FY2015

STRATEGIC BASIC RESEARCH PROGRAMS
(CREST/PRESTO)

Invitation for Application of Research Proposals
[Second Term Application Guidelines]

Department of Innovation Research
Japan Science and Technology Agency

June, 2015

Introduction: In Issuing the Invitation for Research Proposals

1. Purpose and Overview of Strategic Basic Research Programs

The purpose of Strategic Basic Research Programs and an overview of program operations aimed towards achieving goals are as follows. We are eagerly awaiting applications to and participation in the programs from researchers valiantly undertaking challenging research that creates a wellspring of top innovation from excellent basic science.

1.1 Purpose of the Programs

The purpose of Strategic Basic Research Programs is to advance strategic basic research under policies determined by the Japanese Government, and create the seeds of innovative technologies from new scientific knowledge that gives rise to scientific and technical innovation leading to social and economic change.

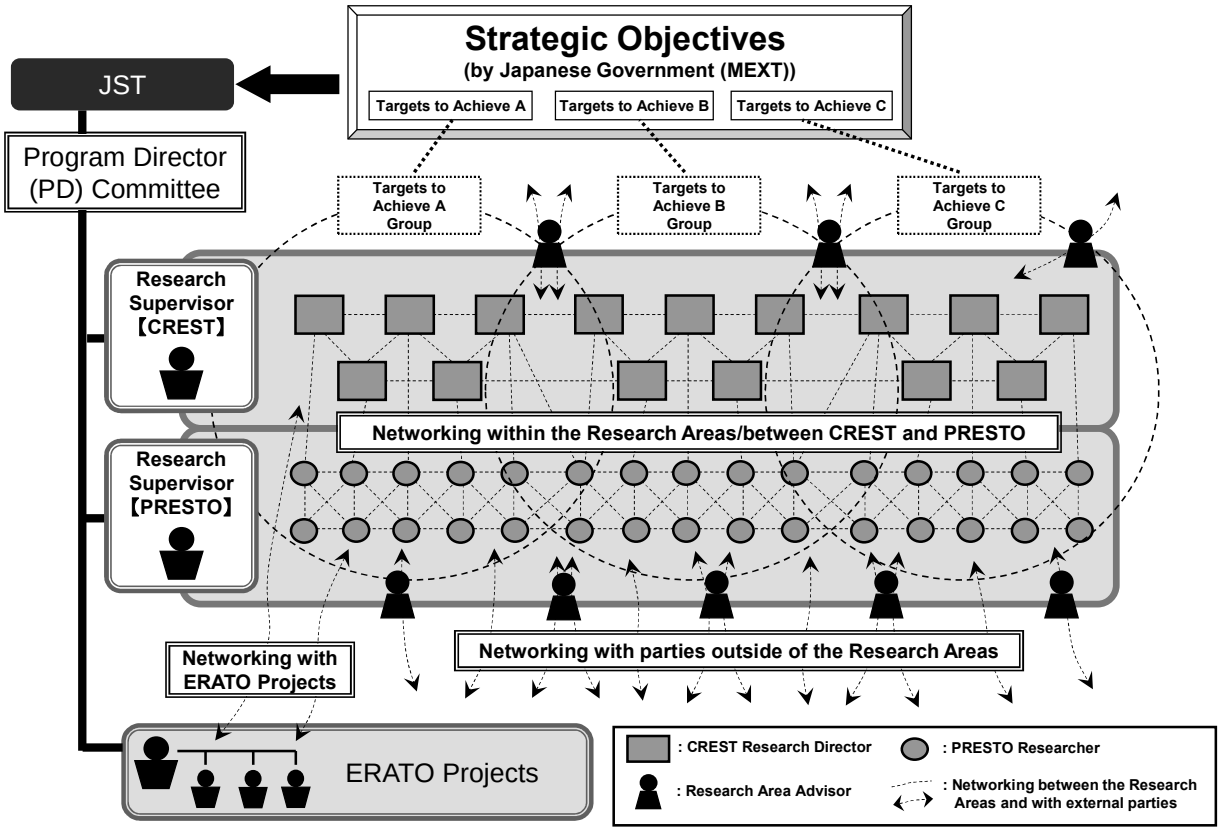
1.2 Overview of the Programs

Based on the national government's science and technology policies and social and economic needs, under "Strategic Objectives" prescribed by the Ministry of Education, Culture, Sports, Science and Technology, JST specifies Research Areas to pursue and Research Supervisors (Program Officers) to lead them. The Research Supervisor pursues strategic basic research aimed at creating the seeds of innovative technologies that will give rise to science and technology innovations that lead to the achievement of solutions in Strategic Objectives.

Program Directors consider and propose management policies and system reforms for each Strategic Basic Research Program. For "CREST" (Research projects pursued by research teams led by Research Directors) and "PRESTO" (Research projects pursued by individual researchers) within Strategic Basic Research Programs, JST specifies Research Areas and Research Supervisors (Program Officers) based on prior evaluations by Program Directors.

The Research Supervisor oversees Research Areas as a "virtual research institute". More specifically, the Research Supervisor acts as the lab director, builds a time-limited system for conducting research by organizing a research project and assembling an optimal mix of researchers from existing institutions and research fields—from industry, academia, and government— and, enlisting the cooperation of Research Area Advisors and others, oversees work in the Research Area to accomplish Strategic Objectives. CREST Research Directors and PRESTO individual researchers, while receiving support from Research Supervisors in accordance with their operating policies, actively build and utilize personal networks through dialogue with Research Area Advisors and others and connections with participating researchers, as well as through relationships with others inside and outside the country, and apply these networks in advancing the research projects they have proposed to achieve innovations in science and technology.

Standard Model for CREST / PRESTO “Virtual Research Institute”



- Strategic Objectives
  - The National Government (Ministry of Education, Culture, Sports, Science and Technology) prescribes Strategic Objectives based on national science and technology policies and social/economic needs.
  - Approx. 3 “Targets to Achieve” for realizing the Strategic Objectives are presented
- Program Director Committee
  - Presentation and sharing of virtual research institutes’ cross-program operational policies
  - Preliminary evaluations of new Research Areas and Research Supervisors
  - Most appropriate distribution of resources and promotion/coordination of collaboration across Research Areas

*Depending on the Strategic Objectives, Research Areas are set for either, both, or a combination of CREST and PRESTO.

- Research Supervisor (Program Officer)

With the aims of generating innovation and achieving Strategic Objectives,

- Formulates and shares operational policies for Research Areas and manages the Research Area with the cooperation of Research Area Advisors (including selection/evaluation of research projects).
- Provides leadership and support in the formation of networks inside/outside the Research Area with eyes to the advancement of science and technology innovation

2. For Researchers Considering Applying for /Participating in the Programs

2.1 Regarding the Proactive Participation in/Contribution to the Programs by Young Researchers

Regarding the Proactive Participation in/Contribution to the Programs by Young Researchers

The intent of these programs is to generate excellent new technological seeds aimed at science and technology innovation in the future. In order for Japan to be a science and technology power moving into the future and continuously generate science and technology innovation, nurturing and supporting the activities of young researchers—next-generation human resources who will lead science and technology in the future—is regarded as the most important factor. Strong expectations are held for young researchers to unflinchingly take on the challenge of innovative research using these programs as their fields of activity, broadening their activities and achieving tremendous breakthroughs.

Many outstanding young researchers have participated in the Strategic Basic Research Program “PRESTO” in the past. With Research Supervisors and Research Area Advisors playing the role of so-called “mentors” and research areas providing young researchers with a forum for mutual inspiration, support is provided to enable young researchers to achieve growth for themselves. We are eagerly awaiting applications to and proactive participation in the PRESTO program from even more younger-generation researchers than ever before.

In addition, under the Strategic Basic Research Program “CREST”, multiple young researchers participate in each research project under the guidance of Research Directors (PI). Please be aware in advance that these PIs bear tremendous responsibility for the future careers of the young researchers under their supervision, and they are requested to consider the future career paths of participants after the project has concluded and provide their cooperation in producing human resources who can play an active role in a diversity of industry-academia-government fields. JST, too, will consider ways of providing support through measures such as creating opportunities for young researchers to inspire and stimulate each other to ensure that the program is a forum for young researchers’ growth.

Revolutionary research that turns stereotypes on their heads is frequently born from the flexible ideas of young people, and we look forward to many young researchers participating in these programs.

Shoichiro TONOMURA
Executive Director
Japan Science & Technology Agency (JST)

2.2 Promotion of Diversity

JST Promotes Diversity!

JST promotes diversity by not only encouraging mutual respect between a diversity of human resources as they each demonstrate their abilities to the maximum, but also emphasizing the diversity of each individual's career and working style. JST generates innovation through diversity, resolving problems for future society and contributing to the strengthening of Japan's industrial competitiveness and spiritual enrichment.

Furthermore, with regard to the "Childbirth, Child-raising, Nursing Care Support System" (renamed the "Childbirth, Child-raising, and Other Support System" from FY2015), based on the voices of researchers who are users of this system, JST is contributing to the generation of innovation in Japan through the creation of an environment that enables researchers who have taken leave to return to research while also revising and improving the support system.

When inviting applications for new research projects and during the screening process, applications are also considered from the perspective of diversity. We look forward to researchers actively applying to join these programs.

Michiharu NAKAMURA
President
Japan Science & Technology Agency (JST)

We Are Waiting for Your Application!

JST promotes diversity under the concept that diversity is a tool for understanding people who think differently from yourself and fusing your thinking with that of the other person to create new value.

While the role of women in diversity is very important, JST's diversity policies are also aimed at young researchers and researchers who have foreign citizenship. To ensure that each individual researcher is able to fully exercise their skills, JST provides continual support for researchers' childbirth, child-raising, and nursing care (for elderly relatives), and also endeavors to maintain a balanced membership composition in committees, etc.

JST diversity is aiming to open the way to a new future by responding flexibly to various problems in cooperation with many people with a diverse range of experiences and ways of thinking. JST promotes diversity for not only JST employees but for all people utilizing the JST system. We look forward to receiving your proactive application to the programs.

Miyoko WATANABE
Office for Diversity and Inclusion

Department of Personnel
Japan Science and Technology Agency (JST)

JST is implementing supportive measures to assist researchers achieve balance between their research work and life events (gender equality expenses assistance that can be used to advance the R&D being carried out by the researcher in question or to reduce their financial burden) with the aim of enabling researchers to continue their R&D work without interrupting their careers due to a life event (childbirth, child-raising, nursing of elderly relatives, etc.) or in the case that the researcher must put their career on hold temporarily, enabling them to resume their R&D activities as soon as it becomes possible for them to do so and continue their career from that point onwards. JST also presents role models for female scientists. For details, please refer to the websites below.

JST's Diversity Activities
http://www.jst.go.jp/diversity/research/index.html
Female Researchers Active in CREST
http://www.jst.go.jp/kisoken/crest/nadeshiko/index.html
PRESTO's *NADESHIKO* Campaign
http://www.jst.go.jp/kisoken/presto/nadeshiko/index.html

2.3 Dialogue with Citizens on Science and Technology

The "Promotion of the 'Dialogue on Science and Technology with Citizens' (A Basic Course of Action)" (announced by the Minister of State for Science and Technology Policy and the Executive Members of the Council for Science and Technology Policy on June 19, 2010) positions "conversations in which scientists explain their research activities and results to society and its citizens in easily comprehensible terms, in sincere two-way communications that encourage hope for the future" as "science and technology dialogues with citizens". Research projects receiving public research funds of 30 million yen or more per year are expected to actively engage in science and technology dialogues with citizens. For details, please refer to"2.3.4 Responsibilities of Research Directors" and the following website:

http://www8.cao.go.jp/cstp/output/20100619taiwa.pdf

2.4 Open Access

JST announced its policy regarding Open Access in April 2013. It is recommended that research results (papers) produced under the CREST or PRESTO programs are made open to the public via institutional repositories or open access publications. For details, please refer to the following website.

http://www.jst.go.jp/EN/about/pdf/OpenAccessPolicy.pdf

3. Towards the Promotion of Fair and Honest Research

Towards the Promotion of Fair and Honest Research

Science is a system of knowledge built up by many of our predecessors that is based on rationality and experimental proof, and scientific researchers generate new knowledge based on the foundation of scientific knowledge already accumulated. Members of the general public also share scientists' curiosity and interest regarding the creation and discovery of new knowledge. Furthermore, the impact science and technology exerts on society is growing larger and larger, and expectations are also growing for science and technology to solve many of the issues facing society.

Against this background, as you know, there has unfortunately been a string of incidents of misconduct in research activities and inappropriate usage of research funding, and knowledge of these incidents has also spread throughout society.

Given this opportunity, I believe that researchers need to renew their awareness of their position in pursuing research independently based on the deep trust and mandate of society, again confirming that as part of their responsibility as researchers, they themselves will carry out their research fairly and honestly, and will not resort to misconduct or inappropriate usage of funding.

In particular, I believe that laboratory heads and other researchers in the position of supervising others have a responsibility to guide and train young researchers—the leaders of science and technology in the future—taking the initiative and setting an example in nurturing young researchers with regard to not only research integrity and rules but also methods of obtaining, processing, and recording research data and handling laboratory notes—what can be said to be fundamental research activities—to ensure that the futures of young researchers are not lost due to misconduct or inappropriate usage of funding.

In collaboration with related institutions, JST is also endeavoring to develop and provide educational materials on research integrity as well as establish and diffuse flexible and appropriate rules for utilizing research funding. In addition, in the unlikely event that misconduct or inappropriate usage of funding does occur, JST deal with such incidences rigorously in cooperation with the relevant research institution, etc. Though these efforts, JST is endeavoring to further foster an environment in which neither misconduct nor inappropriate usage of funding occur and where they are not allowed to occur.

Shoichiro TONOMURA
Executive Director
Japan Science & Technology Agency (JST)

JST takes the following measures in response to misconduct in research activities and inappropriate usage of research funds. Researchers participating in the Strategic Basic Research Programs and their affiliated research institutions are asked to comply with these measures.

(1) Enrolling in Educational Programs on Research Integrity

Beginning with the Invitation for Research Proposals for FY2015, JST requires as a condition of application for the program that the research project applicant has completed an educational program on research integrity.

In addition, in the case that the research proposal is accepted, the Research Director and participants in the research project are required to take a JST-designated e-learning program on research integrity (measure introduced in FY2013)

For details regarding the above, please refer to “6.1 Enrolling in and Completing the Educational Programs on Research Integrity” and comply with the measures promptly.

(2) Measures Regarding the Inappropriate Usage of Research Funds

In the case of inappropriate usage of research funding provided under this program,, the research project in question will be cancelled and all or part of the project’s research funding, etc. must be returned. Furthermore, depending on the details of the misconduct, limitations may be placed on the eligibility of those involved to apply for or participate in these programs or other Ministry of Education, Culture, Sports, Science and Technology (MEXT) competitive funding systems, competitive funding systems allocated by independent administrative agencies under the auspices of MEXT (hereinafter referred to as “MEXT-related competitive funding systems”), or competitive funding allocated by independent administrative agencies under other ministries and agencies..

(3)Measures Regarding the Implementation of Research Funding Management/Auditing Systems and Responses to Misconduct at Research Institutions

Research institutions need to take responsibility, implementing a system for managing and auditing research funds, ensuring that research funding is spent appropriately, and taking measures against misconduct etc. including compliance education. Furthermore, in the case that an accusation of misconduct is leveled at a research institution, a prescribed investigation must be conducted and the findings reported to JST. In the case that the actions taken by the institution are found to be inadequate, funding for indirect costs may be reduced.

For details, please refer to “6.5 Implementation of Proper Systems for Managing and Auditing Research Funds at Research Institutions”.

(4) Measures Regarding Misconduct in Research Activities

In the case that misconduct in research activities (fabrication, manipulation, plagiarism, etc.) is discovered, the research project in question may be cancelled; all or part of the project’s research funding

returned, and measures taken to publicize the facts of the matter. Furthermore, depending on the details of the misconduct, limitations may be placed on the eligibility of those involved to apply for or participate in these programs or other MEXT-related or national government ministry competitive funding systems.

For details, please refer to “6.6 Measures regarding Misconduct in Research Activities”.

References

The above measures shall be implemented in accordance with these application guidelines and the contract research agreement concluded between the research institution in question and JST based on related national government guidelines. The main related national government guidelines are as follows.

- “Guidelines for the Appropriate Implementation of Competitive Research Funding” (decided by the Liaison Conference among Relevant Ministries on Competitive Funds on September 9, 2005; revised October 17, 2012)
- “Guidelines on Management and Audit of the Public Research Expenses in Research Institutions” (decided by the Minister of Education, Culture, Sports, Science and Technology on February 15, 2007; revised February 18, 2014)
- “Guidelines for Responding to Misconduct in Research Activities” (decided by the Minister of Education, Culture, Sports, Science and Technology on August 26, 2014)

Chapter 1 Overview of Research Proposal Solicitation

1.1 Solicitation Period and Requirements

The FY2015 call for and selection of research proposals will take place in two terms, one for existing research areas and the other for research areas newly established in FY2015. The Second Term Application Guidelines apply to research proposals for the new research areas established in FY2015, given in "1.2 Research Areas for which Proposals will be Solicited".

A researcher who submits a proposal for the Call for Research Proposals (First Term) may also submit a proposal to the Call for Research Proposals (Second Term). Proposal selections, however, will be limited to only one research area. Before submitting the proposal, please understand the contents in "Chapter 7 Limitations on the Overlap of Proposals within the Strategic Basic Research Programs".

	Program	Research Areas for which Proposals will be Solicited	Research Proposal Solicitation Period
First Term Invitation for Application of Research Proposals	CREST	Research Areas Established in Fiscal Years 2013 and 2014	
	PRESTO	Research Areas Established in Fiscal Years 2013 and 2014	
Second Term Application Guidelines Second Term Invitation for Application of Research Proposals	CREST	New Research Areas Established in FY2015	Tuesday, June 16, 2015 to 12:00 P.M. (Japan Time) on Tuesday, August 4, 2015
	PRESTO	New Research Areas Established in FY2015	

1.2 Research Areas for which Proposals will be Solicited

Under the Second Term Application Guidelines, CREST will invite research proposals for 4 Research Areas, and PRESTO for 6 Research Areas.

○ CREST

Research Areas	Strategic Objectives	Since
Advanced core technology for creation and practical utilization of innovative properties and functions based upon optics and photonics (Research Supervisor: Ken-ichi Kitayama)	Pioneering next-generation photonics through the discovery and application of novel optical functions and properties	FY2014
Scientific Innovation for Energy Harvesting Technology* (Research Supervisor: Kenji Taniguchi) (Deputy Research Supervisor: Hiroyuki Akinaga)	Elucidation of principles for innovative energy conversion functions, and generation of new substance creation, new device creation, and other core technologies, that will contribute to the high-efficiency conversion and advanced application of microenergy	
Innovative catalysts and creation technologies for the utilization of diverse natural carbon resources (Research Supervisor: Ueda Wataru)	Invention of innovative catalysts using diverse natural carbon resources	
Creation of fundamental technologies contribute to the elucidation and application for the robustness in plants against environmental changes (Research Supervisor: Satoshi Tabata)	Establishment of environmentally-adaptive-plant design systems for stable food supply in the age of climate change	

* Please note the call for proposals of this research area is open for both CREST and PRESTO.

○ PRESTO

Research Areas	Strategic Objectives	Since
Fully controlled photons and their proactive usage for new era creation (Research Supervisor: Ken-ichi Ueda)	Pioneering next-generation photonics through the discovery and application of novel optical functions and properties	FY2014
Scientific Innovation for Energy Harvesting Technology* (Research Supervisor: Kenji Taniguchi) (Deputy Research Supervisor: Hiroyuki Akinaga)	Elucidation of principles for innovative energy conversion functions, and generation of new substance creation, new device creation, and other core technologies, that will contribute to the high-efficiency conversion and advanced application of microenergy	
Science and Creation of Innovative Catalysts (Research Supervisor: Hiroshi Kitagawa)	Invention of innovative catalysts using diverse natural carbon resources	
(Research Supervisor: Shinji Tsuneyuki)	Invention of innovative catalysts using diverse natural carbon resources	
	Creation of innovative core technologies by merging material technology, device technology, and nano-system optimization technology toward the realization of information devices with ultra-low power consumption and multiple functions	
	Creation, advancement, and systematization of innovative information technologies and their underlying mathematical methodologies for obtaining new knowledge and insight from use of big data across different fields	
	Establishment of molecular technology, which is the free control of molecules to bring innovation to environmental and energy materials, electronic materials, and health and medical materials	
Creation of Next-generation fundamental technologies for the control of biological phenomena in field-grown plants (Research Supervisor: Kiyotaka Okada)	Establishment of environmentally-adaptive-plant design systems for stable food supply in the age of climate change	
Innovational technical basis for cultivation in cooperation with information science (Research Supervisor: Seishi Ninomiya)	Establishment of environmentally-adaptive-plant design systems for stable food supply in the age of climate change	
	Development of mathematical sciences to describe and analyze social issues in which basic principle is unclear	

* Please note the call for proposals of this research area is open for both CREST and PRESTO.

1.3 Solicitation and Selection Schedule (Second Term)

1.3.1 Schedule for the acceptance and selection of research proposals

The FY2015 schedule for the acceptance and selection of research proposals (Second Term) is shown in the following table.

Application of proposal is implemented via e-Rad system (http://www.e-rad.go.jp/). Researchers who do not have a login ID and password should immediately complete the researcher registration procedure. As the application deadline approaches, heavy demands on the e-d system could slow the application process and even cause the application deadline to be missed. Please give yourself plenty of time to complete submission of proposal.

	CREST	PRESTO
Research Proposal acceptance begins	June 16 (Tue), 2015	
Application deadline (Deadline for submitting applications through the e-Rad System)	**12:00 P.M. (Japan time) on Tuesday, August 4 (No delays accepted)**	
Document screening period	Early September – Late September	
Notification of document screening results	Middle September – Early October	
Interview period	Late September – Middle October	
Notification / announcement of selected Research Projects	Middle November	
Research begins	After December	

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

1.3.2 Schedule for Briefings of Solicitation

Briefings of Solicitation for each research area are planned as following dates. (NOTE: only in Japanese.)

