need to address human errors and their interactions. Then, it becomes possible to establish fundamental technology to guarantee reliability/security for large scale integrated system earlier than Europe and the United States by suggesting and taking the multidisciplinary approach in which researches of physical errors and those of human errors are organically combined.

Furthermore, as a result, innovations in large-scale integrated-circuit system will be produced under the initiatives by our country, and thereby, reinforcement of international competitiveness required by the semiconductor industry that is basis of all industries will be supported (*1). Additionally, it is expected that it prevents enormous economic losses from happening and brings an increase in added value practically.

4. Image of innovative achievements expected to be achieved under this goal (expected innovative outcome with specific examples), background, and social and economical imperatives.

1) An image of the innovative achievement that can be realized in the future.

By establishing fundamental technology to guarantee reliability/security of large integrated system, the problems such as physical errors and human errors will be overcome, and reliability/security of various systems will be enhanced. Thus, we can expect a spreading effect (innovation) to variety of industries and our life by realizing comfortable IT society with low cost in which lives of people get more convenient with highly digitized financial dealings or public services for example.

2) Social and economical imperatives

Although Japanese semiconductor industries maintain top-level technology in the world, they are not necessarily competitive enough in the global market. By developing a next-generation large-scale integrated-circuit system technology to guarantee higher reliability/security no later than in other countries and gaining extra values from it, we will be able to achieve enhanced global competitiveness required from the semiconductor industry as a result of that .

5. Research and development goal to be achieved during this strategic project

Although performance, packaging technology, and power-saving are required in developing large-scale integrated-circuit systems, we will introduce new concept "dependability (*2)" in this Strategic Sector, and take a multidisciplinary approach considering life cycle (planning, design, manufacturing, testing, distribution, operation, discard) of large scale integrated circuit. Specifically, we aim at overcoming obstacles for dependability brought by physical errors, human errors, human aggression and interaction between systems in large-scale integrated-circuit systems. For example, the targets of research are as follows:

- Elucidation of physical factors affecting dependability in ultimate miniaturization of a large-scale integrated-circuit system and clarifying possible solutions against them.
- Building and verifying design technology/packaging technology to prevent human errors, physical errors and their interaction brought by the larger-scale integration and the higher complexity of a large scale integrated circuit.
- Proposal of methodology to protect built-in information of a large-scale integrated-circuit system.
- Proposal of methodology for information system design to prevent degrading dependability by the mismatch among heterogeneous systems brought by widely spread networks and more open information systems, interactions between human and machine and so on.

6. Scientific justification for research and development goal to be achieved during this strategic project

1) Solution for physical errors

As micronization of a large-scale integrated-circuit system progresses, the characteristics of transistors and components get essentially more diverse due to extremely increased effects of process parameter change and fluctuations in the supply voltage, resulting in degraded reliability. Soft errors such as memory bit inversion and logic malfunction, which is caused by neutron rays generated by reaction of cosmic rays with the atmosphere, may occur frequently, resulting in reliability degradation of systems. Because it is difficult to overcome such circumstances only with conventional circuit design and process technology assuming those circuits and systems run without any those errors, novel transistor structure and architecture aimed at introducing self-recovery and self-adjusting functions are needed.

2) Solution for human errors

Increase in the scale of integration and complexity of system complicates circuit design. If we continue to use current design techniques, design processes will take longer time, result in more human errors, and more overlooked errors in test. Because such defective large-scale integrated circuits could cause serious systems problems, research efforts have to be made for a new design tool which is capable of detecting and correcting human errors.

3) Solution for human aggression

A threat to the dependability by intentional attack such as an extraction of confidential information and personal information that is incorporated into large-scale integrated-circuit system is increasing. In the future, the use of electronic money and electronic medical records are considered to increase, and information of bank account and privacy-related information that are stored in a large-scale integrated-circuit system without any prevention against attacks may leak out, resulting in serious social confusion. As countermeasures for these problems, researches such as building a defense system of information on a chip and erasing information automatically after pre-set amount of time are needed.

4) Solution for interactions

There are various failures and bugs, including physical errors and human errors, in a large-scale integrated-circuit system and they cause abnormal operation or a fatal trouble due to complex interactions among them. Even if failures do not lead to a fatal trouble as long as they are independent and countermeasures against them are taken, these failures often lead to troubles due to complex interactions among multiple failures, bugs and human aggressions. As technologies for preventing these failures caused by such interactions, it is necessary to establish technologies such as detecting information that seems to lead to failure by arranging temperature sensors and voltage sensors in a chip and disconnecting or suspending a module that seems to lead to failure.

<u>7. Specific issues to be overcome in achieving this research and development goal, points to be cared , and any overlapping with existing policies, projects, etc.</u>

To build a system in which reliability/security are guaranteed, it is necessary to build technique for open-system that can adapt to environmental changes rather than for closed-system that can be used only in a strictly defined environment. It is said that a waterfall model, such as Basic plan -> Design -> Build-up -> Use, is suitable for developing a large-scale system, however, the model cannot adapt flexibly to a condition in which the system is operated because the condition is initially fixed. Therefore, it should be considered that effective researches are carried out, including adoption of the spiral model that enhances integrity of reliability/security by repeating "Design -> Build-up -> Use -> Evaluation -> Redesign" organically.

*1 According to the report of WSTS (World Semiconductor Trade Statistics), the share of East Asia other than Japan in the global semiconductor market has increased from 25.1% to 45.4%, while Japanese share has decreased from 22.9% to 19.4% between 2000 and 2005, indicating progress of semiconductor industry in East Asia and decrease of Japan's competitiveness.

*2 The situation under which the quality of products is reliable and users can depend on them feeling secure and safe.

Strategic Sector: "Exploitation of material and nanoprocess for the realization of novel electronic devices with novel concepts, novel functions and novel structures" (Set in FY2007)

<u>1. Title</u>

Exploitation of materials and nanoprocesses for the realization of novel electronic devices with novel concepts, novel functions and novel structures

<u>2. Relationship with the relevant strategic priority for science and technology</u>

This Strategic Sector is to aim at creation of next-generation devices based on new concept/new structure which transcend~~s~~ properties of existing silicon devices and is closely related to following three Strategic Prioritized Science and Technology in the field of "nanomaterials".

①Innovative material/process technology that plays a core role in leading to innovation.

⑤Advanced electronics to overcome the limitation of the existing device performance.

⑨Most-advanced measurement and processing technologies in nanometer scale

3. Reasons, urgency, and needs from specialists and the industries for the priority over other strategic priorities for science and technology, etc

Silicon crystals used for semiconductor integrated circuits (LSIs) represented by CMOS are the materials indispensable to developed information-based society, and can be regarded as the basic materials supporting the people's living. Semiconductor manufacturing technologies are indivisibly related to nanotechnology, since they become more and more sophisticated day by day as exemplified by the fact that the manufacturing accuracy of the CMOS micro-processing plunges into the nanometer range. Consequently the limit of 32 nm hp (half pitch) is approaching, at which micro-processing in silicon CMOS production line becomes extremely difficult, which in turn require device development based on new concept/new principle different from conventional silicon CMOS technologies.

In Japan after 1980's aggressive investments have been made on researches for exploration of post-silicon materials and for development of devices, which leads to a lot of germinating results evaluated to be excellent from a global point of view. In the core research for evolutional science and technology project (Basic Research Programs) of JST, as Virtual Lab in Nanotechnology Area, excellent research seeds have been created in the projects such as "Exploitation of material for next-generation device with non-silicon semiconductor material", "Exploitation of strongly-correlated material to construct a logic circuit/information storage with new concept" and "Exploitation of the material related to molecular-scale electronics", under the Strategic Sector, "Creation of Nanodevice/Material/System for Overcoming Integration/Function Limits in Data Processing and Communications" since 2002.

On the other hand, in other countries, especially in the United States, the NSF (National Science Foundation) which is responsible for basic science plays a core role in promoting "high-risk, high-return" research and development through multiple industry-academic liaison sectors[*)]. This is because it recognizes that the country will win supremacy in the coming electronics after 10-15 years if it succeeds in breaking through "the barrier to next-generation electronics (Beyond CMOS)" that cannot be overcome by the extension of silicon CMOS technology.

Now that the microprocessing in silicon CMOS technology seems to be approaching a fundamental limit, it is a time when those excellent research outputs stored in Japan should be utilized as seeds for innovation, and this Strategic Sector is the highest-priority issue to be addressed urgently.

*) Nanoelectronics Research Initiative (NRI), Western Institute of Nanoelectronics (WIN), Nano Electronics Research Corp (NERC), Institute for Nanoelectronics Discovery and Exploration (INDEX), South West Academy for Nanoelectronics (SWAN) etc..

4. Image of innovative achievement expected to be achieved under this goal (Expected innovative outcome with specific examples), background, and social and economical imperatives.

In the coming ubiquitous/network society, realization of highly integrated CPU's and memory devices will be needed to meet with the demands for higher speed in networks and for larger capacity of contents data. Examples of the typical achievements that can be realized by this Strategic Sector in the future are listed below.