Research Area	Date	Venue
“Advanced core technology for creation and practical utilization of innovative properties and functions based upon optics and photonics”(CREST) “Fully controlled photons and their proactive usage for new era creation”(PRESTO)	June 25 (Thu) 13:30-15:30	<Kansai-Area> TKP Shin-Osaka Business Center Hall 4A
	July 3 (Fri) 13:30-15:30	<Kanto-Area> TKP Ichigaya Conference center Hall 3C
“Advanced Materials Informatics through Comprehensive Integration among Theoretical, Experimental, Computational and Data-centric Sciences” (PRESTO)	July 1 (Wed) 10:00-11:30	<Kanto-Area> JST Tokyo Headquarters Science Plaza B1 Hall
	July 2 (Thu) 11:30-12:30	<Kansai-Area> Campus Plaza Kyoto 4th Floor Lecture room 3
“Science and Creation of Innovative Catalysts”(PRESTO)	July 1 (Wed) 13:00-14:30	<Kanto-Area> JST Tokyo Headquarters Science Plaza B1 Hall
	July 2 (Thu) 13:30-15:00	<Kansai-Area> Campus Plaza Kyoto 4th Floor Lecture room 3
“Innovative catalysts and creation technologies for the utilization of diverse natural carbon resources” (CREST)	July 1 (Wed) 15:00-16:30	<Kanto-Area> JST Tokyo Headquarters Science Plaza B1 Hall
	July 2 (Thu) 10:00-11:00	<Kansai-Area> Campus Plaza Kyoto 4th Floor Lecture room 3
“Scientific Innovation for Energy Harvesting Technology” (CREST/PRESTO)	July 2 (Thu) 14:00-16:00	<Kanto-Area> JST Tokyo Headquarters K's Gobancho 2nd Floor Conference room 2A
	July 6 (Mon) 14:00-16:00	<Kansai-Area> Mielparque-osaka 4th Floor “So-re-i-yu”
“Creation of fundamental technologies contribute to the elucidation and application for the robustness in plants against environmental changes”(CREST) “Creation of Next-generation fundamental technologies for the control of biological phenomena in field-grown plants”(PRESTO) “Innovational technical basis for cultivation in cooperation with information science”(PRESTO)	July 7 (Tue) 14:00-16:00	<Kanto-Area> Waseda University Nihonbashi Campus Hall
	July 13(Mon) 10:00-12:00	<Kansai-Area> TKP Garden City Kyoto “Tachibana”

TKP Shin-Osaka Business Center: 5-13-9 Nishinakajima Yodogawa-ku,Osaka
TKP Ichigaya Conference center: 8 Ichigayahachiman Shinjuku-ku, Tokyo
JST Tokyo Headquarters (Science Plaza): Yonbancho 5-3, Chiyoda-ku,Tokyo
Campus Plaza Kyoto: Nishino-Toin-dori Shiokoji Sagaru, Shimogyo-ku, Kyoto
JST Tokyo Headquarters Annex K's Gobancho: Gobancho 7,Chiyoda-ku,Tokyo
Mielparque-osaka: 4-2-1,Miyahara, Yodogawa-ku, osaka
Waseda University Nihonbashi Campus: 1-4-1 Nihonbashi, Chuo-ku, Tokyo
TKP Garden City Kyoto: 721-1 Higashishiokoji-cho 7 jyo kudaru Karasuma Shimogyo-ku, Kyoto

(NOTE)
Briefing of Solicitation of the following Research Area has been scheduled. The information of the briefing is available from the website below;

Website for Research Proposal Solicitation;
http://www.senryaku.jst.go.jp/teian/top/setsumeikai.html

1.4 Submission of Research Proposal

Please see the following part of this guideline regarding how to submit research proposal and items to be considered.

- The items to be included in the research proposal of CREST:
  “Chapter 2 CREST 2.4 Research Proposal (Form) Completion Requirements”
- Regarding the items to be included in the research proposal of PRESTO:
  “Chapter 3 PRESTO 3.4 Research Proposal (Form) Completion Requirements”
- Regarding the way to apply the Research Proposal：
  “Chapter 8 Recruiting via the Cross-ministerial R&D Management System (e-Rad)”
- The items to be considered in application:
  “Chapter 6 Key Points in Submitting Proposals” and “Chapter 7 Limitations on the Overlap of Proposals within the Strategic Basic Research Programs.”

Chapter 2 CREST Program

2.1 CREST

2.1.1 CREST Overview

Key points and characteristics of CREST are discussed below.

a. CREST promotes goal-oriented basic research that is unique and among the most advanced of its kind in the world, in order to accomplish strategic objectives designated by the national government. CREST supports research undertaken by research teams aiming to produce outstanding results that will contribute greatly to future science and technology innovation.

b. Research Area is overseen by the Research Supervisor, who manages Research Directors at industrial, academic, or government institutions. The Research Supervisor manages Research Areas as a virtual research institute.

The Research Supervisor, in his/her role as director of a virtual research institute, enlists the cooperation of Research Area Advisors and others in managing Research Areas through the following activities.

- Specification of a management direction for individual Research Area
- Research projects selection
- Refinement and approval of research plans (including research costs and assembly of the research team)
- Participating in the research area meetings at which Research Directors report on their research progress and have their results discussed, visiting labs where research is being performed, and taking other opportunities as well to communicate with Research Directors and provide them with advice and guidance on their efforts.
- Research project evaluation
- Other necessary activities

c. A Research Director can bring multiple researchers together in a team optimal for pursuing the Research Director's proposed research initiative. A Research Director advances research that will contribute to the overall purposes of the Research Area, while bearing full responsibility for the research project he/she is leading.

2.1.2 Program Scheme of CREST

(1) Research Budgets

The budget for one research team basically ranges from 150 million yen to 500 million yen (for entire research periods up to five and a half years). In some cases the Research Areas may have independently established budget ranges, so make sure to refer to “Chapter 4 Research Areas Calling for Proposals” for details. In addition, JST, under contract research agreements, pays research institutions funds up to 30% of the research budget (direct cost) to cover overhead (indirect cost).

- Proposed research budgets are examined as part of the selection process. Actual research budgets are determined through examination and approval of research project planning. For more details, please refer to “2.3 After Selection: Proceeding with Research Work”.

(2) Research Period

The research period will be five and a half years or less, starting in December 2015 and ending in March 2021 (i.e. at end of FY2020) or earlier.

- Actual research periods depend on research project plans. For more details, please refer to “2.3 After Selection: Proceeding with Research Work”.

(3) Research Team Organization

A Research Director can bring together multiple researchers into an optimum research team.

a. The person proposing a research project, a research project applicant, can organize a research team – Research Director’s Group – consisting of only people from his/her research lab. Alternatively, when pursuing a research initiative requires it, a research team including a group (“joint research group”) of researchers or other personnel from unrelated research labs or research institutions may also be organized.

b. Among researchers comprising a research team, those representing a "joint research group" are referred to as “Lead Joint Researcher.”

c. When necessary for the pursuit of research, researcher staff, research assistants, and other personnel can be employed within the research budget and allowed to participate as members of the research team.

- For more details on research team organization requirements, please refer to "2.2.4 Proposal Submission Requirements".

2.1.3 Program Flow of CREST

(1) Solicitation and Selection of Proposals

JST solicits research proposals for individual Research Areas specified among the Strategic Objectives designated by the national government. Selection of proposals is made by the Research Supervisor, with the cooperation of Research Area Advisors and others, for individual Research Areas.

- For more details, please refer to "2.2 Solicitation and Selection of Proposals”.

(2) Research Plan Preparation

Once a proposal has been selected, the Research Director prepares an overall research plan covering the entire period of the research project. The Research Director also prepares annual research plans for each year of the project. Research plans cover budgets and research team composition.

- For more details, please refer to "2.3.1 Preparing a Research Plan".

(3) Agreements

Once a research proposal has been accepted, JST will enter into contract research agreements with the research institutions with which the Research Director and Lead Joint Researchers are associated.

- For more details, please refer to "2.3.2 Agreements".

(4) Research Work

Research work is to be performed in a five and a half year period or shorter duration that starts in December 2015 and ends in March 2021(i.e. at the end of FY2020) or earlier.

(5) Evaluation

The Research Supervisor will familiarize himself/herself with the status and results of individual research projects and, with the cooperation of Research Area Advisors and others, produce interim and post-completion evaluations. In addition to research project evaluations, Research Area evaluations are performed to examine Research Areas and the Research Supervisor. Research Area evaluations are performed on an interim and post-completion basis.

- For more details, please refer to "2.3.6 Project Evaluations" and “2.3.7 Research Area Evaluations".

2.2 Solicitation and Selection of Proposals

2.2.1 Eligible Research Proposals

(1) Research proposals are solicited for the four Research Areas mentioned in the section, “1.2 Research Areas for which Proposals will be Solicited” in Chapter 1.

(2) Carefully read the “Research Area Outline” for each of the Research Areas mentioned in “Chapter 4 Research Areas calling for Proposals” and the “Research Supervisor’s Policy on Calls for Application, Selection and Management of the Research Area” before proposing research appropriate for one of the Research Areas.

2.2.2 Solicitation Period

Tuesday, June 16 to 12:00 P.M. on Tuesday, August 4, 2015 (No exceptions).

For information on schedules for briefings, calls for proposals, etc., please refer to "1.3 Solicitation and Selection Schedule (Second Term)".

2.2.3 Numbers of Research Projects

Three to eight research projects shall be selected for each Research Area. (The number for any particular Research Area will vary depending on research intent, conditions with regard to research proposals, and budget limitations.)

2.2.4 Proposal Submission Requirements

Proposal submission requirements are as presented below in items 1), 2) and 3)..

Please make sure that you understand these requirements for your submission.

- In principle, if the determination has been made that a submission will not fulfill the requirements by the time of selection, the research proposal will either not be accepted or selected.
- If a submission has been selected, the research project must maintain its qualified status per the submission requirements for the entire duration of the period of research. If the research project fails to meet the requirements during the research period, the research project will in principle be completely or partially suspended (i.e. be terminated early).

When submitting a proposal, please do so based on an understanding of the points under (1) through (3) below, and discussed in “Chapter 6 Key Points in Submitting Proposals” and “Chapter 7 Limitations on the Overlap of Proposals within the Strategic Basic Research Programs”.

(1) Requirements for Research Project Applicants

a. Research project applicants must be affiliated with a domestic Japanese research institution, where they will organize and pursue the proposed research (The nationalities of research project applicants are not

considered.)

- The following types of people may also submit research project proposals.
  - Researchers who have foreign citizenship, but are associated with a domestic Japanese research institution.
  - Researchers who are not currently affiliated with a research institution, or are affiliated with an overseas research institution, and, if selected as a Research Director, would be able to organize and pursue research as a researcher affiliated with a domestic Japanese research institution. (Nationality will not be considered.)
- This also covers those affiliated to private sector companies and other non-university research institutions.

b. Researchers who are able to bear overall responsibility for a research project as the party responsible for the research team throughout the entirety of the research period.

- For more details, please refer to "2.3.4 Responsibilities of Research Directors".

c. The applicant must either: Have already completed the educational program for research integrity at his/her affiliated research institution; or complete the JST-provided educational program by specified period.

- For details, refer to "6.1 Enrolling in and Completing the Educational Program for Research Integrity."

d. The following two items must be verifiable upon submission.

- If the research proposal is accepted, the Research Director and research participants must not engage in misconduct in their research (fabrication, manipulation, and plagiarism) nor in inappropriate usage unlawful use of research funds.
- The research project applicants and research participants must not have engaged in misconduct in the past to achieve the research results that are mentioned in the submitted research proposal.

- The above verification will be part of the e-RaD Submission Information Entry screen.

(2) Requirements for Organizing a Research Project

The following requirements must be met. Please refer to "2.2.7. Selection Perspective item d".

a. A research team is the optimal organizational approach for pursuing the research initiatives of the research project applicant.

b. When a joint research group is organized to work with the research team, the joint research group is essential for pursuing research initiatives and can contribute greatly to achievement of the research objectives.

c. Participation of an overseas research institution research group (where a researcher affiliated with an overseas research institution participates as a Lead Joint Researcher) in a research project is contingent on whether the research concept can only be achieved with the participation of the selected overseas institution (and requires Research Supervisor approval).
The deliverables of such collaboration, including intellectual property rights, must be traceable.

- When it is desired that one or more overseas research institutions be included in a research team, please note on the research proposal (CREST – Form 12) the reasons why the participation of

research collaborator affiliated with overseas research institutions is required. Please refer (3) b. in the following clause.

d. Researchers who are presently PRESTO researchers cannot function as Lead Joint Researcher (Except in cases in which PRESTO research work will be concluded in FY2015.)

(3) Research Institutions Requirements

a. The research institutions (where the proposed research project will be pursued) with which the research project applicant and Lead Joint Researcher are affiliated must meet the required conditions and be able to enter into a contract research agreement with JST.

- For more details, please refer to "2.3.5 Requirements and Responsibilities of Research Institutions".

b. When a research institution is an overseas research institution, it must meet the following additional conditions.

・The overseas research institution is required to transfer, free of charge, intellectual property rights to JST. (Article 19 of the Industrial Technology Enhancement Act (Japanese version of the Bayh-Dole Act) does not apply to overseas research institutions).

・The overseas institution must be able to properly execute the budget according to the research agreement or according to JST's budget execution policy if such has been specified by JST and must be able to submit to JST a detailed statement of research expenses (equivalent to the balance book of Japanese institutions) prepared in English.

・Payments to the overseas research institution for overhead costs (indirect costs) are not to exceed 30% of the research budget.

・In principle, the overseas research institution can enter into agreements in forms specified by JST.

2.2.5 Conflicts of Interest involving Research Project Applicants and the Research Supervisor

Research project applicants shall be excluded from selection consideration when involved in a relationship involving a Research Supervisor, as described in a. through d. below. When it is unclear whether a condition applies, an inquiry should be made to rp-info@jst.go.jp before submitting a research project proposal by preparing Inquiry Form.

Inquiry Form:
http://senryaku.jst.go.jp/teian-en.html

a. The research project applicant is a relative of the Research Supervisor.

b. The research project applicant and the Research Supervisor are both affiliated with the same smallest organizational unit (e.g. same research lab) of a university, national or other national government-funded research and experiment institution. Or, the research project applicant and the Research Supervisor are affiliated with the same company.

c. The research project applicant and the Research Supervisor are presently working in close cooperation on the same joint research project. Or, have done so within the past five years.
(For example, the research project applicant and the Research Supervisor are working together on the same research project, are performing different parts of the same research project, or are co-authors of a research paper.)

d. The research project applicant and the Research Supervisor were in a close teacher-student relationship for a total of more than 10 years (not necessarily continuous), or were in a direct employer-employee relationship. “Close teacher-student relationship” means cases in which the research project applicant and the Research Supervisor were affiliated with the same research lab, and cases in which the Research Supervisor, though affiliated with a different organization, essentially functioned as a research advisor for the research project applicant.

- For Research Areas in which Deputy Research Supervisors have been established, the same provisions shall apply.
- For inquiries submitted by July 7, responses as to whether any of the relationship conditions described above have been violated shall be provided by the proposal deadline. For inquiries submitted after July 7, such responses may not be provided by the proposal deadline. Acceptance of research project proposals may be canceled if it is determined following the proposal deadline that any of the relationship conditions described above have been violated.
- Please make use of the (CREST- Attachment) Pre-Submission Check Sheet “Conflict of interests with the Research Supervisor.

2.2.6 Selection Method

For schedule information, please refer to “1.3.1 Schedule for the acceptance and selection of research proposals”.

(1) Selection Process

The Research Supervisor, with the assistance of Research Area Advisors, will make documentation- and interview-based selections for each Research Area. External evaluators may also be enlisted to for support.

Depending on the number of applicants and other factors, documentation-based selections can be performed for individual Research Areas by beginning with a preliminary selection relying mainly on the CREST research proposal form, CREST Form 2.

This preliminary selection is performed with attention paid mainly to whether proposals are suited to the purpose of the subject Research Area (whether the proposed research can be expected to contribute to achievement of the research area’s purpose) and whether the proposed research is suited to the purpose of the CREST program. Document-based selection, using CREST Form 3, will then conducted only for the research proposals suited to these purposes. For more details, please refer to the CREST Research Proposal Form, CREST-Form 2. (Whether preliminary selections will be performed will not be announced for any Research Areas.)

An investigation in addition to the considerations above might also be conducted during the selection process. Note the Research Director or the Lead Joint Researcher might be requested to submit a financial statement if they are affiliated with a profit-making-institution.

JST will thus select the Research Directors and research projects according to the selection process above.

For a list of Research Area Advisors, please visit the web page for each Research Area on the CREST website..

http://www. jst.go.jp/kisoken/crest/index.html

(2) Persons Involved in the Selection Process

To ensure fair and transparent evaluations, the following interested parties shall be excluded from the selection process, based on relationships with research project applicants, in accordance with JST rules.

a. Relatives of research project applicants.

b. Persons who were in the same department or research lab as a research project applicant at a university, national and other national government-funded research and experiment institution, or who were affiliated with the same company.

c. Persons who worked in close cooperation on a joint research project with a research project applicant. (For example, a person who worked on a joint research project, co-authored a research paper, worked toward the same objectives as a member of the same research team, performed different parts of the same research project, or were otherwise essentially affiliated with the same research group as a research project applicant.)

d. Persons who were in a close teacher-student relationship, or were in a direct employer-employee relationship, with a research project applicant.

e. Persons in relationships of direct competition with a research project of a research project applicant.

f. Persons in other relationships judged by JST to represent conflicts of interest.

(3) Interview-Based Selections and Notification of Selection Results

a. Research project applicants who have been selected for participation in the interview phase of the process based on documentation-based selection results, shall be notified of their selection in writing. They will also be provided with an overview of the interview process, schedule information, and instructions regarding matters like the submission of additional information. They may be required to submit the proposal, research plan and so on of other research grants. In case Research Director or Lead Joint Researcher belongs to profit-making-institution etc., financial statements may be required to submit.

Information on the schedule for the interview-based selection phase shall be posted on the research proposal solicitation homepage (http://www.senryaku.jst.go.jp/teian.html) as soon as it becomes available.

b. In the interview, the research project applicant shall be asked to explain the proposed research initiative. It should be noted that interviews shall basically be conducted in Japanese, but that English may be used when conducting the interview in Japanese is impractical.

c. Research project applicants who are not selected in either the document-based or interview-based selection phases shall be notified in writing.

d. Research project applicants who are selected shall be notified of their selection in writing and provided with information on procedures for commencing research.

2.2.7 Selection Perspective

(1) Selection Standards (Preliminary Evaluation Standards)

Common selection standards for all CREST Research Areas are described below. (All standards described in a.～d. must be met.)

a. Contributes to the achievement of Strategic Objective.

b. Consistent with the Research Area intent (Refer to Addendum 1. Addendum 2.)

c. Basic research that is unique, highly appreciated internationally, and expected to produce outstanding results (Refer to Addendum 3.) that contribute greatly to science and technology innovation.

d. Meets all of the following conditions.

- The research project applicant has produced research results for accomplishing research objectives.
- Promising preliminary results have been obtained for pursuing the research initiative.
-The research proposals must separately and clearly specify: (i) the background to the research initiative (its necessity and importance); (ii) the actual research record of the research project applicants; and (iii) the research initiative and plan.
- An optimal research organization is in place.
  The research project applicant will exercise strong leadership and bear responsibility for the entire research team, and, if there will be Lead Joint Researchers, they are essential for pursuing the research project applicant's research initiatives, and a collaboration framework sufficient for enabling significant contributions toward the achievement of research objectives will be constructed.
- Research budget planning necessary and sufficient for pursuing the research project applicant's research initiatives has been performed.
- The research institutions with which the research project applicant and Lead Joint Researchers are affiliated have R&D capabilities and other technical foundations in the subject research field.

Addendums

1. Regarding item b. “Research Area intent,” please refer to “Chapter 4 Research Areas calling for Proposals ” and the “Research Supervisor’s Policy on Calls for Application, Selection and Management of the Research Area” for individual Research Areas. Contained therein are discussions of selection perspectives and policies, management directions, etc. for individual Research Areas.
2. Whether the research project structure fits with the desired research project structure to optimize the entire research area under the policies and directions discussed above is another selection perspective.
3. The "results" sought for Strategic Basic Research Programs are new technologies.
   "New technologies" are science and technology R&D results that are viewed as significant for the nation's economy, but have not yet entered commercialization development (have not undergone commercial-scale testing used in commercial production).

- "New technologies" and "commercialization development" are terms used (as rendered in Japanese) in the text of the Act on the Japan Science and Technology Agency, National Research and Development Agency.

(2) Whether research budgets are characterized by "unreasonable duplication" or "excessive concentration" is a selection criterion. For more details, please refer to "6.3 Measures against Unreasonable Duplication and Excessive Concentration”.

2.2.8 Specific Project Investigation

(1) When a research project application can be supported with supplemental research data that can be obtained for little financial cost and in a short amount of time, and it is expected that the application thus supported would be appropriate for regular evaluation in the following or later fiscal years, the Research Supervisor may request the research project applicant to undertake a Specific Project Investigation separate and apart from the regular selection process.

(2) Specific Project Investigation can be performed under the condition that an application will be resubmitted for the subject Research Area in the following or later fiscal years. The resubmitted application will then be treated like other research project applications, and shown no favoritism.

(3) Specific Project Investigation cannot be applied for directly.

2.2.9 Research Proposal Forms and Completion Requirements

Please refer to "2.4 Research Proposal (Form) Completion Requirements".

- ○ The application form may differ depending on the Research Area. Download and use the application form for the Research Area you are applying to form the e-Rad website.
- ○ Some research areas settle distinct requirement for proposal (research period and research budgets). Please refer to Chapter.4 and “Research Supervisor’s Policy on Call for Application, Selection and Management of the Research Area”for detail.