- Exploitation of compound semiconductor such as GaAs and InSb, and wide bandgap semiconductors such as GaN, AlN and diamond:
  ➔ Enables realization of next-generation mobile equipments through development of ultra-fast/low power consumption devices utilizing high electron mobility and high saturation electron velocity.
- Exploitation of strongly-correlated-electrons materials (including superconducting materials):
  ➔ Enables realization of ultrafast logic circuit elements and high-density non-volatile memory devices based on a novel principle by controlling electron spins and orbitals.
- Exploitation of new materials and new device structures such as carbon nanotube and quantum dots:
  ➔ Enables fabricatation of single-electron devices processed with an accuracy of nano-level or molecular level and establishment of nanostructure copying technique using self-organization.
- Exploitation of organic materials (polymers /small molecules):
  ➔ Enables creation of low weight and flexible portable devices robust against mechanical impact. The examples include foldable large-area displays, rollable portable computers, and wearable health devices for continuous monitoring of the blood pressure and the body temperature.

Thus, this Strategic Sector is sufficiently innovative to create numerous innovations, and can adequately meet demands from the society and its economy.

5. Research and development goal to be achieved during this strategic project (creation of knowledge as the source of innovation, technology seeds, technology concepts to be demonstrated etc.)

The aim of this Strategic Sector is to create innovations that lead to next-generation nanoelectronics devices by exploiting materials in the following technological areas and developing their processing technologies.

(1) Exploitation and process development of materials for next-generation devices transcending conventional CMOS using non-silicon semiconductors (compound semiconductor such as GaAs and InSb, and wide-gap semiconductor such as GaN, AlN and diamond).

(2) Exploitation and process development of materials leading to build-ups of novel devices making use of pluralistic fusion and conversion of optical /electric/magnetic functions.

(3) Exploitation and process development of the materials leading to build-ups of novel devices by precise fabrication technique at the nano/molecular level.

(4) Exploitation and process development of the materials for portable devices which are thin, low weight, flexible, foldable and robust against mechanical impact.

6. Scientific justification for research and development goal to be achieved during this strategic project (progress status of related research, potential for development of this field in the future and prospect that many outstanding research plans are proposed)

Virtual Labs in Nanotechnology Area promoted in the Basic Research Programs of JST have achieved encouraging R&D results under their Strategic Sectors. Materials development, on the basis of these R&D results, that would directly lead to the creation of next-generation devices transcending silicon CMOS can be expected through the advanced nanoscience and a lot of excellent research proposals would also be expected. Progress status of R&D related to their objectives is as follows.

(1) Exploitation and process development of the materials for next-generation devices transcending conventional CMOS using non-silicon semiconductors (compound semiconductor promising higher performance than silicon, including GaAs and InSb, and wide gap semiconductor such as GaN, AlN and diamond).

- Use of several times higher electron mobility or faster saturation electron velocity than those of silicon.
  - ➔ An electron can travel without being scattered by crystal lattice in the nano-size device, and thereby, it became possible to design a device that is operable at high frequency above 1 THz.

(2) Exploitation and process development of the materials leading to build-ups of novel devices making use of pluralistic fusion and conversion of optical/electric/magnetic functions.

- Strongly-correlated-electrons materials in which localized electrons and conduction electrons are strongly interacting.
  - ➔ Enables to build up devices with new function whose magnetic, electric and optical properties are mutually controlled. For example, a nonvolatile memory operable with ultra-low power consumption and ultra-high speed by combining magnetic nano-dots and MOS transistor is produced experimentally.
- Optical control by functional photonic materials
  - ➔ It is becoming possible that the ultra-fast optical information-processing devices whose function is controlled by photons instead of electrons are realized.

(3) Exploitation and process development of the materials leading to build-ups of novel devices by precise fabrication technique at the nano/molecular level.

- Nano-carbon materials represented by carbon nanotube/graphene.
  - ➔ Formation of single molecular device is possible, and expected to be materials for novel quantum information device or switching device.
- Quantum wire/quantum dot
  - ➔ Devices including ultra-fast/ultra-low power consumption laser devices in which quantum size effect is utilized will be realized.

(4) Exploitation and process development of the materials for portable devices which are thin, light, flexible, foldable and robust against mechanical impact.

- Organic semiconductor material represented by pentacene.
  - ➔ Application for electronic papers and flexible displays that use the properties such as lightweight, large area, flexible and printable can be expected, and an application as organic laser diode is also investigated.

7. Specific issues to be overcome in achieving this research and development goal, points to be cared , and any overlapping with existing policies, projects, etc.

The goal of this Strategic Sector is to establish materials-oriented research subjects on the basis of nanoscience. However, real innovation will not be achieved only by the basic research in academia. Instead objective-based R&D projects are strongly required, which may be accomplished by consortia based on research centers or by academia-industry alliance whose objectives are clearly oriented to “manufacturing”. It is also required to enhance partnership among different research groups and create synergy effects using common infrastructures (if necessary) under strong initiative of Research Supervisor. What is urgently needed is an establishment of definite systems by which research investment can be effectively connected to future achievements, such as clear role-sharing between basic (academia) and applied (industries) researches, collaboration between theoreticians and experimentalists, and exchange of human resources through an academia-industry alliance

The existing projects and programs, *i.e.*, electronics-related research areas in the program "Virtual Labs by Nanotechnology Area" which has been promoted as the Basic Research Program of JST and will be completed on 2007, have produced a lot of germinating research results under this Strategic Sector. In order to link these achievements to future innovations, the present Strategic Sector should inherit achievements of these research areas and evolve them into further R&D achievements. Unfortunately, since organization of core-institutions and open-user facilities to integrate these materials into practical devices is still under development in Japan it is necessary to effectively link this Strategic Sector to a second phase Nanotechnology Support Project and to encourage more interdisciplinary interactions among researchers from basic and applied areas.

Strategic Sector: "Search for breakthrough by mathematical / mathematical sciences researches toward the resolution of issues with high social needs (focusing on collaboration with wide research fields in science and technology)" (Set in FY2007)

1. Title

Search for breakthrough by mathematical / mathematical sciences researches toward the resolution of issues with high social needs (focusing on collaboration with wide research fields in science and technology)

2. Relationship with the relevant strategic priority for science and technology

In relation to this Strategic Sector, it is referred to in the information and communication field of the promotional strategy by field as follows: "It is clear that any information and communication technology utilizes mathematical achievements. Strengthening the fostering of mathematical researchers is an essential policy for the progress of information and communication technology as well as science and technology in other fields for the next 30 years." In addition, in other fields including life sciences as well, the needs for mathematics are shown in the form of simulation or system researches.

Furthermore, the 3rd Basic Plan for Science and Technology says that "it is necessary to create an environment to encourage intellectual inspiration and integration among different fields by, for example, promoting R & D in which the wisdom of researchers required for problem solving can freely be brought together beyond the existing field classification in order to create new wisdom."

3. Reasons, urgency, and needs from specialists and the industries for the priority over other strategic priorities for science and technology, etc

Considering the present situation of mathematical researches in Japan, the following characteristics can be found:

①Though Japan maintains a certain level of mathematical researches, there is no quantitative increase as seen from the number of papers. It is equivalent to the number in Europe, but far less compared with that in the United States (4-5 times than that in Japan).

② Promotion of mathematics hardly gets into the political limelight, and investment in mathematics in Japan is quite small compared with that in major countries in Europe and in the U.S. (The U.S.: approx. 40 billion yen, France: approx. 19 billion yen, Japan: several billion yen)

③ More emphasis is placed on pure mathematical researches, and fewer researches on application are carried out in Japan.

④There are barriers among different cultures, including the difference in technical terms among fields, leading to difficulty in having contact points with researches in different fields.

Meanwhile, mathematics is a study that serves as a basis for various sciences and provides a breakthrough in R & D of many areas through collaborative researches with other fields. In the 3rd Basic Plan for Science and Technology as well, it is mentioned as follows: "When developing eight promotional strategies by field, they should be proceeded while paying careful attention to flexibly responding to these emerging / multidisciplinary areas and appropriately linking to innovations." In fact, according to the questionnaire survey of industry-academic-government researchers of eight priority fields in Japan at National Institute of Science and Technology Policy, the answer that there are issues for which mathematics' contribution is expected accounted for 81%, showing high needs for mathematics.

Therefore, it is necessary not only to promote mathematics itself but also to immediately launch activities that can contribute to further development in different fields by utilizing the achievements in mathematics.

4. Image of innovative achievements expected to be achieved under this goal (expected innovative outcome with specific examples), background, and social and economical imperatives.

With regard to the issues raised at present, truly innovative solutions (innovations) should be obtained through the processes of logical discussion, organizing issues and selecting approaches which lead to concrete solutions. This "logical discussion" had conventionally been made only with the knowledge within the field, and sufficient in-depth discussions were limited. By introducing mathematical approaches here, a breakthrough in organizing issues and in getting concrete solutions can be expected.

To this end, as seen from various technological innovation cases utilizing mathematical theories in the past (application of the fuzzy set theory into home electric appliances, etc. announced in 1965, application of the wavelet analysis into data compression, etc. in image processing announced in the early 1980s, etc.), the breakthrough should be realized, the innovations be created and improvement in economic and social values be planned by applying mathematical approaches into issues with high social needs including the development of new products.

5. Research and development goal to be achieved during this strategic project (creation of knowledge as the source of innovation, technology seeds, technology concepts to be demonstrated etc.)

In order to build deeper cooperation between mathematics and different fields, it is desirable to flexibly combine activities to promote individual researches with theme setting based on the mathematical researchers' intentions first under certain conditions and those to cultivate collaborative researches seeking the possibility of cooperation with other fields, developing them into collaborative researches with other fields. In addition, in order to judge if the intended Research Subjects can effectively be solved by utilizing mathematics, it is necessary to make the best use of personnel also with a broad view of other fields on the side of mathematical researchers. To this end, the system as shown below should be established for collaborative researches between mathematics and other fields:

(1) To appoint mathematical researchers also with a view of different fields (Research Area) as research supervisors.