2.3 After Selection: Proceeding with Research Work

2.3.1 Preparing a Research Plan

a. Once selected, the Research Director will prepare an overall research plan covering the entire research project period (up to five and a half years). The Research Director will also prepare annual research plans. Research plans include information on the research budget and research team structure. Proposed research budgets will undergo an assessment in the selection process.

b. Research plans (overall and annual plans) become official once they are checked and approved by the Research Supervisor. The Research Supervisor will offer advice and coordination assistance on the research plan, and provide instructions when necessary, based on information the Research Supervisor gains through, for example, the project selection process, discussions with Research Directors, regular progress updates, and the results of research evaluations.

c. The Research Supervisor, in approving research project plans to achieve objectives including the accomplishment of the overall objectives of a Research Area, may merge or link research projects, or take other such coordinative actions.

- ➢ Research organizations and budgets set forth in research plans may be revised during the research project period in response to overall Strategic Basic Research Program budget conditions, Research Area management actions taken by the Research Supervisor, or factors like results of research evaluations.

2.3.2 Agreements

a. Once a research project is selected, JST, in principle, will enter into a contract research agreement with the research institutions with which the Research Director and Lead Joint Researcher are affiliated.

b. If it is not possible to enter into contract research agreements with these research institutions, not possible to put in place the management and audit systems required in connection with the use of public funds, or the subject research institutions are conspicuously financially unstable, it may be impossible to pursue research at the subject research institutions. For more details, please refer to "2.3.5 Requirements and Responsibilities of Research Institutions”.

c. Patents and other intellectual property rights resulting from research shall, in accordance with contract research agreement terms, reside with research institutions under the condition that the research

institutions abide by the items provided in Article 19 (Japanese version of the Bayh-Dole Act) of the Industrial Technology Enhancement Act. However this rule does not apply to foreign research institutes.

2.3.3 Research Costs

In addition to the research costs (direct costs) and pursuant to the contract research agreement, in principle JST will pay research institutions a contract research cost, which is defined as the overhead cost (indirect cost) capped at 30% of the direct costs.

(1) Research Costs (Direct Cost)

Research costs (direct cost) means costs that are directly related to and required for the pursuit of the subject CREST research. Research costs can include:

a. Goods:

Costs for the purchase of new equipment, supplies, etc.

b. Travel:

Expenses for travel by the Research Director or research team members for purposes necessary for and directly related to the accomplishment of the subject CREST research objectives.

c. Personnel and Services:

Salaries, etc. (*1) for staff (research staff, technicians, etc. except for Research Director and Lead Joint Researcher) whose work is directly related to and required for the accomplishment of the subject CREST research objectives; personnel expenses for technicians, research assistants, etc. performing data management or other such tasks; personnel expenses for research assistants (*2); and honorariums, etc. for speakers, etc. (Companies and other organizations may differ in their handling of these expenses. Please confirm details for any particular situation by referring to the contract research agreement explanations provided in the following URL: http://www.jst.go.jp/kisoken/contract/top2.html)

d. Other:

In addition to the above, costs required for the accomplishment of the subject CREST research objectives, costs related to the presentation of research results (research paper submission fees, printing costs, etc.), equipment lease expenses, transportation costs, etc.

- The following costs are not treated as research costs (direct cost).
  - Costs for items not consistent with the subject CREST research objectives.
  - Costs that are considered to be more appropriately handled as overhead cost（indirect cost).
- When it is unclear whether a particular expense is appropriately considered a research cost (direct cost), ask JST for assistance.
- For certain items, JST has created rules and guidelines from sources like the contract research agreement, administration manuals, and a common governmental expense categorization table, and asks that these rules and guidelines be applied appropriately. Universities and other organizations (including public research institutions operated by the national government and National Research and Development agencies, and public-service corporations and other organizations recognized by JST) and companies (mainly research institutions operated by private companies and other non-university organizations) may differ in their handling of administrative matters. For more details, please refer to

the following URLs (only in Japanese).
http://www.jst.go.jp/kisoken/contract/ top2.html

*1 In hiring research staff, please give consideration to supporting the career paths of people who have recently completed their doctoral programs. For more details, please refer to “2.3.4 Responsibilities of Research Directors” and “2.3.9 Other Considerations”.

*2 Considerations in Hiring Research Assistants (RAs)

- ■ Focus on people in the latter stages of doctoral programs.
- ■ It is recommended that annual compensation approximate 2 million yen per year, or 170,000 yen per month, so please estimate research budgets based on these figures.
- ■ Judgments regarding the specifics of payment amounts, payment timing, etc. will be left to research institutions. There are no requirements concerning the payment of amounts either above or below the levels mentioned above.
- ■The prerequisite for one receiving scholarship or other program payments as an RA are that multiple funding sources are not a hindrance to the respective scholarship, program, and affiliated research institution and that expenses can be prorated to the time engaged on the other programs; otherwise.
- ■ Please refer to the guidelines on RAs in “2.3.9 Other Considerations”.

(2) Carryover

In principle, research activities are to be pursued in accordance with annual research plans. However, in consideration of the occasional difficulty of using the entirety of a particular year's research budget and the waste and inappropriate accounting practices that can emerge from unreasonable efforts to use the entirety of a particular year's research budget, JST has adopted a simple carryover system that requires no troublesome application and approval procedures for carrying over to the following year budgeted funds that were not used because progress in implementing the research plan did not warrant them. (The carryover system is for universities and other organizations that have entered into multi-year agreements.)

2.3.4 Responsibilities of Research Directors

(1) Research Directors and Lead Joint Researcher are responsible for fully recognizing that JST research budgets are funded by precious tax revenues collected from citizens, and for fairly and efficiently executing budgeted expenditures.

(2) Once a proposed research project is selected, the Research Director and Lead Joint Researcher shall affirm that they will fulfill the following requirements, presented to them via JST briefings and other means, and submit to JST a written document evidencing this affirmation.

a. Comply with application and other requirements.
b. Pledge not to become involved in research misconduct (fabrication, manipulation, plagiarism) or in the improper use of these funds.
c. To prevent any research misconduct (fabrication, manipulation, plagiarism), enroll in and complete the JST-specified research integrity educational program (the program materials are online) and to educate the research participants of the obligation to enroll in and complete the program. For details refer to “6.1 Enrolling in and Completing the Educational Program for Research Integrity.”

Note that failure to complete the research integrity educational program in c. above can result in the

suspension of the research budget until confirmation has been made that the program has been completed.
(Note) The submission of written confirmation that this item has been completed and the requirement for completion of the research integrity educational program applies to research projects selected in FY2013 and later fiscal years.

(3) The Research Director and research participants are required to complete the research integrity educational program (the program materials are online) specified by JST to prevent research misconduct (fabrication, manipulation and plagiarism). For details, refer to "6.1 Enrolling in and Completing the Educational Program for Research Integrity."

(4) Pursuing and Managing Research
a. At a minimum, entire research teams shall bear responsibility for establishing and implementing research plans.
b. Research teams shall also be responsible for submitting research reports and other required documentation to JST (including the Research Supervisor) and taking steps required for research evaluations. Research teams shall also be responsible for providing the progress and other reports the Research Supervisor may request from time to time.

(5) Research Directors together with research institutions shall appropriately manage (expenditure planning, monitoring, etc.) overall research budgets for research teams. Lead Joint Researcher together with research institutions shall appropriately manage (expenditure planning, monitoring, etc.) research budgets for his/her own research team.

(6) Research Directors and Lead Joint Researcher are asked to be mindful of research and working environments and conditions for their own group's research participants, and especially research staff and others whose employment is being funded by CREST research funds.

(7) It is recommended that Research Directors and Lead Joint Researcher actively support the development of varied domestic and international career paths for research staff who have recently completed doctoral programs and are being employed with research budget funds. In the research project selection interview, research project applicants will be asked about plans* for supporting the development of varied domestic and international career paths for research staff who have recently completed doctoral programs and will be employed with research budget funds. In addition, in interim and post-completion evaluations, questions will be asked regarding the status of career path assistance efforts and the post-completion career paths of the research staff who were the subject of career path assistance efforts. Responses to these questions may positively affect project evaluations.
※ Please refer to the details in "2.3.9 Other Considerations".

(8) Handling of Research Results
a. Given that research results were obtained with national government funding, it is asked that research results be actively reported on both domestically and internationally, with due consideration for the acquisition of intellectual property rights.

* Some activities called for by these plans can be included among research efforts.

b. When reporting on research results through research papers or other media, please indicate that the research results were obtained via the Strategic Basic Research Programs (CREST).

c. Research team members may be asked to participate in JST-sponsored domestic and international workshops and symposia, and to report on research results.

d. It is asked that active efforts be made to secure intellectual property rights. In principle, intellectual property rights are to be pursued, in accordance with contract research agreement terms, by the research institutions with which researchers are affiliated.

(9) Research Directors are asked to actively engage citizens in discussions of science and technology to promote citizen understanding and support of science and technology. Efforts to engage citizens in discussions of science and technology will be evaluated both interim and post-completion evaluations.

- Please refer to the guideline details in "2.3 Dialogue with Citizens on Science and Technology".

(10) Research Directors shall abide by research agreements entered into by JST and research institutions, and shall abide by JST's various rules.

(11) It should be noted that JST will provide research project names, names of researchers, research budget information, and other required information to the Cross-ministerial R&D Management System (e-Rad) and the Government Research and Development Database ("Chapter 6 Key Point in Submitting Proposals"). Research Directors and others, therefore, may be asked to provide various types of information in that connection.

(12) Research Directors will cooperate with Strategic Basic Research Program evaluations, accounting examinations by JST, accounting audits by the national government, and similar activities.

(13) Research Directors will cooperate by providing various types of information, responding to interviews, etc. in connection with follow-up evaluations performed sometime after project completion.

2.3.5 Requirements and Responsibilities of Research Institutions

Research Institutions (affiliated institutions of Research Directors and Lead Joint Researchers) need to make efforts to implement project properly and effectively on implementation of Strategic Basic Research Programs by keeping in mind that the research funds are national government funding and ensuring related national legal compliance.

According to the need, please make necessary arrangements with their Research Institution to obtain consent in advance.

(1) For Domestic Institutions

a. Research institutions, with an autonomously instituted management and audit system for public research budgets, are obligated to properly execute the contract research funds in accord with the "Guidelines for Management and Audit of Public Research Funds at Research Institutions (implementation standards; revised on Feb. 18, 2014)." Research institutions, in addition to reporting the status of their management and audit system for public research budgets to the Ministry of Education, Culture, Sports, Science and Technology, are also obligated to support various investigations into their system implementation and other related matters ("6.5 Implementation of

Proper Systems for Managing and Auditing Research Funds at Research Institutions").
http://www.mext.go.jp/a_menu/kansa/houkoku/1343904.htm

b. In accordance with the "Guidelines for Responding to Misconduct in Research Activities" (August 26, 2014, adopted by the Minister of Education, Culture, Sports, Sciences and Technology), Research Institutions are tasked with building a structure and driving initiatives for preventing misconduct, including the development of codes of conduct and regulations or improvement in researcher integrity as a part of their effort to prevent misconduct in research and development activities.
http://www.mext.go.jp/b_menu/houdou/26/08/1351568.htm

c. Implement proper accounting work according to the research contract and the instruction manual provided by JST, while considering flexible and efficient use of budget. For certain items, JST has created rules and guidelines peculiar to these programs from sources like the contract research agreement, administration manuals and so on. As for the items not defined, the Research Institutions receiving Grants‐in‐aid for Scientific Research may follow the handling regulations for Grants‐in‐aid for Scientific Research.

d. Research Institutions shall cooperate when submitting requested reports to JST, when JST investigates their accounting work, or when government audits are to be implemented.

e. Please cooperate with JST in promoting the conclusion of a research contract so that the research will be implemented efficiently.

f. Please make necessary reports to JST when applying for and after obtaining intellectual property rights vested in the research institutions under the research contract in accordance with Article 19 (Japanese version of the Bayh-Dole Act) of the Industrial Technology Enhancement Act. The prior permission of JST is required when establishing an exclusive license or transferring one to a third party.

g. For intellectual property rights resulting from the execution of the contracted research, agreements stipulating attribution to research institutions must be exchanged with the participating researchers. This should be specified and formulated in their employment regulations.

h. JST examines in advance the propriety and methods of a research contract with profit organizations (private enterprises or research institutions specified by JST). This examination results may require the profit organizations to follow the contract method particularly specified by JST. In some cases the profit organization may be considered unreliable for contracts and unable to do research when their financial status is remarkably unstable. In such a case, the Research Team may be forced to be reorganized.

i. Any research institution with which a research contract cannot be concluded is not able to carry out the research.

j. As part of the effort to prevent misconduct in research and development activities, JST has required researchers, who are part of newly selected research projects from FY2013 onward and who also are

affiliated with a research institution, to enroll in and complete the educational program on research integrity (The procedures required for enrollment will be handled by JST). Research institutions are to supervise, without fail, the enrollment in and completion of the program by the relevant persons.
In the event that the relevant researchers fail to complete the educational program as stipulated despite repeated reminders by JST, the research institution will be instructed to halt, partially or entirely, the execution of contract research fund payments. In line with this instruction, the research institution is to halt all use of the research funds and not restart their use until further notice from JST.

k. When national and public research institutions conclude contract research agreements, they must at their own responsibility thoroughly carry out the procedures regarding budget measures and so on prior to the start of the contract research agreement. In the event that it is judged that the requisite measures have not been taken after the conclusion of the contract this may result in punitive measures including rescission or cancelation of the contract research agreement, and the whole or partial refunding of contract research funds.

(2) For Overseas Research Institutions

a. Overseas research institutions are to autonomously institute a management and audit system for research expenses pursuant to the research agreement and any separate guidelines from JST if so stipulated. A detailed statement of research expenses (equivalent to the balance book of Japanese institutions) are to be prepared and submitted in English.

b. In principle, research agreements will be executed with the contract format specified by JST. In the event that a research contract cannot be executed, or it is deemed that the research institution in question will not execute the budget in line with JST-defined policies, research may not be conducted at that research institution.

c. From the view of the point of Security Export Control, JST may not conclude joint research agreements with such institutions as Japanese Ministry of Economy, Trade and Industry (METI) announces in the “Foreign User List*” (or “End User List”).

d. In principle, research agreements will be concluded with the contract forms specified by JST. In the event that a research contract cannot be included, or it is judged that the research institution in question is not using expenses appropriately and in line with the guidelines specified by JST, research can not be implemented at that research institution.

2.3.6 Project Evaluations

(1) The Research Supervisor shall familiarize himself/herself with research project progress and results, and, enlisting the cooperation of Research Area Advisors and others, perform interim and post-completion research project evaluations. For a project with a research term of five and a half years, the interim evaluation should be conducted around three years after the beginning of research activities, and the post-completion evaluation, immediately following or before the conclusion of research activities in

* METI has issued “Foreign User List” with the aim of strengthening the effectiveness of catch-all control on goods related to weapons of mass destruction.
http://www.meti.go.jp/policy/anpo/law_document/tutatu/t11kaisei/140401kaisei_userlist_kohyo.pdf

proportion to characteristics and developmental stages of research project.

(2) In addition to the above, project evaluations may be conducted when deemed necessary by the Research Supervisor.

(3) The results of interim evaluations and so on should be reflected in subsequent research plan revisions and resource allocations (including increases or decreases in research budgets, changes in research team structure, etc.). On occasion, measures, like actions taken to coordinate multiple research projects or terminate a research project, may be taken.

(4) After the passage of a certain amount of time following the conclusion of research activities, follow-up examinations will be conducted to look at matters such as how research results have been received and are being applied, and the activities participating researchers have taken up following their project involvement. Based on the results of follow-up examinations, external experts selected by JST will then perform follow-up evaluations.

2.3.7 Research Area Evaluations

Separate and apart from the project evaluations mentioned in 2.3.6, research areas and performance of the Research Supervisor will be examined in research area evaluations. Research area evaluations include interim and post-completion evaluations. Research area evaluations focus on matters such as the state of progress achieved toward the accomplishment of Strategic Objectives and conditions with regard to research area management.

2.3.8 Development of the results from CREST and PRESTO into Science and Technology Innovation (Development into ACCEL Program)

In FY2013, a new program (ACCEL) was launched under the Strategic Basic Research Programs umbrella for promoting Proof of Concept (POC) demonstrations for technical feasibility of innovations. This is achieved by Program Managers who, through innovation-oriented research management, accelerates and develops world-leading and outstanding research innovations.

After selection, JST may, based on its monitoring and tracking of the progress and achievements of the research project, request the researchers to consider developing their project innovations in the ACCEL program. A selection process for research project status in the ACCEL program will be held separately.

2.3.9 Other Considerations

(1) RA (Research Assistants)

The 4th Science and Technology Basic Plan states that the national government will strive to achieve as quickly as possible the 3rd Basic Plan objective of enhancing fellowships, teaching assistantships, research assistantships and other forms of financial assistance to help outstanding students pursue graduate studies with a sense of financial security and, in the process, enable 20% of doctoral students (latter stage) to receive aid equivalent to their living expenses.

Given this intent, CREST recommends that when a doctoral student (latter stage) is employed as an RA on a CREST research project, the student's compensation be set at a level approximating living expenses.

Japan's Science and Technology Basic Policy Report
IV. Enhancement of basic research and human resource development
3. Development of human resources to lead S&T
(1) Development of human resources capable of working actively in diverse scenes
(ii) Support for entry into doctoral courses and diversification of career paths

In order to encourage quality students to proceed to a graduate school's doctoral course, it is necessary to ensure various types of career paths so that students may use their expertise not only at their universities but also in industrial sectors or local communities after graduating from their school, in addition to economic support while studying at their graduate school. For this reason, the government will substantially strengthen economic support for doctoral course students, support for career development for students, graduates, etc., and other support.

<Promotional measures>
- The government will increase grant-type economic support, such as fellowships, Teaching Assistants (TA) and Research Assistants (RA), so that quality students may feel secure about proceeding to a graduate school. With this effort, the government will strive to achieve the goal set by the 3rd Basic Plan, i.e., "enabling 20 percent of doctorate course students to receive an amount equivalent to their living expenses." The government will also take measures to reduce the burden of students according to their family budget, such as by tuition reductions, scholarships and loans, and encourage universities to help themselves, such as the use of donations from the private sector.

(2) Career Paths for Young Research Staff with Doctoral Qualifications

The Ministry of Education, Culture, Sports, Science and Technology's basic policy for supporting diverse career paths for young research staff who have doctoral qualifications and are being employed with public research funds (December 20, 2011 Council for Science and Technology, Committee on Human Resources) states that it is necessary to actively support public research institutions and research directors who are using public research funds to employ young research staff with doctoral qualifications in their efforts to secure diverse domestic and overseas career paths for these young research staff members. For more details, please refer to "2.3.4 Responsibilities of Research Directors" and the following URL.

http://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu10/index.htm

2.4 Research Proposal (Form) Completion Requirements

A list of documentation to submit is shown below. Prepare research proposals by following the research proposal completion requirements beginning on the following page. Please use the Research Proposal Form of FY2015.

Some research areas require to use the original proposal forms. Please use the proposal form of the research area which you are planning to apply. Please refer to “Chapter 4. Research Supervisor’s Policy on Calls for Application, Selection and Management of the Research Area”.

Form No.	Document
1	Research Proposal
2	Research Proposal Overview and Major Achievements of the Research Director
3	Research Initiative
4	Research Project Organization 1
5	Research Project Organization 2
6	Research Budget
7	List of Achievements (Research Director) / Ex-Post Evaluation Results (Research Director)
8	List of Achievements (Lead Joint Researcher(s))
9	List of Patents (Research Director & Lead Joint Researcher)
10	Other Support
11	Measures for Protecting Civil Rights and Complying with Laws and Regulations
12	Other Special Remarks

- File sizes should not exceed 3MB in total.
- Please read “2.2.5 Conflicts of Interest involving Research Project Applicants and the Research Supervisor” or the (CREST -- Attachment) Pre-Submission Check Sheet "Relationships with the Research Supervisor.” If there is even one item for which a judgment cannot be made, submit an inquiry form to the following email address before submitting a research proposal.

  Inquiry Form:
  http://senryaku.jst.go.jp/teian.html
  Contact: rp-info@jst.go.jp

For more information on how to submit a research proposal, please refer to "Chapter 8 Recruiting via the Cross-ministerial R&D Management System (e-Rad)”.

Prior to submitting a research proposal, please confirm understanding of “Chapter 6 Key Points in Submitting Proposals” and “Chapter 7 Limitations on the Overlap of Proposals within the Strategic Basic Research Programs”.

Proposal Preparation Checklist

(CREST – Attachment)

○ Please give yourself plenty of time to go complete this checklist.

Check		Reference Material	
Have you completed e-Rad researcher registration?		Chapter 8	☐
Have you completed the educational program on research integrity?		Section 6.1	☐
Conflict of interests with the Research Supervisor:*		Section 2.2.5	
a	The research project applicant is a relative of the Research Supervisor.		No ☐
b	The research project applicant and the Research Supervisor are both affiliated with the same smallest organizational unit (e.g. same research lab) of a university, national or other national government-funded research and experiment institution. Or, the research project applicant and the Research Supervisor are affiliated with the same company.		No ☐
c	The research project applicant and the Research Supervisor are presently working in close cooperation on the same joint research project. Or, have done so within the past five years. (For example, the research project applicant and the Research Supervisor are working together on the same research project, are performing different parts of the same research project, or are co-authors of a research paper.)		No ☐
d	The research project applicant and the Research Supervisor were in a close teacher-student relationship for a total of more than 10 years (not necessarily continuous), or were in a direct employer-employee relationship. “Close teacher-student relationship” means cases in which the research project applicant and the Research Supervisor were affiliated with the same research lab, and cases in which the Research Supervisor, though affiliated with a different organization, essentially functioned as a research advisor for the research project applicant.		No ☐

*If you are not sure of a conflict of interest in any of the items above, always contact JST with your concern by clicking on the Inquiry button: http://www.senryaku.jst.go.jp/teian.html

Prior to electronic submission via e-Rad, please ensure that proposals comply with the instructions in the format specified. Just before the deadline, e-Rad System would be slow due to heavy load. Please give yourself plenty of time to complete submission of proposal.

	Items	Check point	
	Input of general information on the applicant to e-Rad	All necessary information is provided.	□
Form 1	Information on the applicant	All necessary information is provided. Information is matched with e-Rad data.	□
Form 2	Research Proposal Overview and Major Achievements of the Research Director	When converted to PDF format: Is Item 1 no more than two pages long? Is Item 2 within one page?	□
Form 3	Project Description	Form 3 must fit in 6 sheets	□
Form 4	Research Project Organization 1	All necessary information is given (Particularly, effort is provided).	□
Form 5	Research Project Organization 2	All necessary information is given (Particularly, Institution Code, Researcher ID No. and effort are provided).	□

Form 6	Budget Plan	Total Sum is matched with the research budget given in Form 1.	□
Form 7	List of Achievements (Research Director) / Ex-Post Evaluation Results (Research Director)	List a maximum of 20 principal papers.	□
Form 8	List of Achievements (Lead Joint Researcher(s))	Do not exceed 10 papers for each Lead Joint Researcher.	□
Form 9	Patent List (Research Director, Lead Joint Researcher(s))	Form 9 must fit in 1 sheet or less.	□
Form 10	Information on Other Supports	All necessary information is given.	□
Form 11	Protection of Human Rights and Compliance with Laws and Regulations	Even when this is not applicable, please indicate that.	□
Form 12	References and Additional Statement	Form 12 must fit in 2 A4 sheets	□

Instruction for research proposal preparation

(CREST-Form 1)

区分4

FY 2015 Application CREST Research Proposals

Research Area	
Title of proposed research project	
Name of Research Director	
Affiliated Institution, Section, Title	
Researcher ID No.	Enter the 8-digit "e-Rad" login ID which is provided by registering researcher information on the e-Rad system (http://www.e-rad.go.jp/).
Academic Background	List the applicant's undergraduate and graduate education as indicated below: Year: Undergraduate Institution, Major Degree, Supervisor Year: Graduate Institution, Major Degree, Supervisor
Professional Appointments	List, in chronological order, all academic/professional appointments of the applicant finishing with the current appointment. Include the name of a project leader or a supervisor who had/has been at a mentoring position for the given appointment.
Research Period	Enter beginning and ending time periods (month and year) of the proposed research project. The beginning period of the awarded projects is December, 2015 or later. [mm. yy] – [mm. yy]
Total Research Budget	Total Budget: _____ million yen

- **Proposed Research Area**
  Only one application may be submitted across all the Research Areas in CREST and PRESTO.
- **Researcher ID No.**
  Proposals must be submitted via the e-Rad system. Those who do not have Kakenhi ID or e-Rad login ID should contact their affiliated Research Institution personnel or the e-Rad Helpdesk immediately to obtain the e-Rad ID. See Chapter 8 in this guideline.
- **Academic Background & Professional Appointments**
  Make sure to list the names of the supervisor / the head of the affiliated research laboratory.
- **Research period**
  The ending time period of research projects can be set to an arbitrary date prior to March 31, 2021 (default).

(CREST-Form 2)

Research Proposal Overview and Major Achievements of the Research Director

1. Outline of Research Project

- Provide an overall description of the research proposal in less than two A4-size sheets (no exceptions). Use 10.5 point or larger font size (If these instructions are not followed, the research proposal might not be accepted).
- Form 2 chiefly covers material that is critical for documentation-based selection. It will be evaluated from the perspectives below:

a) Is it aligned with the goals of the solicited Research Area (Can the proposal be expected to contribute to fulfilling the purpose of the Research Area? Mainly, does the proposal correspond to items a. and b. in "(1) Selection Standards (Preliminary Evaluation Standards)" in Section 2.2.7, "Selection Perspective")?

b) Is it aligned with the goals of the CREST Program (Mainly, does the proposal correspond to the goal noted in c. in "(1) Selection Standards (Preliminary Evaluation Standards)" in Section 2.2.7, "Selection Perspective" for "Basic research that is unique, highly appreciated internationally, and expected to produce outstanding results that contribute greatly to science and technology innovation?")?

Therefore, in this form, provide a brief description that focuses on the details corresponding to Item 1, "Target and Objectives," from CREST Form 3 (Project Description), and provide the minimum explanation (corresponding to Items 2 to 6 on Form 3) required to understand your description above.

(The scientific/technical evaluation of the validity and feasibility of the Project Description will be considered mainly with CREST Form 3)

- A preliminary selection entailing a documentation-based selection for each Research Area may be held from the perspectives of a) and b) above.

Insert figures and tables (in color) appropriately to be undertaken clearly.

Do not exceed two A4-size sheets (no exceptions)

2. List of principal research papers / invited lectures

- On no more than one A4-size sheet (no exceptions), list your principal research papers and invited lectures (If these instructions are not followed, the research proposal might not be accepted).
- Adjustment to font size and line spacing is acceptable.
- Do not include in your list works by Lead Joint Researcher(s).

(1) List of principal research papers

- From CREST Form 7, Item 1, select a maximum of 10 principal research papers by the research project applicant who will become the Research Director and list them here (Use the same description and format as from CREST Form 7, Item 1).
- Sequentially number each item with a number at the beginning of each title.

(2) List of principal invited lectures

- List a maximum of 10 principal invited lectures by the research project applicant who will become the Research Director.

Do not exceed one A4-size sheet (no exceptions)

(CREST-Form 3)

Project Description

- Clearly state the work to be undertaken. Figures and tables (in color) may be included if necessary.
- Do not exceed six A4-size sheets (no exceptions). Use 10.5 point or larger font size (If these instructions are not followed, the research proposal might not be accepted).
- In the Project Description, make effective references to the descriptions of achievements listed in Forms 7 and 8 to clarify the relationship between the achievement and the research being proposed by the research project applicant.

1. Target and Objectives

Describe specifically:
- Objectives and goals of the proposed research project (expected achievements), and
- Significance in terms of the impact on the advancement of science and technology, potential benefits to society and creation of innovation resulting directly from above mentioned achievement.

2. Background

Describe scientific and technological needs, social demand and requests from economic and industrial interests, including the trends of the related fields to illustrate the importance and necessity of the proposed research project.

3. Research Plans and Approach

Describe the plans of the proposed research project.
- Show the outline of the time schedule to demonstrate your vision and plan specifically, how to attain "1. Target and Objectives ", while indicating milestones of research toward "1. Target and Objectives." Also, show clearly the goal to be achieved after 3 years from research start. This is one of the evaluation basis.
- Include probable challenges in accomplishing the objectives and goals and solutions for them.
- Questions and their solutions likely to be addressed for the achievement of "1. Target and Objectives." should be contained.
- It is possible to describe them per every research subject.
- Strategy to acquire intellectual property rights. Describe relevant intellectual property rights that the proposers own.

(Continued on the next page)

4. Research infrastructure and preparation

Describe research background and achievements of the Research Director and other participants that are relevant to implement the proposed research project including the following information;

- Relevant projects conducted in the past and achievements of your own research efforts (and those of other research participants, if necessary)
- Other preliminary knowledge, data, etc. (if any)
- Measures taken to the item “d” in “2.2.7 Selection Perspective”

5. Originality and novelty of the proposed research and comparison to current state of similar studies

Take into account the situation and trends of research in relevant fields, present originality and novelty of the proposed research project, and its advantages over others.

６．Future Prospect of Research

Describe expected creation of science and technology innovation, creation of new industry, acquirement and enforcement of intellectual properties, contribution to society, etc., which are likely realized in the future, by success of the achievement of the “1. Target and Objectives” in the Project Description

Do not exceed six A4-size sheets (no exceptions)

(CREST-Form 4)

Research Project Organization 1

(Research framework at Research Director's Group)

Research Director's Group (example)

Research Director	**Research Institution** [1)]	**Title**	**Effort**[2)]
○○　○○	*Department of* ***, *Graduate School of* ***, *** University*	Professor	40%
Research Participants[3,4)]	**Affiliation (Omit if the same as above)**[5)]	**Title**	
○○　○○		Professor	
○○　○○		Associate Professor	
○○　○○		Lecturer	
××　××	*** Laboratory, *** Co., Ltd.	Principal Researcher	

1) If your research project is selected, but you will be performing the research at a facility different from your current affiliated institution, provide the name of the institution at which the research will be conducted. Also please provide us with information on the situation in the Note section below.

2) "Effort" indicates 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.

3) Provide sufficient consideration to the roles played by the members of your Research group.–

4) Add additional lines for research participants as necessary. If the research staff has not been finalized at the time of the proposal, a note like "Research staff of n persons" will suffice.

5) If the same research items must be performed at multiple organizations, feel free to add the members from the other organizations as research participants (Refer also to the Q&A).

Note

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

Research subjects and overview

- **Title of research subjects in charge**
- **Overview**

Describe briefly an overview of the research subjects that the Research Director's Group will be in charge of.

Role in the entire research project

Describe the role which the Research Director’s group plays in realizing the proposed research project.

(CREST-Form 5)

Research Project Organization 2

(Research framework at the Joint Research Group)

- If a joint research group (joint research institution) other than the Research Director's affiliated institutions is required, list them in Form 5 (this form) per joint research institution.
- The joint research groups from various institutions such as industries, governments, and academia can be included in Research Director's team.
- Although there is no maximum limit of the number of the joint research groups, compose a necessary and sufficient number of groups for execution of Research Director's research idea. If Research Director does not play a leading role, or if assigned tasks of the joint research groups are not clear, the framework of team is inappropriate.
- Add or delete rows to/from the table as necessary for the number of groups.
- It is not mandatory to have joint research groups to the research team.
- Describe measures taken to the item "d" in "2.2.7 Selection Perspective"

Joint Research Group (1)

(Example)

Lead Joint Researcher	**Joint Research Institution** [1)]	**Title**	**Effort**[2)]
○○ ○○ (Researcher ID No. [6)])	**** Team, *** Department, *** Laboratory (Institution ID [7)]: ********)*	Team Leader	10%
Research Participants [3,4)]	**Affiliation** (Omit if the same as above)[5)]	**Title**	
○○ ○○		Principal Researcher	
○○ ○○		Researcher	
Will hire 2 research participants		Research Fellow	
×× ××	*** Laboratory, *** Co., Ltd.	Principal Researcher	

For 1) to 5), refer to the previous page.

6) Lead Joint Researchers shall write in ID number provided by Grant-in-Aid for Scientific Research <Kakenhi> or the e-Rad system, if any.

7) Lead Joint Researchers shall write in Institution No. of the e-Rad system, if any.

Research subjects and overview

- **Title of research subjects in charge**

- **Overview**

(Describe briefly an overview of the research subjects that this joint research group will be in charge of.)

- **Role in the entire research project and necessity**

(Describe the role which this joint research group plays in realizing the proposed research project.)

(CREST-Form 6)

Budget Plan

- Prepare the budget plan and sort it by items and by groups for each year.
- A more detailed budget plan will be requested when the proposal proceeds to the interview.
- The budget plan, after adopted, may be revised during the research period according to the state of the project, Research Area policy, and project evaluation, etc.
- Organize an optimal research team with necessary and sufficient number of groups. Appropriateness of the budget allocations to the joint research groups, and cost performance will be an important consideration as a part of the selection process.
- Describe measures taken to the item “d” in “2.2.7 Selection Perspective”

Research Budget plan by item (entire team)

(Example)

	1st Year (2015.12 -2016.3)	**2nd Year** (2016.4 -2017.3)	**3rd Year** (2017.4 -2018.3)	**4th Year** (2018.4- 2019.3)	**5th Year** (2019.4- 2020.3)	**Final Year** (2020.4- 2021.3)	**Total** (Million Yen)
Equipment	20	40	0	0	0	0	60
Materials /Consumables	20	40	30	30	20	20	160
Travel	1	2	2	2	2	1	10
Personnel and Services (Number of Researchers)	6 (2)	12 (2)	12 (2)	12 (2)	12 (2)	6 (1)	60
Other	10	0	0	0	0	0	10
Total（Million Yen）	57	94	44	44	34	27	300

Budgeted costs are itemized as follows:

Equipment: Cost for tangible properties with relatively expensive

Materials / Consumables: Cost for purchasing materials and consumables

Travel: Travel expenses of the Research Director or participants.

Personnel and Services: Personnel expenses and compensation for postdoctoral researchers, technicians, research assistants (RA*), etc.

*As for RA, please refer to “2.3.3 Research Costs” and Q&A.

(Numbers of researchers): The number of researchers, technicians, and research assistants who are newly employed for the proposed research project

Other: Costs other than the above (e.g., printing, equipment lease, freight costs, etc.)

Note

- Be thoughtful in your budget allocation to optimize each item and ratios.
- When “Personnel and Services” exceeds 50% of the total budget, or when either of “Material/ Consumables” or “Travel” exceeds 30%, justify it by providing detailed cost estimation and additional information herein.
- If the total requested budget exceeds 500 million yen, describe the "needs for large budget” herein.

(Continued on the next page)

(CREST-Form 6 cont.)

(Continued from the previous page)

Research Budget plan by group

	1st Year (2015.10 -2016.3)	**2nd Year** (2016.4 -2017.3)	**3rd Year** (2017.4 -2018.3)	**4th Year** (2018.4- 2019.3)	**5th Year** (2019.4- 2020.3)	**Final Year** (2020.4- 2021.3)	**Total** (Million Yen)
Research Director Group * University**	20	40	25	25	20	15	145
Joint Research Group (1) * University**	20	30	10	10	5	5	80
Joint Research Group (2) * Laboratory**	17	24	9	9	9	7	75
Total（Million Yen）	57	94	44	44	34	27	300

List of major equipment costing 5 million yen or more (item, estimated cost)

(Example)

*** Group

XXXXXX 15 M Yen (Million Yen)

XXXXXX 5 M Yen

XXXXXX 10 M Yen

*** Group

XXXXXX 7 M Yen

XXXXXX 10 M Yen

(CREST-Form 7)

List of Achievements (Research Director) / Ex-Post Evaluation Results (Research Director)

1. Principal papers, books, and other publications related to this research proposal

- List a maximum of 20 principal papers, books, and other publications related to this research proposal, starting from the most recent to the past in reverse sequence of year of publication.
- Follow the format below when listing research papers (For books, adhere to this format). Item sequence is not fixed.

Place an asterisk (*) at the beginning of the title of the papers referred in the Form 3.

Author(s) (all authors), title, title of journal/book, volume and page numbers, and published year.

2. Research papers/publications other than the above

- In addition to 1 above, list a maximum of 20 principal papers, books, and other publications of the Research Director, starting from the most recent to the past in reverse sequence of year of publication.
- Follow the format below when listing research papers (For books, adhere to this format). Item sequence is not fixed.

Author(s) (all authors), title, title of journal/book, volume and page numbers, and published year.

3. Results of Post Evaluations of Research Project served as Principal Investigator of competitive research funding programs and so on (only those which were open to public after FY2011.)

- Names of competitive research funding programs and so on, name of research projects and URLs of Post Evaluations

(CREST-Form 8)

List of Achievements

(Lead Joint Researcher(s))

- List selected publications of the Lead Joint Researcher, in reverse-chronological order, which are mainly considered to be relevant to the proposed research project and published in recent years. Do not exceed 10 papers for each Lead Joint Researcher.
- Follow the format below when listing research papers (For books, adhere to this format). Item sequence is not fixed.

Author(s) (all authors), title, title of journal/book, volume and page numbers, and published year.

(CREST-Form 9)

Patent list

(Research Director and Lead Joint Researcher(s))

● **Major patents**

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

(List important patent applications of recent years that are considered to be related to this proposal. Do not exceed one page.)

- **Research Director**

- **Lead Joint Researcher(s)**

(CREST-Form 10)

Information on Other Supports

List grants from the government competitive research funds (including CREST and PRESTO) and any other research subsidies (including private foundations and overseas institutions) that the Research Director and/or Lead Joint Researchers are currently receiving, applying for, or planning to apply for by program name, indicating the title of project, research period, roles, amount of annual budget, and effort. Refer also to Section 6.3 “Measures against Unreasonable Duplication and Excessive Concentration.”

(Note)

- Your entitlement to the JST funds may be cancelled at a later date even if you have been selected should your presentation fail to be accurate.

- If the results of applications for research grants become known, or if there are other changes in circumstances during the research proposal selection process that require that the information provided in this form be updated, please prepare a revised version of this form and send a message to the email address provided at the end of these requirements.

- Should you be selected for participation in the interview portion of the selection process, you may be asked to provide information on applications, plans, etc. submitted to other programs.

(Example)

Research Director (Proposer): Name: _____

Program	**Status**	**Title of Project (Name of principal investigator)**	**Research Period**	**Role (Principal Investigator or co-Principal Investigator)**	**(1) Allocated Budget (For entire period) (2) FY 2016 (planned) (3) FY 2015(planned) (4) FY 2014**	**Effort (%)**
ALCA, JST Strategic Basic Research Programs	Submitted	Achieving high performance in X by Y (** **)	2015.4 - 2021.3	Co-Principal Investigator	(1) 140 M yen (2) 35 M yen (3) 8 M yen (4)	25
Grants-in-Aid for Scientific Research, Fundamental research (S)	Awarded	Creating W by V (** **)	2013.4 - 2017.3	PI	(1) 100 M yen (2) 25 M yen (3) 25 M yen (4) 5 M yen	20

- List grants that the proposer is currently receiving, or selected, in descending order of amount of allocated budget (for the entire period). Then list those the proposer is currently applying for or planning to apply for (specify "submitted" or “preparing” in the column "Program").
- Type “Awarded” if it is currently awarded or decided to be awarded, and type “Submitted” for other status.
- Describe directorship or allocated work as "Role."
- Enter the amount of allocated budget (direct cost)."
- Enter "Effort" value of “Awarded” grants. Describe effort for grants the proposer is currently receiving assuming that the CREST proposal is selected.
- “Effort” indicates 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, Technology and Innovation). Do not enter efforts of the programs applying for, or planning to apply for. Enter only the efforts which is receiving or planning to receive on the assumption that only the CREST program is selected.
- Add rows if needed.

(Continued on the next page)

(CREST-Form 10 cont.)

(Continued from the previous page)

Lead Joint Researcher (1): Name: _____

Program	**Status**	**Title of Project (Name of principal investigator)**	**Research Period**	**Role (Principal Investigator or co-Principal Investigator)**	**(1) Allocated Budget (For entire period) (2) FY 2016 (planned) (3) FY 2015 (planned) (4) FY 2014**	**Effort (%)**
Health and Labuor Sciences Research Grants	Awarded	Real world research for Z development (** **)	2013.4 - 2017.3	PI	(1) 50 M yen (2) 20 M yen (3) 20 M yen (4) 5 M yen	10
					(1) (2) (3) (4)	

Lead Joint Researcher (2): Name: _____

Program	**Status**	**Title of Project (Name of principal investigator)**	**Research Period (fiscal year)**	**Role (Principal Investigator or co-Principal Investigator)**	**(1) Allocated Budget (For entire period) (2) FY 2016(planned) (3) FY 2015 (planned) (4) FY 2014**	**Effort (%)**
X Foundation/Y Research grant	Awarded	Aggressive research in the field of Y (** **)	2014.4 – 2016.3	PI	(1) 2 M yen (2) 0 yen (3) 1 M yen (4) 1 M yeb	15
					(1) (2) (3) (4)	

(CREST-Form 11)

Protection of Human Rights and Compliance with Laws and Regulations

- Describe the measures and actions that you will take if your research involves compliance with the related laws and regulations (e.g. research requiring the consent and the cooperation of the other party when implementing the research plan, research requiring consideration for the handling of personal information and research requiring efforts regarding bioethics and safety measures).
- This applies to surveys, research, experiments which require an approval procedure in an ethics committee inside and outside the research institution, such as for example questionnaire surveys in which personal information is involved, interview surveys, the use of provided samples, analysis study of the human genome, recombinant DNA experiments, experiments on animals, etc.
- Please indicate where this is not applicable.

(CREST-Form 12)

References and Additional Statement

- **References**

Provide the names of two (2) individuals who have good knowledge of your Research Project (non-Japanese person(s) are acceptable). Provide names of the reference person, institution and contact information (phone numbers and e-mail address). The evaluators (Research Supervisor and Research Area Advisors) may contact them regarding the research proposal during the screening process. Providing this reference information is not mandatory.

- **Additional Statement**

- In case this proposal is the second or the third one to the same research area, please state points of difference from the previous proposal.
- If participation of overseas joint research group(s) is planned, describe reasons and necessities (please refer to "2.2.4 Proposal Submission Requirements").
- Write why you are applying to the Strategic Basic Research Programs, your ambitions in your research, special awards that should be noted, plans to transfer and the reasons, and other information freely and as necessary. Do not exceed two A4-size sheets.

Chapter 3 PRESTO Program

3.1 PRESTO

3.1.1 PRESTO Overview

Key points and characteristics of PRESTO are discussed below.

a. PRESTO promotes goal-oriented basic research that is unique, challenging, and among the most advanced of its kind in the world, in order to accomplish objectives in Strategic Objectives designated by the national government. PRESTO promotes the pursuit of research through a network of individuals who, through the network, are working to produce world-class, groundbreaking results that will give rise to science and technology innovation.

b. Research areas are overseen by a Research Supervisor, who manages individual researchers and oversees research areas in a virtual research institute.
The Research Supervisor, in his/her role as director of a virtual research institute, enlists the cooperation of Research Area Advisors and others in managing research areas through the following activities.
- Specification of a management direction for individual research areas
- Research project selection
- Refinement and approval of research plans (including research costs)
- Holding research area meetings at which individual researchers report on their research progress and have their results discussed, visiting labs where research is being performed, and taking other opportunities as well to communicate with individual researchers and provide them with advice and guidance on their efforts.
- Research project evaluation
- Other activities necessary to support research activities in various ways

c. Individual researchers, in pursuing the research initiatives they have proposed, and taking responsibility for implementing their own research projects, pursue research that will contribute to the overall purposes of the research area.

3.1.2 Program Scheme of PRESTO

(1) Research Budgets

The budget for one research project basically ranges from 30 million yen to 40 million yen (for entire research periods up to three and a half years). In addition, JST, under contract research agreements, pays to research institutions amounts totaling, in principle, up to 30% of direct cost, over and above research costs (direct cost), to cover overhead cost (indirect cost).

- Proposed research budgets are examined as part of the selection process. Actual research budgets are determined through examination and approval of research project planning. For more details, please refer to “3.3 After Selection: Proceeding with Research Work”.

(2) Research Period

The research period will be three and a half years or less, starting in December 2015 and ending in March 2019 (i.e. at end of FY2018) or earlier.