(2) To collect mathematical subjects in which development to other fields can be expected from mathematical researchers and advance the researches after selection by research supervisors.

(3) To hold workshops, etc. as places of exchange between researchers of mathematics and other fields, developing an atmosphere conductive to collaborative researches between mathematics and other fields.

(4) To make arrangements so that the research forms (individual researches / team researches) can flexibly be settled according to collaborative phases with other fields at the time of application by the research proposers.

6. Scientific justification for research and development goal to be achieved during this strategic project (progress status of related research, potential for development of this field in the future and prospect that many outstanding research plans are proposed)

At the Department of Mathematics in Hokkaido University, they are working on the project "Mathematics Center for Advanced Researches" to invite mathematical questions from researchers who are carrying out advanced researches in various fields in the university as part of "the 21st century COE Program." This is an experimental project to try to search for clues for problem solving by brainstorming with mathematical researchers after obtaining information about the present situation of researches relating to questions from questioners. Fourteen questions have been provided so far. In the process of this project, not only direct solutions are found, but also the following results are obtained:

- Logical structures of the questions become clear following discussions with mathematicians
- Discovery of new mathematical issues and young human resources development with it (development into research themes for students)
- Development into collaborative researches
- Better understanding of the characteristics of each other's fields leading to gaining in breadth as researchers

As mentioned above, the advanced efforts in a university are achieving results, and the accumulation of successful cases for the development into collaborative researches of mathematical researchers with other fields can be expected with experiences of such projects as a beginning.

7. Specific issues to be overcome in achieving this research and development goal, points to be cared , and any overlapping with existing policies, projects, etc.

With respect to collaborative researches between mathematics and different fields proceeded under this Strategic Sector, consideration should also be given to cooperation with the existing policies and projects by handing them over to R & D projects with the existing competitive research funds , etc.

depending on the development phases.

Strategic Sector : "Elucidation of the dynamic mechanism of biological system and establishment of fundamental technology " (Set in FY2006)

1. Title

Elucidation of the dynamic mechanism of biological system and establishment of fundamental Technology

2. Specific Objectives

The present strategic aim is directed toward understanding the dynamic mechanisms of complex biological system to a verifiable extent. It is hoped that the tool or software created during the verification process will become fundamental technology that will be useful in medical, bioengineering and other settings.

The following research and development are some of more specific examples of the aim;

(a) Models to elucidate the dynamic control mechanisms of biological system.
(b) Imaging technology or measuring technology for in-depth analysis for the purpose of understanding the dynamic characteristics of information transmission dynamics in biological system
(c) Simulation technology for spatio-temporal responses of biological system.
(d) Technology to support the understanding of medication, vaccine or bioengineering, disease prevention, diagnosis, treatment or analytical technology or for biological function.

3. Background of Objectives and Social and Economical Imperatives

After the completion of the Human Genome Project, extending its findings to medical or biotechnological innovation has become the next immediate task around the world. On one hand, in medical research, the genes of many genetic diseases such as hemophilia have been identified. However, on the other hand, for diseases such as cancer or other life-style related diseases that involve more than one set of genes or environmental factors, there are not enough methodological approaches to understand what kind of mechanisms of a biological system that consist of intricately inter-relating functional molecule will lead to cause such disease. The demand to develop such methodology and its implementation to an effective therapy is increasing.

The present strategic aim is directed toward elucidating the dynamic mechanism by analyzing spatio-temporal control of functional molecules that comprise a biological system. It is hoped that the result of such research will lead to creation of innovation in disease prevention, diagnoses, treatment or bioengineering area. Such may be simulation of multiple drug administration, on the basis of analysis conducted on time specific patterning of several drugs of which their action mechanisms are relatively known; or discovery of a new biomarker useful for diagnosis and treatment. Understanding the control of metabolic function is hoped to develop effective production method which uses microorganism or plants for bioengineering. Already, Cambridge University has developed a simulation technology for reaction of multiple drugs on heart and the technology is approved by FDA (of U.S. A.) for use in safety testing. However, technology which enables understanding and utilization of dynamic mechanisms of biological systems are few and the development of such technology is demanded.

4. Scientific Justification for the Objectives

21st century research in biology and medicine places more emphasis on understanding the biological system as a whole, starting from genome level, cell and organ, organism or between individual and others. Henceforth, simulation modelings, reconstruction of biological functions, and other attempts have been made. The research that will fall well within the target of the aim set for the present biological system research will combine the modeling, imaging, simulation or in-depth analysis approach, and will aim to enable quantification and estimation for understanding and control of biological function. These researches will require conventional bioscience technique as well as knowledge in theoretical biology, computer science, mathematics and physics and will require tools such as a novel measuring technology, nanotechnology, and computer. Especially latter is hoped to create technology or software that will lead to innovation in the area of life science engineering.

The history of research on biological system is still very short but Japan, Europe and USA mark their beginning at around the same time. In the USA, the research is making its advance at an accelerating speed at governmental and industrial level and also in Europe a research project is being promoted in the EU, Germany, Switzerland and the UK.   Although Japan stands in the second best position after the USA, less governmental involvement in promotion of these researches is observed when compared to USA.   Promoting this research area and cultivating younger researchers for it and actively engaging in promotion of these researches (such as hosting international meeting) is hoped to leverage the scientific and technological standard of our country at an international level.

V. Notes for Application

1. Use of information supplied in Research Proposal Application

Submitted Research Proposals will not be used for purposes other than the selection in light of maintaining the interest of the applicants, provisions of "the Act for the Protection of Personal Information Held by Independent Institutions" and other considerations. All information concerning your application will remain strictly confidential. Please refer to the following website for more details.

http://law.e-gov.go.jp/htmldata/H15/H15HO059.html (Japanese)

○ Handling of information related to the adopted themes

The information related to the adopted themes (system name, research theme name, Research Director, budget, period) is "information to be made available in the public domain" as stipulated in Article 5-1-1 of the Law Pertaining to the Publicizing of Information Held by Independent Administrative Institutions (2001, Law No. 140).

The researcher's name, affiliation, research theme name, and research theme summary will be made public. The research proposal form of the selector will be used by JST for advancing the research after adoption.

○ Information provision to the Government Research and Development Database(*1) from the Cross-ministerial R&D Management System (e-Rad)

Some information could be submitted to the database created by the Cabinet Office through the Cross-ministerial R&D Management System (e-Rad) operated and managed by the Ministry of Education, Culture, Sports, Science and Technology.

Cross-ministerial R&D Management System (e-Rad) Portal Site
http://www.e-rad.go.jp (Japanese only now)

(*1) In order to appropriately evaluate R&D in terms of country and financial resources and effectuate a plan for effective and efficient strategy and resource allocation any and all information will be integratedly and comprehensively understood and a searchable and analyzable database for necessary information will be constructed by the Cabinet Office Bureau of Science, Technology and Innovation Policy.

2. Avoiding unreasonable duplication and excessive concentration

○ Part of the applications submitted might be used to provide some information to other parties in the government or Independent Administrative Institutions in charge of Competitive Research Funds within the range necessary for avoiding "Unreasonable Duplication" and "Excessive Concentration" of the Competitive Research Funds. Relevant information might also be provided to the requesting party if JST is requested to check for duplicated applications in other Competitive Research Fund programs.

["Unreasonable Duplication" and "Excessive Concentration"]

A. "Unreasonable Duplication" refers to a state in which multiple Competitive Research Funds are unnecessarily allocated to identical research proposals of an identical researcher, which falls under any of the following conditions.

1) Substantially identical research proposals (including ones that overlap

considerably. The same applies to the following.) have been submitted simultaneously for different Competitive Research Fund programs and have been selected for two or more funds.

2) A proposal that is substantially resemblant to one already selected and received Competitive Research Funds has been submitted.

3) The purposes of using the research expenses overlap among different research proposals.

4) Other cases equivalent to the above.

B. "Excessive Concentration" refers to a state in which a single researcher or research group (hereinafter referred to as the "Researcher or others") receives a total amount of research expenses for the year that exceeds the limit that is useful effectively and efficiently, and such amount is more than the Researcher or others can spend within the research period, which falls under any of the following conditions.

1) Excessive research expenses are allocated considering the ability and research method of the Researcher or others.

2) Excessive research expenses are allocated in comparison to the Effort (percentage of the time required for the research in the total work hours of a researcher) assigned to the Research Subject.

3) Unnecessarily expensive research facilities are to be purchased.

4) Other cases equivalent to the above.

(Source: "Liaison Conference of Relevant Ministries on Competitive Research Funds"(Revised in Dec. 14, 2007) in "Guidelines for avoiding Unreasonable Duplication and Excessive Concentration of Competitive Research Funds" (Sept. 9, 2005; revised in Nov. 14,2006))

○ If the Applicants are receiving any Competitive Research Funds such as Grants-in-Aid for Scientific Research or any other research subsidies (including those under application) administered by the government or an Independent Administrative Institution, write the description of such funds according to the research proposal format (CREST form-10, PRESTO: form-5). A research proposal might be screened out, adoption might be cancelled or its research expenses will be reduced if any Unreasonable Duplication or Excessive Concentration has been found from details of the research proposals, Effort (rate of time allocated to research) (*2), or other information.

A research proposal might be screened out, adoption might be cancelled or its research expenses might be reduced if any of the information provided proves to be inconsistent with the facts.

(*2) Effort (percentage of time allocated to research)
"Effort" is determined in accordance with the definition – the percentage of time required by a researcher to engage in the research when his/her total annual work hours is 100% – set by Council for Science and Technology Policy. "Total work hours" refers to the overall substantial work time including education, medical care and other activities and not only the time spent for research activities.

○ For avoiding Unreasonable Duplication and Excessive Concentration described above, if you are receiving any other Competitive Research Funds or research subsidies administered by the government or an Independent Administrative Institution, or if your proposal has been selected for such other subsidy program, you may not apply for this program with the same Subject or research proposal.

○ For CREST, for the elimination of irrational duplication and excessive concentration as well as to use research costs effectively, a verification of research application forms is effectuated by the Program Officer of the Program Control Office. Please understand that when selecting, an onsite study may be conducted, if necessary.

○ In the event the applicant plans to receive an amount of financial resources 100 million yen or more the following year from other programs or grants, the adoption and budget amount will, in principle, be comprehensively determined by an onsite study conducted by the Program Control Office in addition to the Executive Office selection taking into consideration the elimination of irrational duplications and excessive concentration. This will be determined separately within the selection process if planning to receive funds 100 million yen or more from multiple programs or grants.

This will not apply to a proposal in the process of application. Depending on the result of the screening however, such a proposal might be screened out from the Research Proposals subject to this program and any decision on adoption might be withdrawn. Please promptly report to JST at the contact point provided at the end of the Guidelines if any of the applications for other programs has been granted at any time during the selection process of this program.

3. Policy on improper use of research expenses

○ If a researcher commits in this Program (including one in collusion) improper use of research expenses against the intent of the program, such as using the funds for unintended purposes or violating predetermined conditions by JST and being wrongfully selected for the research fund program, the research concerned might be terminated, all or part of the research expenses be reimbursed and/or such a fact might be publicized. He or she will furthermore lose eligibility to apply for this program for a certain period of time.

○ A researcher who was subjected to suspension by wrongful use of research expenses in any other Competitive Research Fund programs (*3) administered by the government or an Independent Administrative Institution, and is restricted to apply for and participate in the same program will also be restricted in eligibility to apply for this program and participate in this program for a certain period of time.

○ The information on the wrongdoing of the researcher and others acted in collusion will be provided to other parties in charge of Competitive Research Funds (including Independent Administrative Institutions) if it is concluded that a researcher has wrongfully used the research expenses in this program. Consequently, such researcher's application for and participation in other Competitive Research Fund programs (*3) might become restricted.

A researcher who has wrongfully used such expenses and a person who has acted in collusion in this program shall have the following restrictions imposed on the application and the participation period, depending on the degree of wrongdoing. In principle, the restriction period will be for 2 to 5 years after the following fiscal year of the fiscal year when contract fees have been returned "Application and Participation" refers to proposals and applications for new subject areas and new participation in the Research as a Research Collaborator.

- In case of simple administrative errors, no restrictions on application or participation will be imposed.
- For 2 years if not used for purposes other than this program.
- For 2 to 5 years if used for purposes other than this program determined depending on the individual cases of wrongdoing.
- For 5 years if received due to wrongful acts such as false declarations in proposal documents.

4. Preparation of a management / audit organization for research expenses in research institutions

○ Research institutions shall prepare a management / audit organization for research expenses based on "Guideline on management and audit of the public research expenses in research institutions (Practical standard)" (Feb. 15, 2007, Action by Ministry of Education, Culture, Sports, Science and Technology). They shall report its enforcement status, and correspond to site investigation about situations such as organization maintenance.

Please refer to the following homepage for "Guideline on management and audit of the public research expenses in research institutions (Practical standard)".

http://www.mext.go.jp/b_menu/shingi/chousa/gijyutu/008/houkoku/07020815.htm
(Japanese only)

○ Submittal of a progress report concerning the formulated structure of the research by institutes based on the public research cost management and monitoring guidelines (research standards).When executing agreements, it is necessary for each research institute (*4) to establish a monitoring and management system for the research cost based on guidelines and submit a progress report (failure to submit a progress report will result in the voiding of the research).For this reason, it is necessary, in principle, <u>for each research institute</u> to submit a report to the Ministry of Education, Culture, Sports, Science and Technology's Office of Science and Technology Policy Research and Coordination Division Financial Resource Coordination Office based on the form provided in the website provided below by the start of the research (agreement execution date).

For more information on submission of reports, visit the following website:

【URL】 http://www.mext.go.jp/a_menu/02_b/08191222/001.htm

An environment accessible to e-Rad is required for submittal. If a research institution has not registered the research intuited information for e-Rad, please quickly complete the registration. (Note that 2 weeks are normally required for registration. For more information on registration for the use of e-Rad, visit the following website:

【URL】 http://www.e-rad.go.jp/shozoku/system/index.html

However, if already having submitted a report at the time of a separate application in and after Oct. 2008, another report at this time is not necessary. (However, the document of the purport that "Presentation the document about enforcement condition report was completed on O year O moon O day" will be handed in by research start after adoption determination.)

Further, if continuing research after FY2010), presentation of the report will be called for around the autumn of 2009 through e-Rad. Please pay special attention to the information provided by the Ministry of Education and the Japan Science and Technology Agency.

After submitting the report, depending on need, please cooperate with the onsite study on system formulation by the Ministry of Education (including the financial allocation organization). Also, pertaining to the report content, in the event it is determined that problems are solved pertaining to lingering inappropriateness or insufficiency with respect to the response to "essential items" indicated by the Office of Science and Technology Policy Research and Coordination Division dated May 31, 2007, the allocation of consignment research cost will be suspended.

(*4) For CREST, not only research institutes to which the Research Directors are affiliated but also those research institutes to which Main Research Collaborators receiving an allocation of the research cost.

5. Policy on scientific misconduct in research activities

Policy on scientific misconduct in research activities (e.g., fabrication, falsification, distortion, or plagiarism of research data) is as follows based on "Guideline on policies and procedures for misconduct in research activities, Special Committee on Scientific Misconduct", Council for Science and Technology, Aug. 8, 2006. Please refer to the following homepage on "Guideline on policies and procedures for misconduct in research activities, Special Committee on Scientific Misconduct".

http://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu12/houkoku/06082316.htm
(Japanese only)

If any scientific misconduct is found, the research concerned might be terminated, all or part of the research expenses be reimbursed and/or such a fact might be publicized. Those meet the followings will also be restricted in eligibility to apply for this program and participate in this program for a certain period of time.

- An author and co-author recognized as involved in misconduct on publication concerning the research recognized as the misconduct having occurred, and those who are recognized as involved in the misconduct concerned: 2–10 years after the following of when the misconduct is authorized.
- An author not recognized as having been involved in the misconduct, but authorized as those who should take a responsibility on the contents of the publication concerning the research recognized as the misconduct having occurred: 1–3 years after the following of when the misconduct is authorized

A researcher who was subjected to suspension by wrongful use of research expenses in any other Competitive Research Fund programs (*3) administered by the government or an Independent Administrative Institution, and who is restricted to apply for and participate in the same program will also be restricted in eligibility to apply for this program and participate in this program for a certain period of time.

The information on the wrongdoing of the researcher will be provided to other parties in charge of Competitive Research Funds (including Independent Administrative Institutions) if it is concluded that a researcher has wrongfully used the research expenses in this program. Consequently, such researcher's application for and participation in other Competitive Research Fund programs (*3) might become restricted.

(*3) Other specific programs applicable are as follows:

< Competitive Research Fund programs affiliated with the Ministry of Education, Culture, Sports, Science and Technology (MEXT) >

- Grants-in-Aid for Scientific Research
- Special Coordination Fund for Promoting Science and Technology
- Global COE (Centers of Excellence) Program
- World Premier International Research Center (WPI) Initiative
- Promotion of Key-Technologies Research and Development (R&D in the life sciences based on social needs, R&D for component technology on next-generation IT infrastructure, and R&D in emerging fields with the focus on nanotechnologies and material sciences)
- Japan EOS Promotion Program
- Innovative Nuclear Research and Development Program
- Social technology R&D
- Development of Systems and Technology for Advanced Measurement and Analysis
- Project to Develop "Innovative Seeds"
- Collaborative Development of Innovative Seeds
- Comprehensive Support Program for Creation of Regional Innovation
- Collaboration of Regional Entities for the Advancement of Technological Excellence
- Science and Technology Development Infrastructure Project (tentative)
- Science and Technology Research Partnership for Sustainable Development
- Strategic Program for Regional Outstanding Researchers
- Strategic International Cooperative Program (Joint Research)
- Adaptable and Seamless Technology Transfer Program for Target-Driven R&D
- Strategic Program for the Creation of Innovation (tentative)
- Science and Engineering Entrepreneurship Development program for Vigorous researchers
- Infrastructure Tool Development Program for the Promotion of Ocean Resrouces (tentative)
- Strategic Promotion Program for Basic Nuclear Research
- Development of Environmental Technology using Nano technology
- Project for the Development of Joint Research Center in Humanities and Social Sciences (tentative)
- Project for Research on Humanities and Social Sciences Corresponding to Social Policies and Needs (tentative)

< Competitive Research Fund programs affiliated with other ministries >

- Grants-in Aid for the Food Safety Risk Assessment (Cabinet Office)
- Promotion Program for Reducing global Environmental loaD through ICT innovation (MIC)