- Actual research periods depend on research project plans. For more details, please refer to “3.3 After Selection: Proceeding with Research Work”.

(3) Research Organization

a. The researcher will pursue his/her research as an individual (alone). (When necessary, however, a research assistant may be appointed and paid for out of the research budget.)

b. JST conducts activities necessary for supporting research. Examples of the matters they may address include research labs and approaches, research-related public relations and outreach activities, and applications for patents.

c. Decisions with regard to research labs will be made with consideration of research details and research environments, and will be based on consultations with the researcher and the research institution where research work will be performed. It is possible for research work to be performed outside of the research institute with which the researcher is affiliated.

3.1.3 Program Flow of PRESTO

(1) Solicitation and Selection of Proposals

JST solicits research proposals for individual research areas specified among the Strategic Objectives designated by the national government. Selection of proposals is made by the Research Supervisor, with the cooperation of Research Area Advisors and others, for individual research areas.

- For more details, please refer to "3.2 Solicitation and Selection of Proposals".

(2) Research Plan Preparation

Once a proposal has been selected, the researcher prepares an overall research plan covering the entire period of the research project. The researcher also prepares annual research plans for each year of the project. Research plans cover budgets and research approach.

- For more details, please refer to "3.3.1 Preparing a Research Plan".

(3) Agreements

In advancing a research project, JST will enter into a contract research agreement with the research institution where the researcher will pursue research work.

- For more details, please refer to "3.3.2 Agreements".

(4) Research Work

Research work is to be performed in a three and a half year period or shorter duration that starts in December 2015 and ending in March 2019 (i.e. at the end of FY2018) or earlier.

(5) Evaluation

The Research Supervisor will familiarize himself/herself with the status and results of individual research projects and, with the cooperation of Research Area Advisors and others, produce post-completion evaluations immediately following the conclusion of research work. In addition to research project evaluations, research area evaluations are performed to examine research areas and the Research Supervisor.

- For more details, please refer to “3.3.7 Project Evaluations” and “3.3.8 Research Area Evaluations".

3.2 Solicitation and Selection of Proposals

3.2.1 Eligible Research Proposals

(1) Research proposals are solicited for the six research areas mentioned in the section, “1.2 Research Areas for which Research Proposals are Solicited” in Chapter 1.

(2) Carefully read the “Research Area Outline” for each of the research areas mentioned in “Research Supervisor’s Policy on Calls for Application, Selection and Management of the Research Area” of “Chapter 4 Research Areas calling for proposals” before proposing research appropriate for one of the research areas.

3.2.2 Solicitation Period

Tuesday, June 16 to 12:00 P.M. on Tuesday, August 4, 2015 (No exceptions).

For information on schedules for briefings, calls for proposals, etc., please refer to "1.3 Solicitation and Selection Schedule (Second Term)".

3.2.3 Numbers of Research Projects

The 2015 solicitation for research proposals (second term) is planned to select around 60 proposals for 6 research areas.

- The number of proposals selected may vary depending upon budgetary and other factors.

3.2.4 Proposal Submission Requirements

Requirements for those submitting proposals are discussed below.

Please make sure that you understand these requirements for your submission.

- In principle, if the determination has been made that a submission will not fulfill the requirements by the time of selection, the research proposal will either not be accepted or selected.
- If a research proposal has been selected, the Research Project must maintain its qualified status per the submission requirements for the entire duration of the period of research. If the Research Project fails to meet the requirements during the research period, the Research Project will in principle be completely or partially suspended (i.e. be terminated early).

When submitting a proposal, please do so based on an understanding of the points below and “Chapter 6 Key Points in Submitting Proposals” and “Chapter 7 Limitations on the Overlap of Proposals within the Strategic Basic Research Programs”.

(1) Requirements for Research Project Applicants

a. A research project applicant must be the person himself/herself who is going to be the individual researcher.

b. A research project applicant must be the proposer of the subject research initiative and be the researcher who will independently perform research work in pursuit of the research initiative.

- ✧ Researchers who, because of responsibilities as the head of a research lab, or for other such reasons, cannot devote themselves to the pursuit of proposed research may be excluded from consideration.

c. Research project applicants must hold Japanese citizenship or be a foreign researcher who will pursue research work within Japan.

- Researchers holding Japanese citizenship:

For proposals to perform research work at an overseas research institution, it must be possible for the subject research institution to enter into a research agreement with JST, and, when JST specifies expenditure guidelines, it must be possible to properly undertake expenditures in accordance with the specified expenditure guidelines. For more details, please refer to the next item (3) and the Q&A section at the end of this volume.

- Foreign researchers who will pursue research work within Japan:

Once selected, it will be necessary to perform the proposed research work at a domestic Japanese research institution and it must be possible to perform the proposed research work at a domestic Japanese research institution through the conclusion of PRESTO research. It will also be required that administrative tasks be handled in the Japanese language (or that the researcher's working environment allow for this.)

- Japanese researchers who will perform research work at an overseas research institution and foreign researchers who will perform research work at a domestic Japanese research institution needs to pay attention to the items below;

- Visas, visa renewals, visa changes, etc. should be arranged by each researcher. Failure of a researcher to properly meet visa requirements may result in the rejection of a research proposal or the suspension of a research project.
- In the event that a researcher is subject to export restriction due to the Foreign Exchange and Foreign Trade Act, measures will be taken including the non-adoption of the research proposal and the cancellation of the research project etc.

d. The researcher must take responsibility for his/her PRESTO research project throughout the entire research term and be capable of overseeing it to its completion.

- For more details, please refer to "3.3.5 Responsibilities of Individual Researchers".

e. The applicant must either: Have already completed the educational program for research integrity at his/her affiliated research institution; or complete the JST-provided educational program by specified period.

- For more details, please refer to "6.1 Enrolling in and Completing the Educational Program for Research Integrity".

f. The following two items must be verifiable upon submission.

- If the research proposal is accepted, the individual researcher must not engage in misconduct in their research (fabrication, manipulation, and plagiarism) nor in inappropriate usage of research funds.
- The research project applicant must not have engaged in misconduct in the past to achieve the research results that are mentioned in the submitted research proposal.

- The above verification will be part of the e-RaD Submission Information Entry screen.

(2) Requirements for Research Institutions Conducting PRESTO Research

a. Research institutions conducting PRESTO research (research institutes with which the selected

individual researchers are affiliated or the research institutes with which full-time JST researchers are affiliated) must fulfill all relevant requirements and be capable of entering into a contract research agreement with JST.

- For more details, please refer to "3.3.6 Research Institution Requirements and Responsibilities".

(3) Requirements for Performing Research Work at an Overseas Research Institution

a. Approval of the Research Supervisor (Form 7)

In the event that research is carried out at an overseas research institution etc. an approval of the Research Supervisor will be required regarding the items listed below. Those wishing to conduct the research overseas must complete Form 7 in the research proposal, stating the reasons why they wish to carry out the research overseas. In the event that approval of the Research Supervisor cannot be obtained measures will be taken including the non-adoption of the research proposal and the cancellation of the research project etc.

1. The necessity in achieving the research concept of the researchers
2. The necessity of using the overseas research institution in question

b. The research contract forms stipulated by JST

In principle, research contracts with overseas research institutions will be concluded using the contract forms specified by JST. Furthermore, when JST specifies expenditure guidelines, the research institution in question will properly undertake expenditures in accordance with the guidelines specified by JST. In the event that a research agreement cannot be concluded or it is judged that expenses are not being used in line with the guidelines on the use of expenses, measures will be taken including the non-adoption of the research proposal and the cancellation of the research project etc.

- Please refer to "3.3.2 Agreements (2) For Overseas Research Institutions" for the detail of conclusion of contract research.

3.2.5 Conflicts of Interest Involving Research Project Applicants and the Research Supervisor

Research project applicants shall be excluded from selection consideration when involved in a relationship involving a Research Supervisor, as described in a. through d. below. When it is unclear whether a condition applies, an inquiry form should be made to rp-info@jst.go.jp before submitting a research project proposal.

Inquiry Form

http://www.senryaku.jst.go.jp/teian-en.html

a. The research project applicant is a relative of the Research Supervisor.

b. The research project applicant and the Research Supervisor are both affiliated with the same smallest organizational unit (e.g. same research lab) of a university, national or other national government-funded research and experiment institution. Or, the research project applicant and the Research Supervisor are affiliated with the same company.

c. The research project applicant and the Research Supervisor are presently working in close cooperation on the same joint research project. Or, have done so within the past five years.
(For example, the research project applicant and the Research Supervisor are working together on the same research project, are performing different parts of the same research project, or are co-authors of a research paper.)

d. The research project applicant and the Research Supervisor were in a close teacher-student relationship

for a total of more than ten years (not necessarily continuous), or were in a direct employer-employee relationship. “Close teacher-student relationship” means cases in which the research project applicant and the Research Supervisor were affiliated with the same research lab, and cases in which the Research Supervisor, though affiliated with a different lab, essentially functioned as a research advisor for the research project applicant.

- For Research Areas in which Deputy Research Supervisors have been established, the same provisions shall apply when the relationships described are found to exist.
- For inquiries submitted by July 7, responses as to whether any of the relationship conditions described above have been violated shall be provided by the proposal deadline. For inquiries submitted after July 7, such responses may not be provided by the proposal deadline. Acceptance of research project proposals may be canceled if it is determined following the proposal deadline that any of the relationship conditions described above have been violated.
- Please make use of the (PRESTO - Attachment) Pre-Submission Check Sheet “Conflict of interests with the Research Supervisor.

3.2.6 Selection Method

For schedule information, please refer to "1.3 Solicitation and Selection Schedule (Second Term)”.

(1) Selection Process

For each Research Area, the Research Supervisor, enlisting the cooperation of Research Area Advisors and others, shall select research proposals based on documentation and interviews. In addition, the cooperation of external evaluators may also be enlisted. (In case research project proposers belong to profit-making-institution etc., financial statements may be required to submit.)

Depending on the number of applicants and other factors, documentation-based selections can be performed for individual Research Areas by beginning with a preliminary selection relying mainly on the PRESTO research proposal form, PRESTO Form 2. This preliminary selection is performed with attention paid mainly to whether proposals are suited to the purpose of the subject Research Area (whether the proposed research can be expected to contribute to achievement of the research area’s purpose) and whether the proposed research is suited to the purpose of the PRESTO program. Document-based selection, using PRESTO Form 3, will then conducted only for the research proposals suited to these purposes. For more details, please refer to the PRESTO Research Proposal Form, PRESTO-Form 2. (Whether preliminary selections will be performed will not be announced for any Research Areas.)

When necessary, examinations other than those mentioned above will be conducted as part of the selection process. In case research project applicants belong to profit-making-institution etc., financial statements may be required to submit.

JST shall select researchers and research projects based on the above process.

For a list of Research Area Advisors, please visit the web page for each Research Area on the PRESTO website.

http://www.jst.go.jp/kisoken/presto/index.html

(2) Persons Involved in the Selection Process

To ensure fair and transparent evaluations, the following interested parties shall be excluded from the selection process, based on relationships with research project applicants, in accordance with JST rules.

a. Relatives of research project applicants.

b. Persons who were in the same department or research lab as a research project applicant at a university, national and other national government-funded research and experiment institution, or who were affiliated with the same company.

c. Persons who worked in close cooperation on a joint research project with a research project applicant. (For example, a person who worked on a joint research project, co-authored a research paper, worked toward the same objectives as a member of the same research team, performed different parts of the same research project, or were otherwise essentially affiliated with the same research group as a research project applicant.)

d. Persons who were in a close teacher-student relationship, or were in a direct employer-employee relationship, with a research project applicant.

e. Persons in relationships of direct competition with a research project of a research project applicant.

f. Persons in other relationships judged by JST to represent conflicts of interest.

(3) Interview-Based Selections and Notification of Selection Results

a. Research project applicants who have been selected for participation in the interview phase of the process based on documentation-based selection results, shall be notified of their selection in writing. They will also be provided with an overview of the interview process, schedule information, and instructions regarding matters like the submission of additional information. Information on the schedule for the interview-based selection phase shall be posted on the research proposal solicitation homepage (http://www.senryaku.jst.go.jp/teian.html) as soon as it becomes available.

b. In the interview, the research project applicant shall be asked to explain the proposed research initiative. As part of that explanation, the research project applicant should also provide a figure for the desired overall research budget covering the entire research project period. It should be noted that interviews shall basically be conducted in Japanese, but that English may be used when conducting the interview in Japanese is impractical.

c. Research project applicants who are not selected in either the document-based or interview-based selection phases shall be notified in writing. In addition, rejection reason shall be posted separately.

d. Research project applicants who are selected shall be notified of their selection in writing and provided with information on procedures for commencing research.

3.2.7 Selection Perspective

(1) Selection Standards (Preliminary Evaluation Standards)

Common selection standards for all PRESTO Research Areas are described below. (All standards described in a. through e. must be met.)

a. Contributes to the achievement of Strategic Objectives.

b. Consistent with the Research Area intent (Refer to Addendum 1. Addendum 2.)

c. Basic research that is unique, challenging, internationally expected to develop at an advanced level, and can be expected to produce groundbreaking results (Refer to Addendum 3.) that lead to science and technology innovation.

d. The research project applicant can be expected to contribute to the development of the subject overall PRESTO Research Area and to the ongoing development of related research fields through the content of the proposed research, the applicant's research approach, and the applicant’s efforts to engage with other researchers in discussions and activities that mutually inspire.

e. Meets all of the following conditions.

- The uniqueness of the research project applicant is based on the original ideas of the research project applicant.
- Promising preliminary results have been obtained for pursuing the research initiative.
- The proposed research project is of a scale appropriate for pursuit by an individual researcher.

Addendums

1. Regarding item b. “Research Area intent,” please refer to “Research Area Outline” and “Research Supervisor’s Policy on Calls for Proposals, Selection and Management of the Research Area” mentioned in “Chapter 4 Research Areas for which Proposals will be Solicited” for individual Research Areas. Contained therein are discussions of selection perspectives and policies, management directions, etc. for individual Research Areas.

2. Whether the research project structure fits with the desired research project structure to optimize the entire research area under the policies and directions discussed above is another selection perspective.

3. The "results" sought for Strategic Basic Research Programs are new technologies.
"New technologies" are science and technology R&D results that are viewed as significant for the nation's economy, but have not yet entered commercialization development (have not undergone commercial-scale testing used in commercial production).
   - ✧ < "New technologies" and "commercialization development" are terms used (as rendered in Japanese) in the text of the Act on the Japan Science and Technology Agency, National Research and Development Agency>

(2) Whether research budgets are characterized by "unreasonable duplication" or "excessive concentration" is a selection criterion. For more details, please refer to "6.3 Measures against Unreasonable Duplication and Excessive Concentration”.

3.3 After Selection: Proceeding with Research Work

3.3.1 Preparing a Research Plan

a. Once selected, the individual researcher will prepare an overall research plan covering the entire research project period (up to three and a half years). The researcher will also prepare annual research plans. Research plans include information on the research budget and so on.

b. Research plans (overall and annual plans) become official once they are checked and approved by the Research Supervisor. The Research Supervisor will offer advice and coordination assistance on the research plan, and provide instructions when necessary, based on information the Research Supervisor gains through, for example, the project selection process, discussions with the individual researcher, regular progress updates, and the results of research evaluations.

c. The Research Supervisor, in approving research project plans to achieve objectives including the accomplishment of the overall objectives of a Research Area, may merge or link research projects, or take other such coordinative actions.

- ➢ Research budgets set forth in research plans may be revised during the research project period in response to overall Strategic Basic Research Program budget conditions, Research Area management actions taken by the Research Supervisor, or factors like results of research evaluations.

3.3.2 Agreements

(1) For Domestic Institutions

a. Once a research project is selected, JST, in principle, will enter into a contract research agreement with the research institutions where the individual researcher will perform research work.

b. If it is not possible to enter into contract research agreements with these research institutions, not possible to put in place the management and audit systems required in connection with the use of public funds, or the subject research institutions are conspicuously financially unstable, it may be impossible to pursue research at the subject research institutions. For more details, please refer to "3.3.6 Research Institution Requirements and Responsibilities".

c. Ownership of discoveries, etc. made as a result of PRESTO research, shall, in accordance with contract research agreement terms, be assigned as described below.

1. Researcher with a Joint Appointment

Patents and other intellectual property rights resulting from research shall, in accordance with contract research agreement terms, reside with the research institution under the condition that the research institution abide by the items provided in Article 19 (Japanese version of the Bayh-Dole Act) of the Industrial Technology Enhancement Act.

2. Researcher with an Exclusive Appointment

Ownership of intellectual property rights shall be determined based on the terms of the agreement entered into with the research institution where the research work was performed.

(Note) Jurisdiction for discoveries depends on rules of each institution.

As for the difference between Joint appointment and Exclusive appointment, please refer "3.3.3 Joint appointment and Exclusive appointment".

(2) For Overseas Research Institutions

a. In addition to fulfill the requirements described in "3.2.4 Proposal Submission Requirement", research agreements will be concluded with the contract forms specified by JST in principle. When JST specifies expenditure guidelines, the ability to properly undertake expenditures in accordance with the guidelines specified by JST shall be a necessary condition.

- Please refer to the following URL regarding the research contract forms.
  http://www.jst.go.jp/kisoken/presto/en/2015PRESTO/index.html

b. In case it is not possible to enter into a contract research agreement, the institution is not equipped with the system necessary for manage the research funds, etc., it may not be possible to pursue research at the subject research institution. Please refer to "3.3.6 Research Institution Requirements and Responsibilities" for detail.

c. For inventions and other intellectual property attributable to PRESTO research, overseas research institutions agree, in principle, to voluntarily assign their rights to JST, as called for in the research agreement. JST's share of such property rights shall, in principle, be shared with researchers.

3.3.3 Joint appointment and Exclusive appointment

The individual researcher whose research proposal has been selected will become affiliated with JST under

joint appointment*1 or exclusive appointment*2. In case neither appointment could be made, notify JST in advance.

- If necessary, researchers who are planning to submit a research project proposal should notify the research institutions with which they are affiliated, collaborate, etc. of their intent ahead of time.
- If necessary, a researcher may change his/her research institution affiliation or otherwise revise the terms of his/her participation during the research project period.

*1 Joint appointment: The researcher is affiliated with a university, national and public testing and research institution, National Research and Development Agencies, foundation, company, etc. and his/her participation will be based on a concurrent appointment at JST. Based on JST's regulation, JST reward the researcher a fixed amount of money monthly. The researcher shall take out social insurance at his/her affiliated institution.

*2 Exclusive appointment: The researcher is not affiliated with a research institution, company, etc. or will need to resign his/her existing appointment for certain reasons of the organization he/she currently belongs to and will participate as a researcher employed by JST. In order to be an exclusive appointment researcher, employment contract should be signed after the necessity of employment by JST is found eligible. As per JST's regulation, JST reward the researcher with an annual salary scheme. An annual salary includes salary, various allowance, bonus, etc.. As for social insurance, the researcher shall take out health insurance, welfare annuity insurance, employees' pension funds and employment insurance which JST designates.

3.3.4 Research Costs

In addition to the research costs (direct costs) and pursuant to the contract research agreement, in principle JST will pay research institutions a contract research cost, which is defined as the overhead cost (indirect cost) capped at 30% of the direct costs. In addition, when necessary a portion of research expenditures may be executed by JST.

(1) Research Costs (Direct Cost)

Research costs (direct cost) means costs that are directly related to and required for the pursuit of the subject PRESTO research. Research costs can include:

a. Goods: Costs for the purchase of new equipment, supplies, etc.

b. Travel: Expenses for travel by the individual researcher for purposes necessary for and directly related to PRESTO research. Also, expenses for a participating researcher noted in research plans to travel domestically to report on research results that were obtained by the researcher and are directly related to PRESTO research.

c. Personnel and Services: Personnel expenses for a research assistant performing work directly related to PRESTO research.

d. Other: For example, expenses related to the reporting of research results (research paper submission fees, etc.)

- The following costs are not treated as research costs (direct cost)).
  - Cost for items not consistent with PRESTO research objectives.
  - Costs that are considered to be more appropriately handled as overhead cost (indirect cost).
- For certain items, JST has created rules and guidelines from sources like the contract research agreement, administration manuals, and a common governmental expense categorization table, and asks

that these rules and guidelines be applied appropriately. Universities and other organizations (including public research institutions operated by the national government and national research and development agencies s, and public-service corporations and other organizations recognized by JST) and companies (mainly research institutions operated by private companies and other non-university organizations) may differ in their handling of administrative matters. For more details, please refer to the following URLs. (Only in Japanese)

http://www.jst.go.jp/kisoken/contract/top2.html

(2) Carryover

In principle, research activities are to be pursued in accordance with annual research plans. However, in consideration of the occasional difficulty of using the entirety of a particular year's research budget and the waste and inappropriate accounting practices that can emerge from unreasonable efforts to use the entirety of a particular year's research budget, JST has adopted a simple carryover system that requires no troublesome application and approval procedures for carrying over to the following year budgeted funds that were not used because progress in implementing the research plan did not warrant them. (The carryover system is for universities and other organizations that have entered into multi-year agreements.)

(3) Once a research project has been selected, the Research Supervisor, after consulting with the individual researcher, will officially authorize the research plan covering the entirety of the research project period and an annual research plan specifying details on matters including the budget for the first year of the project. For the second and subsequent years of research project, the annual research plan will undergo a similar evaluation and authorization procedure by the Research Supervisor. It should be noted that research budgets may be increased or decreased in response to the Research Supervisor's evaluation or in light of conditions with regard to research progress.

3.3.5 Responsibilities of Individual Researchers

(1) Individual Researchers are responsible for fully recognizing that JST research budgets are funded by precious tax revenues collected from citizens, and for fairly and efficiently executing budgeted expenditures.

(2) Once a proposed research project is selected, the individual researcher shall affirm that he/she will fulfill the following requirements, presented via JST briefings and other means, and submit to JST a written document evidencing this affirmation.

a. Comply with application and other requirements.
b. Pledge not to become involved in research misconduct (fabrication, manipulation, plagiarism) or in the improper use of these funds.
c. To prevent any research misconduct (fabrication, manipulation, plagiarism, etc.), enroll in and complete the JST-specified research integrity educational program (the program materials are online) and to educate research assistants of the obligation to enroll in and complete the program. . For more details, refer to “6.1 Enrolling in and Completing the Educational Program for Research Integrity.”