- Financial aid for Promotion of Advanced Technology Development in Telecommunications and Broadcasting (MIC)
- Program for Promotion of Private-Sector key Technology Research (MIC)
- Promotion Program for Fire and Disaster Prevention Technologies (MIC)
- Strategic Information and Communications R&D Promotion Programme (SCOPE) (MIC)
- Health and Labour Sciences Research Grants (MHLW)
- Program for Promotion of Fundamental Studies in Health Sciences (MHLW)
- Program for New Technology Development to Activate Agriculture, Forestry, Fisheries and Food Industry by Cooperating Industry, Academia and the Government (MAFF)
- Research and Development Projects for Application in Promoting New Policy of Agriculture Forestry and Fisheries (MAFF)
- Program for Promotion of Basic and Applied Researches for Innovations in Bio-oriented Industry (MAFF)
- Support fund for industrial technology research (METI)
- Grant for Practical Application of University R&D Results under the Matching Fund Method (METI)
- R&D for Promotion of Oil and Natural Gas Development (METI)
- Consortium R&D projects for regional revitalization (METI)
- Program for Technology Strategy and Demonstration of Development for Energy-Conservation (METI) (tentative)
- The Eco-Innovation Project Aimed at Discovering Innovative Technologies that Promote Sustainable Innovation and Global Warming Countermeasures (METI)
- Program for Promoting Fundamental Transport Technology Research (MLIT)
- Construction Technology Research and Development Subsidy Program (MLIT)
- Environmental Research and Technology Development Fund (MOE)
- Research Grants for Promoting the Sound Material-Cycle Society (MOE)
- Global Environment Research Fund (MOE)
- Program for Development of Technologies to Prevent Global Warming (MOE)

In addition, a system which inaugurates a general invitation is also contained in FY2009.In addition, when the above-mentioned handling and an object system are changed, we shall announce that fact to you appropriately by the homepage of the Ministry of Education, Culture, Sports, Science and Technology, and JST, etc.

6. Miscellanea

Researchers shall comply with laws, regulations, and guidelines concerning bioethics and safety regulated by the ministries concerned.

Those studies requiring the approval of the head of the institutions to which the researchers belong, reporting, confirmation, etc., must follow the specified procedures. Major laws, regulations by the ministries concerned are exemplified as follows. Note that other regulations may apply according to the contents of a research.

- The Law Concerning Regulation Relating to Human Cloning Techniques and Other Similar Techniques, (Law No. 146, 2000)
- Guideline on the handling of particular embryos (Ministry of Education, Culture,

Sports, Science and Technology Notification No. 173, 2001)

- Guideline on the establishment and use of human embryonic stem cells (Ministry of Education, Culture, Sports, Science and Technology, Notification No. 155, 2001)
- Ethical guidelines on human genomes and gene-analysis research (Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Health, Labor and Welfare, and Ministry of Economy, Trade and Industry, Notification No. 1, 2004)
- Ministerial ordinance on the criteria for implementation of clinical tests of medical supplies (Welfare ministerial ordinance, No. 28, 1997)
- Circumstances of R & D using human tissues extracted from operations (Health Sciences Council reply, 1998)
- Ethical guidelines on epidemiological research (Ministry of Education, Culture, Sports, Science and Technology and Ministry of Health, Labour and Welfare, Notification No. 1, 2004)
- Guideline on gene therapy clinical study (Ministry of Education, Culture, Sports, Science and Technology and Ministry of Health, Labour and Welfare, Notification No. 2, 2004)
- Ethical guidelines on clinical study (Ministry of Health, Labour and Welfare, Notification No. 459, 2004)
- Law Concerning the Conservation and Sustainable Use of Biological Diversity through Regulations on the Use of Living Modified Organisms (Law No. 97 of 2003)

Please refer to the following homepage for details about the secure of bioethics and safety in the Ministry of Education, Culture, Sports, Science and Technology.

MEXT website: "Approaches to Bioethics and Safety (Japanese)"
http://www.mext.go.jp/a_menu/shinkou/seimei/index.htm

All appropriate measures must be taken for the protection of human rights and interests prior to your application if your research includes studies or investigations that require agreement or cooperation of another party or social consensus.

If any violation of any of the provisions above has been found after your research proposal has been selected, or if any other improper act has been committed, the selection might be cancelled, the research concerned might be terminated, all or part of the research expenses be reimbursed and/or such a fact might be publicized.

VI. Duplicated Applications for JST Programs

Certain restrictions apply to research proposal applications made for "CREST" and "PRESTO" FY2009 Basic Research Programs that are in duplicate with applications to other programs within the Basic Research Programs or related programs (JST programs).

(1). Only one (1) research proposal can be submitted as a Research Director (CREST) or as a Researcher (PRESTO) for this year's application. (Please also refer to II-A-2 "Number of proposals and schedule of application and selection".)

(2). If you are in any of the following positions, as a rule, do not apply as a Research Director (CREST) or a Researcher (PRESTO). (Except when the period of the research concerned ends in fiscal year 2009.)

- Research Director of ERATO (Supervisor-Oriented Research) in the Basic Research Programs
- Research Director of ICORP (International Cooperative Research) in the Basic Research Programs
- Research Director of CREST (Team Research) in the Basic Research Programs
- Researcher of PRESTO (Individual Research) in the Basic Research Programs
- Team Leader of Development of System and Technology for Advanced Measurement and Analysis (PRESTO only)

(3). If an application for FY 2009 CREST or PRESTO has been short-listed and, the program involves more than one Research Subject funded through JST's Competitive Research Funds, the amount of research funding allocated to an individual Research Director or research participant may be reduced, or one of the studies to be performed may be selected over another, or some other adjustment may be made (Except for research subjects selected before FY2008 whose research period ends in FY 2009).

(4). If you are applying for this program as a Researcher (PRESTO) and simultaneously applying for Development of System and Technology for Advanced Measurement and Analysis as a Team Leader, one of either will be selected upon consultation when both applications are short-listed.

Q & A

Please also refer to Q&A on the following website.
http://www.jst.go.jp/kisoken/teian-en.html

See the website below for information on the operation of the system (e-Rad), the registration of affiliated research institutes and researchers, and the use of e-Rad.
http://www.e-rad.go.jp/ (Japanese only now)

1. For both CREST and PRESTO

(Applications for the 2009 Research Proposal Invitation)

Q. Is the approval of the institution to which the researcher belongs required for the application?

A. The institution's approval is not necessary. After adoption, however, JST and the institution to which researcher belong conclude a research agreement. Please give prior explanation to a research institution if needed.

(Indirect costs (overhead costs))

Q. Will the indirect costs be paid to all research institutions entered into the research agreement?

A. The indirect costs will be paid to all research institutions entered into the research agreement to a maximum of 30% of the direct costs (contract research expenses).

Q. For what purposes will the indirect costs be spent?

A. Indirect costs are allocated to research institutes to cover necessary costs to improvement of the research environment of researchers participating in Research Subjects selected for this program and expenditures required for functional improvement of the overall research institution,. The principal purposes for spending indirect costs are exemplified as follows according to "the common guideline concerning execution of the indirect cost of a competitive research fund" (March 23, Heisei 17, Liaison conference of relevant ministries on competitive research funds).

1). Expenses incurred for the administration department
– Expenses for facility management and equipment preparation, maintenance and operation
– Expenses required for management affairs
Office equipment, consumables, equipment lease, miscellaneous tasks, labor costs, communications and transportation, rewards, domestic travel,
meetings, printing,
etc.

2). Expenses incurred for the research department
– Expenses for shared goods
Office equipment, consumables, equipment leases, miscellaneous tasks, labor costs, communications and transportation, rewards, domestic travel, meetings, printing, newspapers/magazines and heating, lighting and water
– Expenses required for promoting research activities through application of research
Labor costs for Researchers, research support, etc., office equipment, consumables, equipment leases, miscellaneous tasks, communications and transportation, rewards, domestic travel, meetings, printing, newspapers/magazines and heating, lighting and water

– Expenses related to patents
– Expenses for preparation, maintenance and operation of research buildings
– Expenses for preparation, maintenance and operation of laboratory animal facilities
– Expenses for preparation, maintenance and operation of Researcher community facilities
– Expenses for equipment preparation, maintenance and operation
– Expenses for network preparation, maintenance and operation
– Expenses for mainframe (including supercomputer) preparation, maintenance and operation
– Expenses for preparation, maintenance and operation of mainframe building
– Expenses for preparation, maintenance and operation of library
– Expenses for preparation, maintenance and operation of cultivated land
etc.

3). Expenses for other relevant business departments
– Expenses for developing business from research results
– Expenses for publicity activities
etc.

In addition to the above, the indirect costs will be allocated to those expenses deemed indirectly necessary for carrying out the studies by the head of an institution, except those expenses funded more appropriately as direct costs.

Further, a research institution that receives an allocation of indirect funds is required to exercise appropriately control of indirect funds and maintain documents such as receipts to prove the appropriate use of indirect costs (*) for a period of 5 years after the termination of the applicable research agreement.

(*)Documentary evidence showing the added total including the indirect funding from other Public Research Funds is acceptable. (Separate accounting for each agreement is not required.)

(Research location)

Q. What are the criteria for judging that conducting the research would be difficult at a location other than an overseas institution?