Note that failure to complete the research integrity educational requirement in c. above can result in the suspension of the research budget until confirmation has been made that the program has been completed.

(Note) The submission of written confirmation that this item has been completed and the requirement for completion of the research integrity educational program applies to research projects selected in FY2013 and later fiscal years.

(3) The Research Director and research participants are required to complete the research integrity educational program (the program materials are online) specified by JST to prevent research misconduct (fabrication, manipulation and plagiarism). For details, refer to "6.1 Enrolling in and Completing the Educational Program for Research Integrity."

(4) Research Environment and Management

Individual Researchers shall be responsible for arranging research implementation location and environments necessary for promotion of research. When serious obstruction of research implementation location and environments to promote research is found, cancellation of research project may be cancelled.

(5) Pursuing Research and Submitting Research Plans etc.

Individual Researchers shall be responsible for the general pursuit of research work and the production of research results. In addition, Individual Researchers shall prepare research plans and submit regular reports and other communications.

(6) Individual Researchers shall be responsible for matters including oversight of the expenditure and management of funds, the performance of administrative procedures, the management of research assistants, and matters related to travel.

(7) Handling of Research Results

Individual Researchers shall be responsible for reporting on the progress of research work to parties including the Research Supervisor. In addition, researchers shall present research results both inside and outside Japan and actively secure intellectual property rights. When reporting on research results through research papers or other media, researchers should indicate that the research results were obtained via the PRESTO program. Researchers shall participate in JST-sponsored domestic and international workshops and symposia to report on research results.

(8) Individual Researchers shall participate in research area retreats held by the Research Supervisor (twice annually) and engage in activities such as reporting on research results.

(9) Individual Researchers are asked to actively engage citizens in discussions of science and technology to promote citizen understanding and support of science and technology.

※ Please refer to "2.3 Dialogue with Citizens on Science and Technology" for detail.

(10) Individual Researchers shall abide by research agreements entered into by JST and research institutions or other parties, and shall abide by JST's various rules.

(11) It should be noted that JST will provide research project names, names of researchers, research budget

information, and other required information to the Cross-ministerial R&D Management System (e-Rad) and the Government Research and Development Database (“Chapter 6 Key Points in Submitting Proposals”). Individual Researchers and others, therefore, may be asked to provide various types of information in that connection.

(12) Individual Researchers will cooperate with Strategic Basic Research Program evaluations, accounting examinations by JST, accounting audits by the national government, and similar activities.

(13) Individual Researchers will cooperate by providing various types of information, responding to interviews, etc. in connection with follow-up evaluations performed sometime after project completion.

3.3.6 Research Institution Requirements and Responsibilities

Research Institutions (affiliated institutions of Individual Researchers and institutions where Individual Researchers who conclude exclusive appointments with JST pursuit research) need to make efforts to implement project properly and effectively on implementation of Strategic Basic Research Programs by keeping in mind that the research funds are national government funding and ensuring related national legal compliance.

According to the need, please make necessary arrangements with their Research Institution to obtain consent in advance.

(1) For Domestic Institutions

a. Research institutions, with an autonomously instituted management and audit system for public research budgets, are obligated to properly execute the contract research funds in accord with the “Guidelines for Management and Audit of Public Research Funds at Research Institutions (implementation standards; revised on Feb. 18, 2014)." Research institutions, in addition to reporting the status of their management and audit system for public research budgets to the Ministry of Education, Culture, Sports, Science and Technology, are also obligated to support various investigations into their system implementation and other related matters (“6.5 Implementation of Proper Systems for Managing and Auditing Research Funds at Research Institutions”).

http://www.mext.go.jp/a_menu/kansa/houkoku/1343904.htm

* In the case of researchers with exclusive PRESTO appointments, there may be occasions in which the research institute where research work is to be performed is asked to enter into an agreement (joint research agreement, etc.) other than a contract research agreement and to manage research funds in accordance with that agreement.

b. In accordance with the “Guidelines for Responding to Misconduct in Research Activities” (August 26, 2014, adopted by the Minister of Education, Culture, Sports, Sciences and Technology), Research Institutions are tasked with building a structure and driving initiatives for preventing misconduct, including the development of codes of conduct and regulations or improvement in researcher ethics as a part of their effort to prevent misconduct in research and development activities.
http://www.mext.go.jp/b_menu/houdou/26/08/1351568.htm

c. Implement proper accounting work according to the research contract and the instruction manual provided by JST, while considering flexible and efficient use of budget. For certain items, JST has created rules and guidelines peculiar to these programs from sources like the contract research agreement, administration manuals and so on. As for the items not defined, the Research Institutions receiving Grants‐in‐aid for Scientific Research may follow the handling regulations for Grants‐

in‐aid for Scientific Research.

d. Research Institutions shall cooperate when submitting requested reports to JST, when JST investigates their accounting work, or when government audits are to be implemented.

e. Please cooperate with JST in promoting the conclusion of a research contract so that the research will be implemented efficiently.

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

g. For intellectual property rights resulting from the execution of the contracted research, agreements stipulating attribution to research institutions must be exchanged with the Individual Researchers. This should be specified and formulated in their employment regulations.

h. JST examines in advance the propriety and methods of a research contract with profit organizations (private enterprises or research institutions specified by JST). This examination results may require the profit organizations to follow the contract method particularly specified by JST. In some cases the profit organization may be considered unreliable for contracts and unable to do research when their financial status is remarkably unstable. In such a case, the Research Team may be forced to be reorganized.

i. Any research institution with which a research contract cannot be concluded is not able to carry out the research.

j. As part of the effort to prevent misconduct in research and development activities, JST has required researchers, who are part of newly selected research projects from FY2013 onward and who also are affiliated with a research institution, to enroll in and complete the educational program on research integrity (The procedures required for enrollment will be handled by JST). Research institutions are to supervise, without fail, the enrollment in and completion of the program by the relevant persons.
In the event that the relevant researchers fail to complete the educational program as stipulated despite repeated reminders by JST, the research institution will be instructed to halt, partially or entirely, the execution of contract research fund payments. In line with this instruction, the research institution is to halt all use of the research funds and not restart their use until further notice from JST.

k. When national and public research institutions conclude contract research agreements, they must at their own responsibility thoroughly carry out the procedures regarding budget measures and so on prior to the start of the contract research agreement. In the event that it is judged that the requisite measures have not been taken after the conclusion of the contract this may result in punitive measures including rescission or cancelation of the contract research agreement, and the whole or partial refunding of contract research funds.

(2) For Overseas Research Institutions

a. Overseas research institutions shall prepare a management / audit system for research expenses on their responsibility based on the joint research agreements and, if they exist, expenditure guidelines designated by JST.

b. JST might examine and audit the state of execution and so on during the term of the research contract. Foreign research institutions are required to report on the state of execution and so on at JST’s request. Research projects are not able to be implemented at research institutions which are not

capable of reporting.

c. From the view of the point of Security Export Control, JST may not conclude joint research agreements with such institutions as Japanese Ministry of Economy, Trade and Industry (METI) announces in the "Foreign User List*" (or "End User List").

d. In principle, research agreements will be concluded with the contract forms specified by JST. In the event that a research contract cannot be included, or it is judged that the research institution in question is not using expenses appropriately and in line with the guidelines specified by JST, research can not be implemented at that research institution.

- Please refer to the following URL regarding the research contract forms.
  http://www.jst.go.jp/kisoken/presto/en/2015PRESTO/index.html

3.3.7 Project Evaluations

(1) The Research Supervisor shall familiarize himself/herself with research project progress and results, and, enlisting the cooperation of Research Area Advisors and others, perform post-completion research project evaluations immediately following or before the conclusion of research activities in proportion to characteristics and developmental stages of research project.

(2) In addition to the above, project evaluations may be conducted when deemed necessary by the Research Supervisor.

(3) After the passage of a certain amount of time following the conclusion of research activities, follow-up examinations will be conducted to look at matters such as how research results have been received and are being applied, and the activities researchers have taken up following their project work. Based on the results of follow-up examinations, external experts selected by JST will then perform follow-up evaluations.

3.3.8 Research Area Evaluations

Separate and apart from the problem evaluations mentioned in 3.3.7, research areas and performance of the Research Supervisor will be examined in research area evaluations. Research area evaluations focus on matters such as the state of progress achieved toward the accomplishment of Strategic Objectives and conditions with regard to research area management.

3.3.9 Development of the results from CREST and PRESTO into Science and Technology Innovation (Development into ACCEL Program)

In FY2013, a new program (ACCEL) was launched under the Strategic Basic Research Programs umbrella for promoting Proof of Concept (POC) demonstrations for technical feasibility of innovations. This is achieved by Program Managers who, through innovation-oriented research management, accelerates and develops world-leading and outstanding research innovations.

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* METI has issued "Foreign User List" with the aim of strengthening the effectiveness of catch-all control on goods related to weapons of mass destruction.
http://www.meti.go.jp/policy/anpo/law_document/tutatu/t11kaisei/140401kaisei_userlist_kohyo.pdf

After selection, JST may, based on its monitoring and tracking of the progress and achievements of the Research Project, request the researchers to consider developing their Project innovations in the ACCEL program. A selection process for Research Project status in the ACCEL program will be held separately.

3.4 Research Proposal (Form) Completion Requirements

A list of documents to submit is shown below.

Prepare research proposals by following the research proposal completion requirements beginning on the following page. Please use the Research Proposal Form of FY2015. Some research areas require to use the original proposal forms. Please use the proposal form of the research area which you are planning to apply. Please refer to "Chapter 4. Research Supervisor's Policy on Calls for Application, Selection and Management of the Research Area".

Form No.	Document
1	Research Proposal
2	Research Proposal Overview and Major Achievements of the Research Project Applicant
3	Research Initiative
4	List of publications
5	Other Support
6	Measures for Protecting Civil Rights and Complying with Laws and Regulations
7	Other Special Remark

- File sizes should not exceed 3MB in total.
- Please read "3.2.5 Conflicts of Interest involving Research Project Applicants and the Research Supervisor" or the (PRESTO -- Attachment) Pre-Submission Check Sheet "Relationships with the Research Supervisor." If there is even one item for which a judgment cannot be made, submit an inquiry form to the following email address before submitting a research proposal.

  Inquiry Form:
  http://senryaku.jst.go.jp/teian.html
  Contact: rp-info@jst.go.jp
- For more information on how to submit a research proposal, please refer to "Chapter 8 Recruiting via the Cross-ministerial R&D Management System (e-Rad)".
- Prior to submitting a research proposal, please confirm understanding of "Chapter 6 Key Points in Submitting Proposals" and "Chapter 7 Limitations on the Overlap of Proposals within the Strategic Basic Research Programs".

(PRESTO – Attachment)

Proposal Preparation Checklist

○ Please give yourself plenty of time to go complete this checklist.

Check		Reference Material	
Have you completed e-Rad researcher registration?		Chapter 8	☐
Have you completed the educational program on research integrity?		Section 6.1	☐
Conflict of interests with the Research Supervisor*		Section 3.2.5	
a	The research project applicant is a relative of the Research Supervisor.		No ☐
b	The research project applicant and the Research Supervisor are both affiliated with the same smallest organizational unit (e.g. same research lab) of a university, national or other national government-funded research and experiment institution. Or, the research project applicant and the Research Supervisor are affiliated with the same company.		No ☐
c	The research project applicant and the Research Supervisor are presently working in close cooperation on the same joint research project. Or, have done so within the past five years. (For example, the research project applicant and the Research Supervisor are working together on the same research project, are performing different parts of the same research project, or are co-authors of a research paper.)		No ☐
d	The research project applicant and the Research Supervisor were in a close teacher-student relationship for a total of more than 10 years (not necessarily continuous), or were in a direct employer-employee relationship. “Close teacher-student relationship” means cases in which the research project applicant and the Research Supervisor were affiliated with the same research lab, and cases in which the Research Supervisor, though affiliated with a different organization, essentially functioned as a research advisor for the research project applicant.		No ☐

*If you are not sure of a conflict of interest in any of the items above, always contact JST with your concern by clicking on the Inquiry button: http://www.senryaku.jst.go.jp/teian.html

Prior to electronic submission via e-Rad, please ensure that proposals comply with the instructions in the format specified.
Just before the deadline, e-Rad System would be slow due to heavy load. Please give yourself plenty of time to complete submission.

	Items	Check	
	Input of general information on the applicant to e-Rad	All necessary information is provided.	□
Form 1	Information on the applicant	All necessary information is provided. Information is matched with e-Rad data.	□
Form 2	Research Proposal Overview and Major Achievements of the Research Project Applicant	When converted to PDF format: Is Item 1 no more than two pages long? Is Item 2 within one page?	□
Form 3	Project Description	Form 3 must fit in 6 A4 sheets as a PDF file.	□

Form 4	List of Publication and Patent		□
Form 5	Information on Other Supports	All necessary information is provided.	□
Form 6	Protection of Human Rights and Compliance with Laws and Regulations	Even when this is not applicable, please indicate that.	□
Form 7	References and Additional Statement		□

Instruction for research proposal preparation

区分４

(PRESTO-Form 1)

FY 2015 Application PRESTO Research Proposals

Research Area	
Title of proposed research project	
Name of Applicant	
Affiliated Institution, Section, Title	
Researcher ID No.	Enter the 8-digit “e-Rad (http://www.e-rad.go.jp/)” login ID which is provided by registering researcher information on the e-Rad system.
Academic Background	List the applicant’s undergraduate and graduate education as indicated below: Year: Undergraduate Institution, Major Degree, Supervisor Year: Graduate Institution, Major Degree, Supervisor
Professional Appointments	List, in chronological order, all academic/professional appointments of the applicant finishing with the current appointment. Include the name of a project leader or a supervisor who had/has been at a mentoring position for the given appointment.
Research Budget	Total Budget: _____ million yen (Do not include indirect cost)
Affiliate Appointment	□Joint Appointment □Exclusive Appointment
Place to Pursuit Research Work	□ Present Affiliated Institution □ Other (Place to Pursuit Research Work:)

- **Proposed Research Area**
  Only one application may be submitted across all the Research Areas in CREST and PRESTO.
- **Title**
  Correctly enter titles, such as Specially Appointed Associate Professor, Tenure-Track Assistant Professor, etc
- **Researcher ID No.**
  Proposals must be submitted via the e-Rad system. Those who do not have Kakenhi ID or e-Rad login ID should contact their affiliated Research Institution personnel or the e-Rad Helpdesk immediately to obtain the e-Rad ID. See Section 8.3.1 in this guideline.
- **Place to Pursuit Research Work**
  Please check the place which you plan to pursuit research.
  Applicant who choose “Other” shall be asked when the proposal is selected. JST also accepts consultation prior to submission.

(PRESTO-Form 2)

Research Proposal Overview and Major Achievements of the Research Project Applicant

1. Outline of Research Project

- Provide an overall description of the research proposal in less than two A4-size sheets (no exceptions). Use 10.5 point or larger font size (If these instructions are not followed, the research proposal might not be accepted).
- Form 2 chiefly covers material that is critical for documentation-based selection. It will be evaluated from the perspectives below:

a) Is it aligned with the goals of the solicited Research Area (Can the proposal be expected to contribute to fulfilling the purpose of the Research Area? Mainly, does the proposal correspond to items a. and b. in "(1) Selection Standards (Preliminary Evaluation Standards)" in Section 3.2.7, "Selection Perspective")?

b) Is it aligned with the goals of the PRESTO Program (Mainly, does the proposal correspond to the goal noted in c. in "(1) Selection Standards (Preliminary Evaluation Standards)" in Section 3.2.7, "Selection Perspective?" for "Basic research that is unique, highly appreciated internationally, and expected to produce outstanding results that contribute greatly to science and technology innovation?")?

Therefore, in this form, provide a brief description that focuses on the details corresponding to Item 1, "Target and Objectives," from PRESTO Form 3 (Project Description), and provide the minimum explanation (corresponding to Items 2 to 5 on Form 3) required to understand your description above (The scientific/technical evaluation of the validity and feasibility of the Project Description will be considered mainly with PRESTO Form 3).

- A preliminary selection entailing a documentation-based selection for each Research Area may be held from the perspectives of a) and b) above.
- Insert figures and tables (in color) appropriately to be undertaken clearly.

Do not exceed two A4-size sheets (no exceptions)

2. List of principal research papers/invited lectures

- On no more than one A4-size sheet (no exceptions), list your principal research papers and invited lectures (If these instructions are not followed, the research proposal might not be accepted).
- Adjustment to font size and line spacing is acceptable.

(1) List of principal research papers

- Enter up to five of the research project applicant's principal research papers selected from section 1 of PRESTO Form 4. (Enter the same information, and use the format, as shown in PRESTO Form 4 section 1.)
- Sequentially number each item with a number at the beginning of each title.

(2) List of principal invited lectures

- Enter up to five lectures the research project applicant was invited to give (if any).
- Sequentially number each item with a number at the beginning of each title.

Do not exceed one A4-size sheet (no exceptions)

(PRESTO-Form 3)

Project Description

- Clearly state the work to be undertaken. Figures and tables (in color) may be included if necessary.
- Do not exceed six A4-size sheets (no exceptions). Use 10.5 point or larger font size (If these instructions are not followed, the research proposal might not be accepted).

1. Target and Objectives

2. Background

Describe circumstances to propose the project, relation to your research so far and so on.

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

Describe including the domestic and international research trends in the related research areas.

4. Research Plans and Approach

Describe the necessity of the research, preliminary knowledge or data, specific plans of the proposed research project and the way (including the purpose, the problem and the solution toward achievement of the target.

5. Future Prospect of Research

Describe expected developments in science and technology, creation of science and technology innovation, creation of new industry, contribution to society, etc., which are likely realized in the future, by success of the proposed research project.

6. Explanation of Keywords

Describe the explanation of keywords which is thought to be necessary for reviewer to understand the contents of the research.

Do not exceed six A4-size sheets (no exceptions)

(PRESTO-Form 4)

List of Publication and Patent

1. Principal research papers, books, and other publications

- List selected research papers, books, and other publications of the research project applicant, in reverse-chronological order, which are considered to be relevant to the proposed research project and published in recent years. Place an asterisk (*) at the beginning of the title of the papers / books of which the applicant is the first author.
- Follow the format below when listing research papers (For books, adhere to this format). Item sequence is not fixed.

Author(s) (all authors), title, title of journal/book, volume and page numbers, and published year.

2. Research papers/publications other than the above

-In addition to the works provided in 1 above, list any relevant and recent achievements that helps understanding the proposed research project or that represent research project applicant's research work. (Place an asterisk (*) at the beginning of the title of the papers / books of which the applicant is the first author (if any)).
- Follow the format below when listing research papers (For books, adhere to this format). Item sequence is not fixed

Author(s) (all authors), title, title of journal/book, volume and page numbers, and published year.

3. Major Patent

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

(PRESTO-Form 5)

Information on Other Supports

List grants from the government competitive research funds (including CREST and PRESTO) and any other research subsidies (including private foundations and overseas institutions) that the Research Director and/or Lead Joint Researchers are currently receiving, applying for, or planning to apply for by program name, indicating the title of project, research period, roles, amount of annual budget, and effort. Refer also to Section 6.3, “Measures against Unreasonable Duplication and Excessive Concentration”.

(Note)
- Your entitlement to the JST funds may be cancelled at a later date even if you have been selected should your presentation fail to be accurate.
- If the results of applications for research grants become known, or if there are other changes in circumstances during the research proposal selection process that require that the information provided in this form be updated, please prepare a revised version of this form and send a message to the email address provided at the end of these requirements.
- Should you be selected for participation in the interview portion of the selection process, you may be asked to provide information on applications, plans, etc. submitted to other programs.

(Example)

Program	**Status**	**Title of Project (Name of principal investigator)**	**Research Period**	**Role (Principal Investigator or co-Principal Investigator)**	**(1) Allocated Budget (For entire period) (2) FY 2015 (planned) (3) FY 2014**	**Effort (%)[5)]**
PRESTO	Submitted					80
Grants-in-Aid for Scientific Research, Fundamental research (C)	Awarded	XXXXXXXX (XXX)	2014.4 - 2017.3	PI	(1) (2) (3)	10

-List grants that the proposer is currently receiving, or selected, in descending order of amount of allocated budget (for the entire period). Then list those the proposer is currently applying for or planning to apply for (specify "submitted" or “preparing” in the column "Program").

-Type “Awarded” if it is currently awarded or decided to be awarded, and type “Submitted” for other status.

-Describe directorship or allocated work as "Role."

-Enter the amount of allocated budget (direct cost)."

-Enter "Effort" value of “Awarded” grants. Describe effort for grants the proposer is currently receiving assuming that the only PRESTO proposal is selected. Don’t exceed 100% in total.

-Add rows if needed.

(PRESTO-Form 6)

Protection of Human Rights and Compliance with Laws and Regulations

- Describe the measures and actions that you will take if your research involves compliance with the related laws and regulations (e.g. research requiring the consent and the cooperation of the other party when implementing the research plan, research requiring consideration for the handling of personal information and research requiring efforts regarding bioethics and safety measures).
- This applies to surveys, research, experiments which require an approval procedure in an ethics committee inside and outside the research institution, such as for example questionnaire surveys in which personal information is involved, interview surveys, the use of provided samples, analysis study of the human genome, recombinant DNA experiments, experiments on animals, etc.
- Please indicate where this is not applicable.

(PRESTO-Form 7)

References and Additional Statement

- **References**

Provide the names of two (2) individuals who have good knowledge of your Research Project (non-Japanese person(s) are acceptable). Provide names of the reference person, institution and contact information (phone numbers and e-mail address). The evaluators (Research Supervisor and Research Area Advisors) may contact them regarding the research proposal during the screening process. Providing this reference information is not mandatory.

- **Additional Statement**

-

- If participation of overseas joint research group(s) is planned, please refer to "3.2.4 Proposal Submission Requirements" and describe reasons and necessities.

Other than stated above, state the reason(s) why you have applied for PRESTO, any requests concerning your research, scheduled or planned changes in your professional position, or any concerns that you might have.