A. Cases such as the following are bases for judgment that the research must be conducted overseas.
1. Necessary facilities are not available in Japan, but only at an overseas institution.
2. Field research that is only feasible overseas is required.
3. Research materials are available only at the research institution or location concerned, which cannot be transported into Japan.

(Personnel changes after adoption)

Q. Can research be continued even if the Research Director (CREST) or Researcher (PRESTO) has been assigned to a different job position (promotion, change of institution, etc.) during the research period?

A. The research can be continued on the condition that it can be continued without difficulty at the new location. The Research Director (CREST)/Researcher (PRESTO) cannot be replaced for reasons of personnel changes.

Q. Can the equipment and/or other items provided by research expenses be moved to the new

institution if the institution for the research must be changed because of personnel relocation or other reasons during the research period?

A. Equipment and other items provided by the research expenses can be moved. Equipment acquired through contract research expenses (direct cost), in general, can also be moved to the new research institution through transfer or other means.

(Other)

Q. Who is the Program Officer (PO) of this program? What role does that person play?

A. The Research Supervisor acts as the Program Officer (PO) assigned to the Competitive Research Fund program for the CREST and PRESTO studies in this program. For information on the roles of the Research Supervisor, please refer to Chapter II-B-1-(2) "Research Supervisor" and all of Chapter II-B-1 for CREST and Chapter II-C-1-(3) "Research Supervisor" and all of Chapter II-C-1 for PRESTO.

Q　What is the Researcher No. in Form 1?

A　Those with a Researcher's Number of Grant-in-Aid for Scientific Research can use the same numbers. Those without this number are the 8-digit Researcher No. provided when registering researcher information on e-Rad (Cross-ministerial R&D Management System 〔http://www.e-rad.go.jp/〕 (Japanese only now)).

Applications are effectuated through e-Rad; however, whether having a Number of Grant-in-Aid for Scientific Research or not, before using e-Rad, it is necessary to register researcher information on e-Rad. Those without e-Rad login ID should contact their affiliated research institute administrative staff or the e-Rad Helpdesk (see Application Guideline Appendix 3) without delay.

The registration procedures may take several days; therefore, please start the registration procedures at least two weeks in advance.

Q. Please provide information about the Research Subjects selected and state of applications for the last year's program.

A. Please visit the JST website (CREST Term 1 "http://www.jst.go.jp/pr/info/info511/index.html/", Term 2" http://www.jst.go.jp/pr/info/info551/index.html" (Japanese)).

Q. Can a representative of an applicant take the interview if the applicant cannot be present on the interview day? Alternatively, can the interview be rescheduled for another day?

A. A representative will not be accepted for the interview. The interview schedule is finalized after adjusting a number of evaluators and, for that reason, cannot be rearranged. Please confirm the interview screening period in "II.A.2. Schedule of Application and Selection" (page 5) and visit the JST website (http://www.jst.go.jp/kisoken/teian-en.html) for the interview schedule for each Research Area.

2. CREST

(Research expenses to be indicated in the proposal)

Q Must the basis of calculating the research expenses and annual budget be presented in the research proposal?

A Although no basis for research expenses is necessary, indicate research expense schedules for each item of expenditure and for each endowed institution in form-6 of Research Proposal Application. Those who have been selected for the interview shall separately prepare supplementary information materials that include details of the research expenses.

(Research framework and budget allocation)

Q Please give examples of an unacceptable collaborative research group composition or research expenses allocation.

A A research framework whose researcher group does not play a central role in the proposed research concept, a framework that involves outsourcing a substantial portion of the research externally, a framework that does not clearly define the role and position of the collaborative research group with respect to the research concept, or a research expenses that equally distributes research costs among the collaborative research group without regard for role or position.

Q Would it be possible to change the research framework appearing in the application form at the time of the interview or after adoption?

A Selection is effectuated based on the information appearing in the research proposal application form, and we ask that the information to appear in it be carefully thought through prior to submittal so as to avoid changes. However, a change request can be made at the time of adoption as per Research Supervisor.

(Applicant requirements)

Q. Are part-time researchers (e.g., a visiting researcher) eligible for application? Is a researcher reaching mandatory retirement age during the research period eligible for application?

A. Such researchers are also eligible as long as they have a domestic research base and are able to carry out the research throughout the research period.

(Research team organization)

Q. When subscribing for CREST, is it possible to put into a team by making PRESTO researcher under research implementation into a main research collaborator?

A. In principal, the PRESTO researcher under research implementation(except for the case which will end in FY2009) shall not participate in the research as a CREST collaborator.

(Research expenses)

Q. Does the amount indicated as "Total Research Expenses" and "Research Expenses Plan" (entered into the electronic application system and written in CREST Form 1 and CREST Form 6) in the research proposal include the indirect costs paid to the research institutions when the research agreement is signed?

A. The total research expenses do not include the indirect costs. Please indicate the direct costs only.

Q. How are the research expenses allocated within a team determined?

A. The allocation of research expenses within a team is determined according to the research plans established annually after the adoption of research proposals. Please refer to II-B-1-(3) “Research plans” for information about the research plans.

(Purposes of research expenses)

Q. Can the patent application and maintenance fees for patents applied by the research institutions be paid from the research expenses?

A. Fees for patent application, examination order, maintenance, attorney, etc. cannot be paid as direct costs, but as indirect costs.

Q. Can some tasks such as programming be outsourced to an external party?

A. Outsourcing is allowed when necessary for promoting the research. In such cases, however, the outsourced tasks must be based on a service agreement that does not include any part of research and development. Please consult JST in advance if any part of research and development is included in the tasks, which must be subcontracted.

(Research agreement)

Q. Does the research agreement with the Main Research Collaborator’s institution take the form of “subcontract (*)” through the institutions of the Research Directors? * “Subcontract” under the research agreement is a form in which JST signs a contract only with the institution of the Research Director and such institution in turn signs another research agreement with the institution of the Main Research Collaborator.

A. The research agreement for this project does not take the form of “subcontract”; instead, JST enters into individual research agreements with institutions of both the Research Director and Main Research Collaborator.

(Research evaluation)

Q. How do you evaluate the researches and how do you use the results?

A. The evaluation of CREST Research Subjects, in general, consists of 1. a midterm evaluation conducted approximately three years from the start of the studies, and 2. ex-post evaluation conducted after the research period ends. Please refer to II-B-1-(4) “Research subjects evaluation” for details. In addition, the evaluation of Research Areas (II-B-A-(5) “Research areas Evaluation”) and a follow-up evaluation after a fixed period from research termination are conducted. All evaluation results will be posted on the JST website.

(Duplicated Applications)

Q. Can the applicant apply the proposal for CREST as a Research Director while he participates in other research proposal as Main Research Collaborator.?

A. Yes, it is possible. If such proposals will be shortlisted, there is a possibility that any adjustment may be made taking the scope and scale of each research into consideration, for instance, to reduce the research expenses or to select one research to be implemented out of such proposals.

3. PRESTO

(Applicant requirements)

Q Do many female researchers apply for the program?

A For PRESTO, 1,240 researchers have taken part since its inception in 1991. Of them, some 115 are female. In FY2008, 12.6% of PRESTO applicants were women and 16.2% of those whose proposals were adopted were women. JST hopes to have many great applications from all walks of life regardless of gender or research history. A special homepage about PRESTO female researchers is available. Please have a look. (URL: http://www.jst.go.jp/kisoken/presto/nadeshiko/(Japanese)) In addition, from last year, JST appeals to children, youths and those involved in science and technology that "Scientists and engineers, both male and female, are admirable figures" through a "Role model". Through these efforts, JST has been promoting gender equality vigorously, under the philosophy to encourage as many people as possible to become "attractive and charming researchers and engineers." (URL: http://www.jst.go.jp/gender(Japanese))

Q. Are there any age restrictions to apply for PRESTO?

A. No particular age restrictions apply to the PRESTO application. However, the researches are performed primarily by young researchers in their 30s, who are expected to achieve great success through this program.

Q. Are part-time researchers (e.g., visiting researcher) eligible for application?

A. No restrictions on the applicants' status apply to PRESTO.

Q. Is it possible to subscribe for PRESTO as a researcher and to participate in CREST as a main research collaborator?

A. The application to PRESTO is possible. However, when it has already participated in CREST as a main research collaborator and the becomes an adoption of PRESTO candidate this time, or when both PRESTO for which self has subscribed, and CREST which is having participation planned as a main research collaborator become an adoption candidate simultaneously this time, it may adjust choosing the cut of a research cost, and one research which the researcher concerned does, after taking the details of research, a scale, etc. into consideration etc.

Q. Are Japan Society for the Promotion of Science (JSPS) Research Fellowships for Young Scientists eligible for application?

A. They are eligible for application. Please inquire to each organization about the propriety of duplication to PRESTO in the program of organizations other than JST if any program of organizations other than JST is already in use, or applied for.

(Research expenses to be indicated in the proposal)

Q. Must the basis of calculating the research expenses and annual budget be presented in the research proposal?

A No basis for research expenses is necessary. Those who have been selected for the interview shall separately prepare supplementary information materials that include details of the research expenses.

(part-time/full-time engagement)

Q. Are there any conditions for the researcher to belong to JST as part-time researcher?

A. The condition is that permission for the additional job is granted by the research institution. The applicant must comply with the institution's regulations concerning part-time work hours.

(Purposes of Research Expenses)

Q, Can the patent application and maintenance fees for patents applied by the research institutions be paid from the research expenses?

A. Fees for patent application, examination order, maintenance, attorney, etc. cannot be paid as direct costs, but as indirect costs. JST will separately bear such fees corresponding to the JST share if JST holds a share of the patents.

Q. Can some of the tasks such as programming be outsourced to an external party?

A. Outsourcing is allowed when necessary for promoting the research. In such cases, however, the outsourced tasks must be based on a service agreement that does not include any part of research and development.

(Employment of researchers with a doctoral degree)

Q. Can researchers with a doctoral degree (postdoctoral researchers) be employed for PRESTO Type programs as research assistants?

A. In PRESTO, it is not possible to make a research team with any doctoral degree (postdoctoral researchers). However, postdoctoral researchers could be employed as a research assistant supporting an independent study of an individual applicant researcher.

(Other)

Q. Can the researcher suspend PRESTO research because of so-called life events (e.g., childbirth, childcare and nursing care) and resume the research later?

A. If a life event occurs to a PRESTO researcher during the research period, that researcher may suspend the research upon consultation with the Research Supervisor for up to the period specified for each type of life event and resume the research after such period. In such cases, JST will appropriate funds when the research is resumed, in the amount equal to the Research Expenses that were unused because of the suspension.

Q. Will salary for the researcher be paid from Research Expenses? Approximately how much will they be?

A. The researcher will be paid by JST separately from Research Expenses. Payments to full-time researchers will vary depending on their age, which should range between approximately 7 and 8 million yen per year.

Q. What kind of thing is it as executing a part of research cost by JST if needed?

A. When there is an item of expenditure with difficult execution which cases of traveling expenses of the PRESTO full-time engagement researcher etc. in a research institution according to the situation of an item of expenditure, a research institution, or a researcher that commissioning does not get used, JST executes a research cost directly.

Appendix1

Keyword List

No.	Keywords
001	Genetics
002	Genome
003	Protein
004	Sugar
005	Lipid
006	Nucleic acid
007	Cell and tissue
008	Biomolecules
009	Biodynamics
010	Cytogenesis and differentiation
011	Brain and nervous system
012	Animal
013	Plant
014	Microorganism
015	Viruses
016	Praxiology
017	Evolution
018	Information engineering
019	Proteome
020	Translation research
021	Transplantation and regeneration
022	Health care and welfare
023	Regenerative medicine
024	Food
025	Agricultural, Forestry and Fishery Products
026	Genetically modified food
027	Biotechnology
028	Dementia
029	Cancer
030	Diabetes
031	Circulatory organs and hypertension
032	Allergies and asthma
033	Infectious diseases
034	Cranial nerve disease
035	Aging
036	Drug reaction
037	Biotechnology-related equipment
038	For Tonic network
039	Advanced telecommunications
040	Cable access
041	Advanced Internet technologies
042	Mobile communications
043	Satellite network

No.	Keywords
044	Cryptography and authentication
045	Secure networking
046	Highly Reliable network
047	Copyright and content protection
048	High-performance computing
049	Dependable computing
050	Algorithms
051	Modeling
052	Visualization
053	Analysis and evaluation
054	Recording technology
055	Data storage
056	Large-scale file system
057	Multimodal interface
058	Image, character and voice recognition
059	Most Language processing
060	Automatic tending
061	Virtual reality
062	Agent technology
063	Smart sensor information systems
064	Software efficiency and stability improvement
065	Directory and information retrieval
066	Content archiving
067	System-on-chip technology
068	Device design and manufacturing processes
069	High-density packaging
070	Advanced functional device technology
071	Power saving, high energy density technology
072	Display
073	Remote sensing
074	Monitoring (non remote sensing)
075	Atmosphere phenomena
076	Climatic change
077	Hydrospheric phenomena
078	Geographic phenomena
079	Biological phenomena
080	Qualitative/quantitative environmental forecasts
081	Environmental change
082	Hazardous chemical substances
083	Waste treatment
084	Waste recycling
085	Atmospheric pollution prevention and purification
086	Water and soil pollution prevention and purification

No.	Keywords
087	Environmental analysis
088	Pollution prevention and countermeasures
089	Ecosystem restoration and maintenance
090	Environmental harmonious agriculture , forestry, and fishery
091	Environmentally harmonious urban infrastructure and construction
092	Natural coexistence
093	Policy research
094	Magnetic storage
095	Hyperfine semiconductors
096	Very high-speed information processing
097	Atomic and molecular scale processing
098	Scanning probe electron microscope (STM, AFM, STS, SNOM, others)
099	Quantum dot
100	Quantum wire
101	Quantum well
102	Superlattice
103	Molecular Machine
104	Nanomachine
105	Tunnel phenomena
106	Quantum computer
107	DNA computer
108	Spin electronics
109	Strong correlation electronics
110	Nanotube and fullerene
111	Quantum containment
112	Self organizing
113	Molecular recognition
114	Minority electron device
115	High-performance laser
116	Superconducting material and elements
117	High-efficiency photovoltaic material and elements
118	Quantum beam
119	Optical switching
120	Photonic crystals
121	Microresonator
122	Terahertz / infrared material and elements
123	Nanocontact
124	Supramolecular chemistry
125	MBE epitaxial
126	Monomolecular measuring (SMD)
127	Optical tweezers
128	(Molecular) motor
129	Enzyme reaction

No	Keywords
130	Confocal microscope
131	Electronic microscope
132	Very thin film
133	Energy in general
134	Renewable energy
135	Atomic energy
136	Solar batteries
137	Photovoltaic power
138	Wind power
139	Geothermal power
140	Waste heat recovery
141	Cogeneration
142	Methane hydrate
143	Biomass
144	Natural gas
145	Energy conservation
146	New energy
147	Energy efficiency
148	Reducing carbon dioxide emissions
149	Reducing greenhouse gas emissions
150	Fuel cell
151	Hydrogen
152	Electric vehicles
153	LNG vehicles
154	Hybrid vehicles
155	Ultra Precision measuring
156	Light Source technology
157	Precision grinding
158	Plasma processing
159	Micro machine
160	Precision parts processing
161	High-speed prototyping
162	Ultraprecision die transfer
163	Injection molding
164	High-speed assembly molding
165	High-speed transmission circuit design
166	Micro connectivity
167	Virtual reality
168	Human centered production
169	Multicompany joint production systems
170	Quality control systems
171	Low-entropy-oriented manufacturing
172	Seismic isolation (Earth change prediction)
173	Earthquakes

	Keywords
174	Volcanoes
175	Tidal waves
176	Landslides
177	Torrential rain
178	High tides
179	Flooding
180	Fires
181	Natural disasters
182	Observing and Predicting natural phenomena
183	Earthquake-resistant engineering
184	Earthquake-control
185	Seismic isolation
186	Disaster prevention
187	Disaster prevention robotics
188	Disaster mitigation
189	System recovery and restoration
190	Rescue
191	Fire fighting
192	Marine safety
193	Emergency communication
194	Crisis management
195	Rio-time management
196	National land development
197	National land improvement
198	National land conservation
199	Broadly-based regional research
200	Living areas
201	Urban development
202	Overpopulated cities
203	Water resources
204	Water circulation
205	Water basin
206	Water resource management
207	Freshwater production
208	Drought
209	Prolonging technology
210	Life-prolonging technology
211	Cost-reduction
212	Environmental management
213	Construction machinery
214	Construction management
215	International corporation
216	International contribution
217	Geographic information system (GIS)

No	Keywords
218	Traffic accidents
219	Logistics
220	Next-generation transporting system
221	Intelligent transport system (ITS)
222	Advanced cruise-assist highway system (AHS)
223	Transportation demand management
224	Barrier-free access
225	Universal design
226	Transportation equipment
227	Electronic navigation
228	Traffic Control
229	Rocket
230	Artificial satellites
231	Reusable transport systems
232	space infrastructures
233	Space exploitation
234	Satellite communications and broadcasting
235	Satellite positioning
236	International space station (ISS)
237	Earth surveillance and
238	Planetary exploration
239	Astronomy
240	Space science
241	Space transportation
242	Marine science
243	Marine development
244	Marine microorganisms
245	Marine exploration
246	Marine utilization
247	Marine protection
248	Marine resources
249	Deep sea environment
250	Marine ecology
251	Continental shelf
252	Polar region
253	Philosophy
254	Psychology
255	Sociology
256	Pedagogy
257	Cultural Anthropology
258	History
259	Literature
260	Law
261	Economics

Appendix2

Research Field List

No.	Priority research fields	Categories
0101	Life science	Genomes
0102	Life science	Medicine and medical care
0103	Life science	Food science and technology
0104	Life science	Neuroscience
0105	Life science	Bioinformatics
0106	Life science	Environment and ecology
0107	Life science	Materials production
0189	Life science	Basic biology
0199	Life science	Others
0201	Information communications	High speed network technology
0202	Information communications	Security technology
0203	Information communications	Service and application related technology
0204	Information communications	Home appliance networking technology
0205	Information communications	High speed computing technology
0206	Information communications	Simulation technology
0207	Information communications	High speed mass storage
0208	Information communications	Input and output technology*1
0209	Information communications	Human arbitrary and meaning understanding technology
0210	Information communications	Sensor technology
0211	Information communications	Human interface evaluation
0212	Information communications	Software technology
0213	Information communications	Device technology
0289	Information communications	Shared basic research
0299	Information communications	Others
0301	Environment	Global environment
0302	Environment	Regional environment
0303	Environment	Environmental risk
0304	Environment	Recycling-oriented social systems
0305	Environment	Biodiversity
0389	Environment	Shared basic research
0399	Environment	Others
0401	Nanotechnology, materials	Nanomaterials (electronic, magnetic, optic application, etc.)
0402	Nanotechnology, materials	Nanomaterials (structural material application, etc.)
0403	Nanotechnology, materials	Nano-information device
0404	Nanotechnology, materials	Nano-medical and life science application
0405	Nanotechnology, materials	Nanobiology
0406	Nanotechnology, materials	Energy and environmental application
0407	Nanotechnology, materials	Surface and interface
0408	Nanotechnology, materials	Measurement technology and standard technology
0409	Nanotechnology, materials	Processing, synthesis, and process
0410	Nanotechnology, materials	Basic properties
0411	Nanotechnology, materials	Calculation, theory, and simulation
0412	Nanotechnology, materials	Materials and technologies to create safe space
0489	Nanotechnology, materials	Shared basic research
0499	Nanotechnology, materials	Others