Chapter 4 Research Areas Calling for Proposals

4.1 CREST

Research area in the strategic objective "pioneering next-generation photonics through the discovery and application of novel optical functions and properties"

4.1.1 Advanced core technology for creation and practical utilization of innovative properties and functions based upon optics and photonics

Research Supervisor: Ken-ichi Kitayama (Professor, Graduate school of Engineering, Osaka University)

Overview

The goal of this research area is to produce disruptive innovation (innovation producing technologies under an entirely different standard of value that displaces existing values) in new fields of photonics that will meet future demands of society and industry through cross-disciplinary, multilayered integration and development of conventional optical sciences, while simultaneously working to clarify the fundamental principles sustaining the creation of new technological ideas. These efforts are aimed at the synthesis of new optical functional materials, the development of communication and network technologies using innovative techniques for controlling light, the visualization of microstructures with high temporal and spatial resolutions, and the creation of basic technologies and systems for complex light through integration with advanced mathematical sciences. This cross-disciplinary and coordinated approach toward further supporting a broad range of fields that includes the environment, energy, manufacturing, telecommunications, medical care, and security through the clarification, control, and application of such new optical physics and functions will lead to the formation of a higher-order social and industrial infrastructure capable of meeting various aspects of social demands, including precision, sensitivity, capacity, power consumption, and cost.

We will not limit ourselves to in-depth studies on technologies in a single field in this research area, but will keep a broad perspective that encompasses related fields of technology in an effort to conduct R&D that can create a new paradigm for merging dissimilar fields.

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

(1) Background

Photonics has potential as a basic technology capable of resolving issues that people face in their daily lives, such as security, health, and food safety, strengthening our competitiveness at the national level through improvements in industrial productivity and the creation of new industries, and creating diverse systems that can effect disruptive innovation in any of various fields on a global scale, including global warming countermeasures and space development. For example, innovative optical communication and networking technologies and sensing

technologies could spur the rapid development of the Internet of Things (IoT), while biophotonics, which has made great strides in recent years, is expected to contribute to the realization of advanced medical care and diagnostic systems utilizing noninvasive observation and analysis. Moreover, the use of optical sciences to synthesize unexpoited optical functional materials and substances is anticipated to help create a foundation for new materials industries.

For the current fiscal year, we invite proposals in this research area on the following topics.

(2) Desired research topics

In this research area, we are targeting use-inspired basic research involving photonics, rather than pure basic research or pure applied research as described hereinbelow. Research directors should have the ability and preparedness to lead the charge across the “valley of death” spannning between basic research and viable products and technologies. In this research area, we are looking to conduct R&D focused on expanding the applications of photonics into such diverse fields as the environment, energy, manufacturing, telecommunications, medical care, and security by radicalizing photonics technologies and integrating them through a cross-disciplinary, multilayered approach, and we want to be able to verify the construction of a world-leading system approximately eight years following the completion of this project.

The systems mentioned here are not simply standalone measuring and data processing equipment, transceivers, and manufacturing equipment, but are intended to be the collective integration of these devices, capable of processing and visualizing data and providing applications and services. Accordingly, when submitting a proposal for this research area, the applicant must present an image of the system they envision for the future. In other words, we would like applicants to tell us in a tangible and convincing manner what sort of contribution, direction, and vision the achievement of their research concept, backed by their own experience and knowledge, will have on society and industry. Proposals that do not answer these questions sufficiently or that are viewed as being pure basic research or pure applied research will not be selected. Some specific examples could be an ultrafast optical communication system having a single-photon source employing metamaterials (enhancing convenience in people’s lives and contributing to global warming measures through the establishment of an ultrafast, low-power communication technology in response to the dramatic increase in data processing and power consumption accompanying the popularity of cloud computing, etc.), a 3D machining system employing an attosecond laser (contributing to the creation of new manufacturing industries through applications to low-cost, high-precision microfabrication of diverse target materials), and a deep tissue imaging system employing ultra-sensitive photodetectors (pioneering new diagnostic and therapeutic techniques by establishing technologies for the visualization of cells and tissues that was previously not possible). However, please present your vision and future direction based on your own research concept without getting caught up on these examples.

In addition to the above information, we are looking for proposals on challenging and innovative R&D in a variety of fields. When describing your research proposal, we would like you to clearly establish a direction and vision for the system you wish to develop, without limiting yourself to the above examples, and explain in detail what this system will eventually look like, including the anticipated progress and results along the way and at the end of the project and what gives this system clear superiority over existing technology. When necessary, please provide any numerical targets needed to support your proposal. As the end result of this research project, it would

be optimal to be able to verify the underlying technology required to implement the system you have proposed and to be able to demonstrate its potential as a viable product. However, proposals that are focused on suitable goals and that detail the underlying technologies to be researched and the course of development to be continued for some years following the completion of this project are in line with the intention of this research area.

For your reference, the following are some examples of photonics technologies and fields we ourselves would like to address in this research area. However, please bear in mind that these are merely examples.

1) Development of nanoscale laser micromachining and measuring technologies and creation of new materials

• Design new substances and materials from a theoretical approach

• Develop optical control and sensing technologies to study inherent structures of organisms

2) Improvement of noninvasive *in vivo* sensing and imaging techniques

• Establish high-precision, high-security biometrics technologies

• Elucidate mechanisms of interaction occurring under light irradiation between a biologically relevant substance and a non-biological substance, such as a photoprobe

3) Development of techniques for observing electronic states at high resolutions

• Observe and control ultra-fast dynamic processes, such as electrons emitted from a solid

• Develop nano-optical devices, such as surface plasmon-based circuits and interferometers

• Establish control technologies for coherent light with an extremely short pulse duration and for photoresponses and photochemical reactions

4) Development of an optical frequency comb for ultimate measurements of time and space and a laser acceleration technology

• Develop technologies for manipulating electrons in matter with attosecond precision

• Develop advanced optical sciences for use under extreme environments and conditions, such as a laser acceleration technology

(3) Research project organization

In order to implement the research concept, the research leader should be willing to share his or her vision with researchers and engineers in different but complementary technological fields and to conduct collaborative research with a team-based approach to identifying needs and encouraging dialog. Please keep this point in mind when putting together a team best suited for your purposes and indicate the specific approach to be adopted by the team and individual groups therein. It is preferable that the implementation of this research not be confined to a framework involving only universities and national R&D agencies, but makes use of the technical skills and knowledge on the application side (industry, medical personal, etc.).

This research area is soliciting proposals with an upper limit for research expenses of three hundred million yen per research project.

(4) Collaboration with other research areas

Administration of this research project will include collaboration with the PRESTO (Sakigake) research area "Fully-controlled photons and their proactive usage for new era creation (FRONTIER)," and the joint holding of area conferences and workshops when needed. We will also promote collaboration with related academic societies and research institutes and will occasionally hold symposiums and integrate studies for the purpose of actively

expanding into new research areas.

Briefings on the call for proposals in this research area will be held according to the following schedule. We hope to see many interested parties in attendance. Both briefings listed below will be held jointly for the CREST research area “Pioneering next-generation photonics through the discovery and application of novel optical functions and properties” and the PRESTO research area “Fully-controlled photons and their proactive usage for new era creation.”

Date & Time	Venue
June 25 (Thu) 13:30-15:30	<Kansai-Area> TKP Shin-Osaka Business Center Hall 4A
July 3 (Fri) 13:30-15:30	<Kanto-Area> TKP Ichigaya Conference center Hall 3C

For more information, please visit the following site: http://www.senryaku.jst.go.jp/teian.html.

Research Areas in the strategic objective, "Elucidation of basic principles for innovative energy conversion, and synthesis of new materials, development of new energy harvesting devices, and other core technologies, that will contribute to the high-efficiency conversion of ambient microenergy into electricity and their new advanced applications.

4.1.2 Scientific Innovation for Energy Harvesting Technology

Research Supervisor: Kenji Taniguchi（President, National Institute of Technology, Nara College)
Deputy Research Supervisor: Hiroyuki Akinaga（Principal Research Manager, National Institute of Advanced Industrial Science and Technology (AIST)）

Overview

The aim of this Research Area is to create innovative core technologies for converting heat, light, vibration, electromagnetic field, biological body, and other types of ambient microenergy into electricity in the range of μW ～mW for use in self-powered sensors, microprocessors, and other types of devices.

More specifically, research will be promoted along two principal lines. One will focus on the development of core technologies and their underlying basic principles, for the highly efficient conversion of ambient microenergy produced from heat, light, vibration, electromagnetic, biological body, and other forms of energy sources. This is research that will develop substances and devices to convert untapped microenergy into electricity based on the new principles. It will be the challenge of discovering new principles contributing to innovative energy conversion such as that utilizing spin correlations or topological correlated phases and developing new materials with physical properties far surpassing the characteristics of substances to date. The other principal line of research will be on theories, analytical evaluation, and material design for developing the core technologies mentioned above. This research will attempt to develop new analytic formulations for the physical phenomena (properties of materials and interfaces, transport phenomena, etc.) that come into play in energy conversion, and will put forth guidelines for new-material design based on condensed matter physics or applying computer simulation. It is extremely important to pursue these two principal lines of research in closely collaborative and mutually complementary ways.

Accordingly, this Research Area calls for highly challenging proposals, which pursue to produce innovative principles, substances and devices to be tested and verified in their final stages, and which will lead to follow-on research and development stages.

This Research Area, therefore, will be an integrated CREST/PRESTO where work will be pursued under the strong leadership of the Research Supervisor and Deputy Research Supervisor, and efforts will be made to reorganize research teams, coordinate research programs, and promote strong communication among researchers pursuing different themes, all for the maximization of research achievements.

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

Background and Basic Directions

For the advanced information-oriented society going forward, energy supplies for wireless nodes and sensors, the numbers of which will grow to an enormous scale, will be critical. Therefore, how to secure electric energy, for example in terms of power supplies, battery exchanges, etc., will be a key concern. If it becomes possible to use ubiquitous untapped energy as power sources, the concept of a "power source" will change and there will be qualitative differences in the forms and methods by which these new power sources are used.

Seeking to contribute to the development of such a society, work in this Research Area will endeavor to develop core technologies for the highly efficient conversion of untapped microenergy into electricity or for their advanced applications. Success will require the development of energy conversion principles based on novel concepts and ideas, and it will be necessary to hone existing principles, substances, and devices still at their embryonic stages.

In order to promote the research mentioned above, this Research Area will receive proposals from a wide array of research fields. Points that should be kept in mind regarding research proposals and Research Area management are given below.

Targeted Research Fields and Research Approaches

Research on energy harvesting to date has taken the approach of focusing on technologies for the conversion of particular forms of energy, such as heat, light, vibration, or electromagnetic field, into electric energy. The advanced information-oriented society going forward, however, requires innovative technologies to generate electricity for power sources. Phononics, photonics, and two areas where recent advances have been particularly noteworthy - spintronics and multiferroics - are all fields in which Japan has competitive advantages on the global research stage, and all of these fields would offer exciting new physical properties to be applicable in innovative energy harvesting technology. .

We will actively solicit original, ambitious proposals for the creation of electric energy conversion methodologies based on new ideas and perspectives from ongoing advanced research. We will particularly welcome proposals that address physical properties not previously considered in energy conversion, while surpassing the bounds of contemplation by the Research Supervisor and Deputy Research Supervisor. Of course, there is no intent to discourage proposals for research on existing energy harvesting technology. Such proposals, however, should not be for work that would be an extension of existing research and be predictable in terms of results.

In other words, in all cases, selection will depend heavily on whether the outstanding characteristics of the technology are clearly shown and on whether there are significant increases in power generation.

For material research, trial-and-error experiments should be avoided from a long-term perspective. It is necessary to show within the research period that the research strategy is scientifically valid, being based on physics, computer simulations, or other evidence, before shifting focus to the actual search for substances or materials design. To accomplish this, researchers submitting proposals must clearly present their own original ideas in their proposals. In doing this, researchers must identify a principal that is universal and not limited to particular substances, and create a model that illustrates the principle. Of course, there is no intent to reject serendipity in the

research process, and one of the characteristics of this Research Area is difficulty in setting clear milestones. However, the sold bases for determining that new physical properties have been manifested or that substances have been discovered should be made clear. It is expected that efforts will then be focused on commercialization after elaborate scientific consideration for achieving their high performance or functionality.

※ Neither CREST nor PRESTO programs will solicit proposals for power generation technology based on solar cells, artificial photosynthesis, or biotechnology in this fiscal year.

※ CREST program will not solicit proposals for teams proposed to conduct research only on the second of the two main lines of research - theories, analytical evaluation, and material design described in the research area overview.

※ The CREST program will seek proposals including not only the creation of new principles or new materials but also a pathway to develop new devices in the future.

Research Period and Research Expenses

The research period for this Research Area will begin in fiscal 2015 and extend through fiscal 2022 (tentative). Management of the Research Area will be divided into two research phases. The first will be a time for creating core technologies to contribute to the conversion of untapped microenergy into electricity, or to their advanced uses. The second phase will be a time for selecting promising core technologies developed in the first phase, finding their new applications, and taking other steps toward the verification of innovative new principles, substances, and devices.

Based on the above, research proposals for the current fiscal year will be solicited as described below.

Research periods for CREST projects will begin in fiscal 2015 and must end by fiscal 2018 (four fiscal years). This differs from existing practice. Research expenses must not exceed 160 million yen (total expense).

Research periods for PRESTO projects will begin in fiscal 2015 and must end by fiscal 2018 (four fiscal years). Research expenses must not exceed 40 million yen (total expense).

For both CREST and PRESTO projects, research progress will be accommodated based on the monitoring throughout the research period. Specifically, in the final fiscal year of each project, a progress evaluation addressing the practical value of research achievements, with an eye toward future commercialization, will be performed. As a result of the evaluation, certain research projects will be restructured to maximize second-half results for the Research Area. This work will take place as a collaborative effort of the research teams and researchers in the Research Area (for both the CREST and PRESTO programs), who will form a new team organization that spans different fields and is mutually complementary. Work will focus on resolving problems, considering the research results achieved to date and future potential, and this reconstruction of research structure will be conducted under the responsibility of the Research Supervisor and Deputy Research Supervisor.

* Please develop efficient research expense plan through active utilization of shared research facilities in Japan.

Other

Under the "Future Prospect of Research" section of the proposal, be sure to provide not only the explanation requested on the CREST or PRESTO research proposal form but also a scenario clearly describing what actions will be required during the research phase immediately following the research period in order to advance the work described in the proposal to the development stage targeting commercialization. Assume the objectives of the proposed research will be achieved during the research period.

Date & Time	Venue
July 2 (Thu) 14:00-16:00	<Kanto-Area> JST Tokyo Headquarters K's Gobancho 2nd Floor Conference room 2A
July 6 (Mon) 14:00-16:00	<Kansai-Area> Mielparque-osaka 4th Floor "So-re-i-yu"

For more information, please visit the following site: http://www.senryaku.jst.go.jp/teian.html.

Research area in the strategic objective "Creation of innovative catalysts using diverse natural carbon resources"

4.1.3 Innovative catalysts and creation technologies for the utilization of diverse natural carbon resources

Research Supervisor: Wataru Ueda (Professor, Department of Material and Life Chemistry, Faculty of Engineering, Kanagawa University)

Overview

This research area will promote the creation of innovative catalysts that can convert methane and other alkane gas resources to useful chemicals and energy, in order to progress towards the establishment of an industrial infrastructure that can make balanced use of diverse natural carbon resources. If new technologies can be used to convert methane, alkane and other natural gas resources easily into chemicals and energy, it will be possible to decrease our current dependence on oil, and to reduce carbon dioxide emissions. However, since it is difficult to convert methane and other alkane gas resources directly to chemicals, existing processes are indirect, for example *via* syngas ($CO + H_2$) generated by methane reforming.

The keynote object of this research area is to overcome this difficult task by pursuing new approaches to create advanced catalyst technologies. It is aimed to achieve a significant jump on the accumulated experience value on catalysts, by engaging with data-intensive science, computational science, and measurement technologies that have made advances in recent years.

This research area will focus on research themes using methane as a reactant. Research themes regarding reactions using ethane, propane and other lower alkanes as reactants will be promoted only if they show higher activity and/or selectivity compared to the existing ones.

It is aimed to promote genuinely world-leading catalyst researches that aim at pioneer new uses for resources such as natural gas in the future chemical industry, and lead to the establishment of a new industrial infrastructure.

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

1. Policy Concerning Recruitment and Screening

(Background)

In the near future, it is anticipated that a new framework will emerge making balanced use of various carbon resources. Of these, alkane gas resources such as methane have the potential to become a major resource. The coasts around Japan are rich in methane hydrate, while neighboring Russia and China have locations with extensive natural gas and shale gas resources, but there are technical restrictions on their exploitation at present. If these alkane gas resources can be used at a similar level to oil, it will be possible for Japan strategically leverage a new carbon resource balance structure. Also, it can lead to new chemical industries, and permit to address environmental issues at a different level than before, by enabling the development of direct methane fuel cells, or by boosting the use hydrogen, for example.

Accordingly, it is very important to achieve a new carbon resource balance structure based on the use of alkane

gas resources. Catalysts are the key to enabling the chemical technologies required for this shift to a new balance structure, because catalysts are indispensable for establishing the chemical processes for exploiting massive alkane gas resources. However, adhering to conventional energy consumption processes such as steam reforming of methane alone will not be sufficient in the new age. It will be necessary to achieve processes for exploiting alkane gas resources to the maximum such as catalytic oxidation that produces both energy and chemicals, and reactions in new directions such as from methane to methanol in order to break free from older technologies. Consequently, the catalysts required will be very advanced. In addition, since alkanes are far less reactive than oil, it will be necessary to eschew earlier petrochemical catalyst technologies in favor of overwhelmingly innovative catalyst chemistry and technologies.

The currently developing methodologies for creating new states of matter from approaches such as nano-integration and hyper-nano-space structures are very important for the development of catalysts with new functions. However, it is also important to focus on approaches using new substances even in simple structures that can lead to unprecedented catalytic functions. The reason for this is that there are many materials that have yet to be considered for catalysts. It is true to say that the methodologies and common assumptions relating to the development of catalysts using conventional catalyst chemistry prevented attention being paid to these types of catalysts. In order to achieve catalytic reactions with methane, which is considered difficult, it is essential to pursue approaches that are not dominated by typical assumptions. In other words, It is aimed to achieve a significant jump on the accumulated experience value on catalysts, by engaging with data-intensive science, computational science, and measurement technologies that have made advances in recent years, to usher in a new age.

This research area will target the development of unconventional research concepts which leads to novel catalytic function domains. Four approaches are shown below as examples.

Example 1. Search for new catalytic materials based on unexplored substances

It is aimed to break away from the conventional exhaustive material research approach that clings to existing catalyst configurations, and seek to develop technologies for creating innovative catalysts. Specifically, all of the substances and materials that have already been studied as catalysts from among the many research fields will be excluded, and then, new catalytic substances will be searched among the remaining unexplored materials and substances. In other words, continuous development based on existing knowledge will be precluded.

However, in order to search efficiently for new catalytic substances that are suitable as catalytic targets from among enormous groups of substances, it is essential to establish innovative research methods that eschew the research approaches of conventional catalyst chemistry. For example, research proposals in which measurement technologies and materials informatics, which have evolved in recent years, take the lead in the creation of innovative catalysts will be recommended.

Example 2. The creation of innovative catalysts through the establishment of new state of matter

The aim is to introduce new states of matter (unstable valence, three-dimensional atomic arrangement, complex structures, assemblies and so on) in substances (element classes and their constituents) that already exist as catalysts, achieve catalytic reactions with alkane gases such as methane, and develop methods for synthesizing new

substances and methodologies for conferring catalytic functions. This is the most important approach for creating innovative catalysts, and it is hoped that the originality of the researchers will be strongly reflected in the creation of catalytic functions.

In order to develop methodologies that can precisely control the local environments for the catalytic target at element level, it will be effective to leverage knowledge obtained from materials research in diverse fields. Accordingly, the participation of researchers from fields other than catalysis is desirable. In addition, a ripple effect can be expected where further advances in new catalytic substances obtained through the approaches of Example 1 are encouraged.

Example 3. Understanding the dynamism of catalytic reactions and using that for innovation in catalysts

Catalytic substances always possess dynamism, dynamically changing the reactants or products, involving phenomena that are not normally familiar in materials research other than catalysts. In particular, catalytic oxidation is one example that is strongly affected by this phenomenon. Controlling this dynamism is one of the greatest difficulties in creating catalysts, and it is one reason why the study of new substances as catalysts does not lead to immediate results. While it is necessary to pursue research into catalytic substances selected with a strong awareness of this important point, awareness alone is not sufficient to overcome this difficult challenge. What is required is academic development that clarifies the substance structures that ensure dynamism. This involves establishing computational science for dynamism, in-situ observation and measurement of dynamism, and the catalytic substance structure—dynamism correlation. Going further, it will be necessary to tackle computational science and measurement technologies, clearly targeting the methane catalyst chemistry mentioned above. Working with other groups by providing this information for other research, for example, into creating new states of matter, is expected to contribute to the realization and innovation of each catalyst.

Example 4. Creation of molecular assembly catalysts with superior functions

In order to establish a chemical process that can exploit massive alkane gas resources, molecular catalysts that mimic methane monooxygenase and other natural enzyme systems or enzymes will be the basis for our research, but it will be necessary to establish a catalyst that can outstrip the functions of enzymes in terms of reaction amount and rate. For this reason, in addition to activation functions already studied to date, creating new molecular assembly catalysts where reaction-promoting fields can be created by the formation of multiple interactions domains may be promising.

In this example too, it is to be expected that sharing the knowledge of researchers in different fields will radically accelerate the advances of currently known molecular catalysts and lead to the development of new states of matter.

(Policy for this fiscal year)

In this research area, bearing in mind the research concept above, research proposals with a precise and new viewpoint concerning catalytic functions for the chemical transformation of alkane gas resources that boldly designs collaboration between fields to create innovative catalysts are welcome. In this fiscal year, research proposals focusing on advanced analysis and forecasting of catalytic functions using measurement and

computational methods will be accepted. Support cooperation with other research teams so that the results of the selected research projects will be used as basic technology common to the research area.