No.	Priority research fields	Research categories
0501	Energy	Fossil fuel and artificial fuel
0502	Energy	Nuclear energy
0503	Energy	Natural energy
0504	Energy	Energy conservation and energy utilization
0505	Energy	Environmental load reduction
0506	Energy	Cooperation and contribution to international society
0589	Energy	Promotion of basic scientific technologies
0599	Energy	Others
0601	Manufacturing technology	High precision technology
0602	Manufacturing technology	Precision part processing technology
0603	Manufacturing technology	High value added extreme technology (micromachine etc.)
0604	Manufacturing technology	Technologies to minimize environmental load
0605	Manufacturing technology	Quality control and manufacturing floor safety technology
0606	Manufacturing technology	Advanced production technology
0607	Manufacturing technology	Medical and welfare equipment
0608	Manufacturing technology	Assembly process
0609	Manufacturing technology	System technology
0689	Manufacturing technology	Shared basic research
0699	Manufacturing technology	Others
0701	Social infrastructure	Researching mechanisms of and forecasting abnormal natural phenomenon
0702	Social infrastructure	Researching applied technology for mitigating disaster damage
0703	Social infrastructure	Advanced disaster prevention support systems
0704	Social infrastructure	Disaster prevention technology
0705	Social infrastructure	Measures to deal with deterioration of social infrastructure
0706	Social infrastructure	Safety measures for semi-hazardous and hazardous substances
0721	Social infrastructure	Rebuilding living areas in harmony with the environment
0722	Social infrastructure	Broadly-based regional research
0723	Social infrastructure	Improving water cycle and implementing water management
0724	Social infrastructure	Developing new transportation systems geared to the new flow of people and materials
0725	Social infrastructure	Barrier-free access
0726	Social infrastructure	Adoption of universal design
0789	Social infrastructure	Shared basic research
0799	Social infrastructure	Others
0801	Frontiers	Planetary science(including astronomy)
0802	Frontiers	Space exploitation
0821	Frontiers	Marine science
0822	Frontiers	Marine development
0889	Frontiers	Shared basic research
0899	Frontiers	Others
0900	Humanities and sociology	
1000	Natural science	

*1: Indicates technology that simplifies input/output with information communications systems. Note that this does not apply to Research Category Nos. 209 to 211.

Appendix3

Applications using the Cross-ministerial R&D Management System (e-Rad)

1 e-Rad application

The research proposals for CREST and PRESTO in FY2009 will be made using the Cross-ministerial R&D Management System (e-Rad). The e-Rad application procedure is in the following table.

e-Rad application procedure chart

（1） Registration of research institution and registration of researcher information (advance preparations)
(Acquisition of login ID and password)
Please carry out registration procedure with the margin for two weeks or more.

⇩

（2） Download the Research Proposal Application Form from e-Rad
http://www.e-rad.go.jp/ **(Japanese only now)**

⇩

（3） Prepare the Research Proposal Application Form

⇩

（4） Enter necessary items in e-Rad and upload the Research Proposal Application Form
Since e-Rad is crowded, please finish just before a deadline by the deadline previous day.

⇩

（5） Check the situation of application information in the e-Rad portal site.
【PRESTO】Application deadline：May 12, 2009 (Tue.) at 12 p.m. (noon)
【CREST】Application deadline：May 19, 2009 (Tue.) at 12 p.m. (noon)
The application for CREST and PRESTO doesn't need the approval of research institution.

⇩

（6） Received by JST
Check the situation of application information in an e-Rad portal site.

About the Cross-ministerial R&D Management System (e-Rad)

The Cross-ministerial R&D Management System (e-Rad) is an online, cross-ministerial system to manage the process relating to R&D management (invitation for application → selection → adoption → adopted subject management → research achievements report) centering on competitive funding over which each ministry holds jurisdiction. "e-Rad" is the nickname for the system and is an acronym for "electronic system for research and development."

2 e-Rad hours of operation, Inquiry Counter

(1) e-Rad hours of operation

(Mon. to Fri.) 6:00 p.m. to 2:00 a.m. (the next day)

(Sun.) 6:00 p.m. to 2:00 a.m. (the next day)

Operation is suspended on Saturdays. On National Holidays, the system can be used within the abovementioned timeframe. However, even within the normal hours of operation, the system may be suspended for maintenance purposes. Temporary suspensions will be announced on the e-Rad Portal Site.

(2) Inquiry Counter

Inquiries about the Program are received through JST as always. Contact the e-Rad Helpdesk for inquiries on e-Rad operation.

Please refer to the JST Research Proposal Invitation for Applications Portal Site or the e-Rad Portal Site ("Portal Site") before submitting your inquiry.

・JST Research Proposal Invitation for Applications Portal Site：
http:/http://www.jst.go.jp/kisoken/teian-en.html

・e-Rad Portal Site：http://www.e-rad.go.jp　(Japanese only now)

For inquiries on the program in general or on procedures such as the drafting and submittal of the application form	JST Strategic Creation Office, General Research Field Management Division, Research Promotion Section	＜Please contact by email (unless in emergencies)＞ E-mail： rp-info@jst.go.jp［for applications only］ Telephone: 03-3512-3530［for applications only］ （Office hours：10:00–12:00／13:00–17:00*） *Except Saturdays, Sundays, and National Holidays
Inquiries on e-Rad registration of research institutions or researchers and on its operation	e-Rad Helpdesk	For research institute administrators and researchers not affiliated to an institute ※　Researchers affiliated to a research institute are to inquire through their institute Telephone: 0120-066-877（toll free） Office hours：9:30–17:30* *Except Saturdays, Sundays, and National Holidays

3 Cautionary items when using e-Rad

1) Registration of research institutes

For applications by CREST Research Directors or PRESTO individual researchers, registration of the research institutes to which researchers are affiliated is necessary on e-Rad by the time of application submission. See the e-Rad Portal Site for the research institute registration method. The application procedure takes several days to complete; therefore, please register at least two weeks in advance. After registration is complete, there is no need to re-register when other ministries invite applications for their programs or projects. Also, it is not necessary to re-register when registration is already complete for programs or projects at other ministries."

2) Registration of researcher information

CREST Research Directors or PRESTO individual researchers must register researcher information on e-Rad and an e-Rad login ID and password must be obtained. (No login ID is required for a CREST Collaborative research group leader at the time of application; however, one is required when accepted). The information on researchers affiliated with research institutes is to be registered by the administrative staff of those institutes. The information on researchers not affiliated with a research institute is to be registered by the e-Rad system administrator. See the e-Rad Portal Site for the necessary procedure. Registration takes several days so please register at least two weeks in advance.

4 Submittal documents cautionary items

Portal Site	http://www.e-rad.go.jp/
Submittal deadline	**【PRESTO】Application deadline：May 12, 2009 (Tue.) at 12 p.m. (noon)** **【CREST】Application deadline：May 19, 2009 (Tue.) at 12 p.m. (noon)**
Cautionary items ・e-Rad usage method	・ Submit information using e-Rad. The e-Rad operational manual can be downloaded from the Portal Site. ・ After confirming the contents of the program, please download the prescribed form. ・ Please apply by preparing the Research Proposal Application Form (uploadable file) either in MS Word or PDF format. See the Portal Site for the operation systems recommended for the MS Word or PDF format. ・ Image file formats attachable to the Form are GIF, BMP, and PNG only. Any other formatted file cannot be properly converted to PDF. ・ The maximum size for an uploaded file is 3 MB. Multiple files cannot be uploaded. ・ Application documents are automatically converted to PDF when uploading. ・ Text may be disrupted when using a foreign or special writing system. Please be sure to check converted PDF file contents in the System. Please refer to the manual on allowable writing systems. ・ After uploading the Form, it is possible to amend the information until submission by the researcher to JST. No amendments can be made after JST submission. Although approval is not necessary from the affiliated research institute, the administrative staff of affiliated research institutes can view the information submitted. ・ Application documents whose reception status on the Reception Status window in the System is "In Progress" after the deadline for submittal has elapsed will be rejected. ・ The reception status of application forms can be confirmed on the Reception Status window.

[Inquiry Counter]

Inquiries are preferable to be made by e-mail, except the case of urgency.

- Please note that the updated information will appear in the homepage for Application of Research Proposals to which you can refer.

  http://www.jst.go.jp/kisoken/teian-en.html

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Department of Research Promotion
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Tel: 03-3512-3530 [Application only] (Mon. – Fri. 10:00–12:00 / 13:00–17:00*)
*Except for public holidays