In addition, this research area will be managed taking into consideration the cooperation with the related CREST and PRESTO research areas, so the applicant should keep that in mind when building the team.

There are not restrictions concerning the type of reaction, but the keynote object will be research using methane as a reactant. Research themes regarding reactions using ethane, propane and other lower alkanes as reactants will be promoted only if they show higher activity and/or selectivity compared to the existing ones

2. Research area management policy

This research area will pursue high-level research aimed at cooperation with future industries under the leadership of a research director. Even during the research period, research cooperation with the industry that would lead to the creation of catalysts that can convert alkane gas into useful chemicals and energy will be recommended.

The management policy of this research area is to optimize the research plan for each research project through budget allocation, proper research team building and so on, based on international research and development benchmarking.

In addition, measures to enable cooperation with the PRESTO "Science and Creation of Innovative Catalysts" for the creation of innovative catalysts for methane and other alkane gas resources to be inaugurated at the same time, and the PRESTO "Advanced Materials Informatics through Comprehensive Integration among Theoretical, Experimental, Computational and Data-centric Sciences" addressing materials research focused on calculation based on theory and data-intensive science will be considered.

Moreover, according to the progress in the research, collaboration and cooperation with research institutes and programs nationwide, such as the MEXT's "Nanotechnology Platform Japan" will be promoted.

Notes

This research area is setting an upper limit for research expenses of three hundred million yen per research project.

Time & Date	Venue
July 1 (Wed) 15:00-16:30	<Kanto-Area> JST Tokyo Headquarters Science Plaza B1 Hall
July 2 (Thu) 10:00-11:00	<Kansai-Area> Campus Plaza Kyoto 4th Floor Lecture room 3

For more information, please visit the following site: http://www.senryaku.jst.go.jp/teian.html

Research area in "Establishment of environmentally-adaptive-plant design systems for stable food supply in the age of climate change"

4.1.4 Creation of fundamental technologies contribute to the elucidation and application for the robustness in plants against environmental changes

Research Supervisor: Satoshi Tabata (Director and Vice Chairman of the Board of Trustees, Kazusa DNA Research Institute)

Overview

This area promote research on establishment of the technology for designing useful plants from the molecular level on up, based on a comprehensive understanding of the environmental response mechanism of plants in the field. Specifically, the properties of plants responding robustly to environmental fluctuations will be quantitatively determined, and then new technologies enabling artificia control of growth and functions will be established. From the standpoint of exit strategies, the primary emphasis is on economic plants as experimental material, and efforts will be focused on identifying function markers, DNA markers and other biomarkers for developing new plants.

Specific research and development activities should keep in mind the ultimate aim of applying the knowledge gained at the molecular level up to the level of field environments. Activities will be conducted in the following three categories:

1) Highly precise quantitative analysis of the environmental response mechanisms of plants
2) Modeling of plant environmental response mechanisms
3) Evaluation of the plant characters modified by sophisticated reconstruction of genes or genotype

The promotion of research in this area will require making a quantitative understanding of the diverse functions of plants, analyzing large-scale data of different types, and building and verifying models. Accordingly, we encourage the participation of researchers in many fields in addition to plant physiology, such as breeding, ecology, statistics, information science and engineering. In addition, collaboration among different fields will be promoted through comprehensive management of the research area that encompasses these fields. Furthermore, in order to maximize achievements in accordance with the strategic objective, the management of this research area will also be coordinated with the PRESTO (Sakigake) "Creation of Next-generation fundamental technologies for the control of biological phenomena in field-grown plants" and " Innovational technical basis for cultivation in cooperation with information science" research areas.

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

Background

Plant science is playing a more and more important role in the effort to find solutions to food supply issues resulting from global climate change. Despite the very high level of plant science research in Japan and the highly regard in which it is held throughout the world, however, these strengths have not led to applications or commercial development. One of the reasons for this is the complexity of the environmental response mechanisms of the plants themselves. For many species, scientists do not yet have an adequate understanding of response mechanisms at the molecular level in farm fields and other field environments in particular. Moreover, large volumes of omics data are being collected due to advances in measurement and analysis instruments in recent years, such as next-generation sequencers, mass spectrometers, high-speed computers and so on, and these are expected to make a major contribution to breeding, but the fact that the data are a mixture of both wheat and chaff is a major barrier to the effort to link the achievements of basic plant research to the development of new useful plants. There is also the issue of differences in the perception of value of the achievements between basic and applied researchers — specifically, the different perspectives of researchers who want to get their research into high-impact journals and researchers who want to achieve specific breeding objectives.

In this research area, we will keep the need to deal with these issues in mind while working to build an organization to promote research that is not bound by conventional thinking. In doing so, we will work to make new discoveries and create new technologies and develop the basic technologies that will lead to new plant varieties, thereby helping to resolve the food supply issues faced not only by Japan but by the entire world.

Necessary Research & Development and Research Organization

There are three research and development categories in this research area. When submitting proposals, please ensure that two or more of the following categories are involved in the proposal.

1) Highly precise quantitative analysis of the environmental response mechanisms of plants

Conducting a more precise quantitative analysis of the gene(s) of plants grown in field environments and the behavior of metabolic product and the like (changes in temporal and spatial expression patterns, etc.), and their relationship to phenotypes, will enable understanding of the interconnectedness among environmental factors, gene(s), phenotypes and so on. Moreover, for the basic necessary tools, research into simple, efficient and precise methods for analysis of the behavior of relevant gene(s) in a field environment, ones for measurement and evaluation of phenotypes, and ones for measurement of environmental factors will be conducted, in addition to the

development of technologies and equipment. (The following are mere examples of research and development; we welcome creative proposals based on new concepts.).

(a) Methods for highly precise omics analysis of plants in the field

(b) Methods for highly precise character evaluation of plants in the field

(c) Association analysis of highly precise omics data and highly precise phenotype data

(d) Development of technologies, tools, equipment etc. for conducting (a) - (c)

2) Modeling of plant environmental response mechanisms based on actual measurement data

Statistical analysis and mathematical modeling will be performed for the interconnectedness of environmental factors, gene(s), genotypes and phenotypes. This will make it possible to establish technologies for predicting phenotypes based on environmental data and genetic data. (The following are mere examples of research and development; we welcome creative proposals based on new concepts.) We also welcome proposals that do not simply build mathematical models but also allow verification of the constructed models by means of observations based on actual data, or that resolve problems with existing models.

(a) Construction of mathematical models relating to environmental response mechanisms of economic plants

(b) Development of technologies for creating new models associating gene loci and phenotypes based on probability theory

(c) Construction of models that associate genetic information and phenotypes and then incorporate the effect of field environments

3) Evaluation of the plant characters realized by sophisticated reconstruction of genes or genotype predicted by models

Based on identification of the combination of genes needed to produce a desired phenotype in a certain environment, these genes will be introduced and constructed artificially through genetic engineering, cross-breeding and so on, and then cultivated in specified isolation chambers, isolated farm fields or ordinary fields. This will make it possible to confirm the validity and repeatability of the identified factors. (The following are mere examples of research and development; we welcome creative proposals based on new concepts.)

(a) Reconfiguration and character evaluation of gene loci and genotypes derived from model analysis

(b) Quantitative assessment of various in-cell omics indicators in a field environment of plants with genes derived from model analysis

From the standpoint of applied development of the achievements of basic research, economic plants such as solanaceous, cruciferous, leguminous and gramineous plants are recommended as target plant taxa. However, research into model plants (*Arabidopsis thaliana*, *Lotus corniculatus*, etc.) with the intent of using the research achievements to develop useful economic plants will not be excluded. As the recent development of next-generation sequencers and other equipment relating to genetic analysis has made it cheaper and easier to conduct genome sequencing, the targets may also include wild plant varieties, fruits, other miscellaneous vegetables and so on that grow naturally in field environments.

In general, the research will be conducted in the field. However, research in artificial climate incubators, artificial climate chambers and other small, enclosed environments or plant factories with completely artificial light or the like where a stable environment can be ensured may be conducted as long as the objective is to deploy the achievements in the farm field and so on in the future.

Moreover, in order to address global food supply issues, field research may include the use of overseas farm fields . Studies should be conducted in compliance with the laws and regulations of the region where the field research is conducted, and with due approaches to the local community (for persuasion and to ask for cooperation, etc.).

The research organization will need to conduct a quantitative analysis of plant functions from various perspectives. For this reason, it is recommended that the organization include participation by

- researchers in the areas of molecular physiology, molecular breeding, population genetics, field crop physiology, ecophysiology and so on;
- plant-related researchers from the molecular level to the field level;
- statistical scientists and computer scientists who conduct genome analysis, computer processing and modeling;
- agricultural researchers in the areas of agriculture, breeding, agronomy and so on; and
- engineering researchers who develop the measurement technologies and instruments, etc., that are used in the field.

Moreover, depending on the location where the research is conducted, collaboration with national and local governments, national and prefectural research institutions, private companies and so on may also be considered.

Collaboration Inside and Outside the Research Area

We are actively seeking proposals from research teams with the farm fields that will be the hub for collaboration both inside and outside the research area, as well as ones from research teams with database support functions. For example, we will provide active support to efforts to provide farm fields for joint use by researchers in this CREST and the relating PRESTO research areas. We also welcome such teams that can install a common database for this research area that would make it possible to register the data obtained by each team and provide the data to

researchers in this CREST and the relating PRESTO research areas, and such teams that possess data analysis, model-building and other support functions.

Activities in the Research Area Following Selection

At an early stage following selection in this research area, a meeting shall be set up between the research supervisor, the research director and the lead joint researchers and so on, in order to formulate a research plan together with the research director to ensure the smooth creation of achievements. A research area advisor and the like will also be appointed to concurrently advise the PRESTO research areas that are inaugurated at the same time, in order to ensure collaboration among research areas during administration. Through this research area management, joint research will be encouraged if it is possible that, as a result of this collaboration, multiple CREST research and PRESTO research projects will be able to develop their topics using the same approach.

Moreover, in order to promote collaboration within the research area, we also plan to consider the possibility of limiting the target plant species so that, in the event that there is a call for proposals in the next and subsequent fiscal years, different research and development efforts can be compared using the same species or varieties.

In addition, a discussion encompassing the entire area will be conducted to determine what contribution in this research area can make to the shared use of data and data analysis tools, and to other open science initiatives. For example, when a database is compiled and made available, stating clearly the policy for database compiling and provision, cooperation in providing the data to the JST National Bioscience Database Center (NBDC) may be requested.

Furthermore, there will also be collaboration with other CREST and PRESTO research areas, as well as with programs being implemented by the Cabinet Office's Cross-ministerial Strategic Innovation Promotion Program (SIP) and other ministries and agencies. In addition, workshops and symposiums in collaboration with international institutions will be held in order to promote the achievements created in this research area.

Considerations when Submitting Proposals

When submitting proposals for this research area, please clearly indicate the following three items:

(1) Objectives to be achieved three years and five years after selection

(2) Development following the conclusion of the CREST program, and

(3) The basis for the proposal as regards the aforementioned items.

The upper limit for total research expenses will be 500 million yen (except overheaded expense) . For proposals that exceed 300 million yen(except overheaded expense), please clearly indicate the basis for the expenses in the proposal. Also note that research expenses will be revised for each fiscal year, and expenses may increase or decrease in accordance with the progress of research.

Note: The briefing sessions for the call for proposals in this research area (to be held jointly with the newly inaugurated PRESTO area for FY 2015 relating to strategic objectives in the plant field) will be held on the following dates at the following locations. The doors will be opened 30 minutes before starting. Please bring your business card for the registration. We hope that many interested parties will attend.

Time & Date	Venue
July 7 (Tue) 14:00-16:00	<Kanto-Area> Waseda University Nihonbashi Campus Hall
July 13(Mon) 10:00-12:00	<Kansai-Area> TKP Garden City Kyoto “Tachibana”

For more information, please visit the following site: http://www.senryaku.jst.go.jp/teian.html

Chapter 4 Research Areas Calling for Proposals

4.2 PRESTO

Research areas in the strategic objectives "pioneering next-generation photonics through the discovery and application of novel optical functions and properties"

4.2.1 Fully-controlled photons and their proactive usage for new era creation (FRONTIER)

Research Supervisor: Ken-ichi Ueda (Professor Emeritus, University of Electro-Communications)

Overview

It is said that light has no intrinsic limitations. The object of this research area is to test and attempt to overcome limitations using light. More specifically, the research area targets (1) research attempting to create new uses for light that can meet a variety of future demands of society in such areas as the environment, energy, manufacturing, telecommunications, and medical care; (2) research using phenomena that appears through the presence and mediation of light to break down walls of conventional fields, such as physics, chemistry, biology and engineering, and bring about great innovation; (3) research for establishing more universal principles and phenomena from the perspective of optical science through high-energy density physics, high field photon science, and studies on the properties of matter under extreme conditions; and (4) research for thoroughly investigating light sources and light-sensing, measuring, and imaging functions needed to implement the above items (1) - (3) and to make such functions available for new applications.

This research area will take a cross-disciplinary approach by actively exchanging information with researchers in other science/technology fields peripherally related to optical sciences and is aimed at producing new perspectives and ideas in advanced research on fields that treat diverse and complex phenomena.

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

Optical science has seen remarkable progress in recent years in the performance of light sources that provide new perspectives in a wide range of fields and serve as a major driving force for the development of new fields. Light is said to have essentially no intrinsic limitations. The goal of this research area is to explore boundaries by thoroughly investigating the essential character of light in all of its properties. We will conduct researches that tackle important issues in a variety of fields in an effort to tear down walls between disciplines by actively utilizing and applying these properties of light.

Examples of research targets

The following are some specific examples of research that fall within the scope of this research area, but is not intended to be restricting.

(1) A study on light-mediated biology, organisms, and medical applications in general, including active functional expressions that transcend imaging

Since creatures on earth were born and raised under light, light has a noninvasive property to organisms and cells while simultaneously possessing a wondrous energy that applies a needed stimulus to living things. Consequently, applications for optics and photonics in bio-science, life-science, and medical science will likely increase in importance. Through the introduction of such ground-breaking technologies as super-resolution optical microscopes and fluorescent protein in recent years, this study is expected to have an immense impact on society, as in the direct observation of activity in living cells. We also anticipate applications for optical sciences in elucidating the mechanisms of more basic physiological phenomena.

(2) A study on devices that apply nanophotonics to produce new functions, and their specific applications

Progress in advanced technological development in the field of nanophotonics has revealed many new properties. The truth is that many hurdles remain in the way of connecting this field to actual applications in society. However, just as research has unveiled new properties of light, progress in research is anticipated to lead to more practical applications for nanophotonics.

(3) A study on physical properties under extreme conditions, light-atom interactions of ultra cold atoms and space-time measurements with optical lattice clocks, and so on.

The physics of ultracold atoms prepared via laser cooling is not only important for verifying basic principles of physical properties, but has also been used to create ultraprecise clocks with optical lattices. Now we can perform measurements to prove that time does not pass at the same rate everywhere in space, which is beginning to open up a whole new world of possibilities. Since ultraprecise frequency control and space-time measurements using light enable us to study fundamental principles of physics through a micro-macro connection, as in gravitational wave astronomy, there is promise for research studies under new concepts.

(4) High-energy physics and its underlying new optical sciences for studying interactions with new matter produced from high energy density and high-intensity electric fields

It has been theoretically predicted that concentrating light to ultrahigh intensity will cause a vacuum to break down into matter. The path to proving this theory involves research on particle acceleration and gamma ray conversion under vacuum through nonlinear, relativistic optics, pulse compression with plasma photonics devices, and plasma interactions with light at extreme conditions. While this research includes many problems that cannot readily be resolved, making an attempt at resolving the issues may lead to the development of advanced technologies that could impact other fields. Research on the creation of materials having new properties, even new materials generated using high temperature and high density, and on transitional states that

are far more diverse than those at room temperature may provide a key opportunity to gain new knowledge in condensed matter physics.

Philosophy on research proposals

The quintessence of research is to challenge the limits of science and technology identified to that point and to attempt to understand and expand the true nature of science and technology by investigating these limits. If research that studies theoretical limits is called pure science, then research on utilizing highly developed technologies to demonstrate a required performance while satisfying the identified limits and developing viable technologies and devices that are beneficial to society may be called "limit-exploring research." Ceaselessly challenging the limits in this way to expand horizons is my goal for this research area.

The research examples given above are all at a stage in which they have begun to show potential. By challenging these issues in earnest, we will likely reveal things that have not been seen before. For this reason, there is great value in grappling with research that challenges limits. Since you are all likely on the cutting edge of research involving light, any proposals in fields outside those in the above examples that go beyond the scope of the research supervisor's concept will be whole-heartedly accepted if they are new and important. In any case, when submitting a proposal I would like the applicant to express a strong passion for implementing their concept. At the same time, I expect the research proposals to be supported by a self-awareness that their study could lead to important research in the long-term.

Exchange and collaboration with other fields

The 20th century is universally regarded as the Electronics Age because there were great technological advances particularly in the field, which led to the creation of a new phase of society and new industries. Based on this case, revolutionary achievements in advanced research must trigger a rippling effect to other fields. Photonics has been considered as a field possessing such promise. In fact, the technology has produced fruits in optical communications when photonics or optics was merged with electronics, but there is much more work to do in order to expand applications into other fields. By resolving these issues, the technology has greater influence on other fields and lead to a paradigm shift in photonics itself.

In light of this, the call for proposals for this research area will give importance to proposals for greatly expanding research through exchange and collaboration with other fields, and we intend to encourage this attitude during implementation of the research because advanced research in fields handling diverse and complex subject matters can also produce new perspectives and ideas when researchers in different fields actively collaborate. Further, the more complex the subject matter, the more important it is to use sound techniques. When superior methods and techniques developed in one field are applied to another, one can anticipate ground-breaking results. For this research area, we are anticipating the participation of researchers from different fields that all deal with light. In addition to the strong passion mentioned earlier, I expect researchers to establish their own positions on research that includes constructively adopting new techniques and perspectives learned through exchange and collaboration with those in other fields, and encourage them to be mindful of unexpected developments.

Exploring the limits of research requires that one possess clear objectives. It could be said that all researchers are challenging their own limits. Even when the goal seems monumental, one can explore paths that close in on the limits so that the goal does not remain a perpetually unattainable one. Take a broad view of your research from your own perspective and not that of others and work hard toward your goal while gauging the distance between the goal and the limits. As the research supervisor, I will endeavor to provide suitable advice and guidance to direct individual research tasks and will encourage collaboration with researchers in other fields while simultaneously striving to train research personnel that can flourish in the coming era.

Briefings on the call for proposals in this research area will be held according to the following schedule. We hope to see many interested parties in attendance. Both briefings listed below will be held jointly for the CREST research area “Pioneering next-generation photonics through the discovery and application of novel optical functions and properties” and the PRESTO research area “Fully-controlled photons and their proactive usage for new era creation.”

Date & Time	Venue
June 25 (Thu)　13:30-15:30	<Kansai-Area> TKP Shin-Osaka Business Center Hall 4A
July 3 (Fri)　13:30-15:30	<Kanto-Area> TKP Ichigaya Conference center Hall 3C

For more information, please visit the following site: http://www.senryaku.jst.go.jp/teian.html.

Research Areas in the strategic objective, “Elucidation of basic principles for innovative energy conversion, and synthesis of new materials, development of new energy harvesting devices, and other core technologies, that will contribute to the high-efficiency conversion of ambient microenergy into electricity and their new advanced applications.

4.2.2 Scientific Innovation for Energy Harvesting Technology

Research Supervisor: Kenji Taniguchi（President, National Institute of Technology, Nara College)
Deputy Research Supervisor: Hiroyuki Akinaga（Principal Research Manager, National Institute of Advanced Industrial Science and Technology (AIST)）

See “4.1.2 Scientific Innovation for Energy Harvesting Technology”

Research area in the strategic objective “Invention of innovative catalysts using diverse natural carbon resources”

4.2.3 Science and Creation of Innovative Catalysts

Research Supervisor: Hiroshi Kitagawa (Professor, Department of Chemistry, Graduate School of Science, Kyoto University)

Overview

In the modern society, oil is the principal carbon resource in the production of feedstocks that can be converted into chemicals and energy. To make efficient use of resources other than oil, such as methane and the lower alkanes which form the main constituent of natural gas, the creation of highly advanced technologies based on new ideas will be required.

This research area aims to create innovative catalysts that efficiently convert methane and lower alkanes into chemical feedstocks and energy.

Specifically, this research area will conduct research leading to the design and creation of advanced catalysts in reactions that can efficiently convert methane and the lower alkanes. Research on a wide range of catalysts will be promoted in this research area. Catalyst types can be homogeneous, heterogeneous or microorganisms. Metals, oxides, metal complexes and organometallic complexes, molecules, proteins, and etc. can take various structures, such as nanoparticles, nanowires, nanosheets, porous materials, cage-types, core-shell types. Also, research into external reaction fields such as light, plasma, and electric fields can be included in the scope of this research area.

This research area aims to pioneer new methodologies in nanotechnology and materials research for catalysts, through the collaboration with fields such as computational science and evolving measurement technologies, and to promote original and challenging research that could become the new mainstream science and transform the chemical industry in the future.

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

1. Background

Modern society produces feedstocks that can be converted into chemicals and energy with oil as the main carbon resource. But to improve the management of resource and energy, it is necessary to use low cost resources such as natural gas in addition to oil to produce feedstocks that can be converted into chemicals and energy.

However, in existing industrial processes that uses methane as a resource, which is the most abundant of natural gas, chemical feedstocks are produced indirectly via syngas ($CO+H_2$) . The production of useful chemicals directly from methane is extremely difficult, and industrial processes have not been developed. On the other hand, direct conversion of lower alkanes into useful chemical is easier compared to methane. For this reason, it is predictable that only groundbreaking, innovative processes will become substantial candidates to replace the existing industrial processes. Many countries already started the development of new processes under the slogan “valorization of low value carbon”. The realization of innovative catalysts and processes that can directly convert

methane and the lower alkanes into useful chemicals would have a very high international impact, but it will also require the development of highly advanced technologies. These advancements can lead to the dawn of a new “gas-based chemical industry” using natural gas resources, just as the Haber-Bosch process -that achieved the synthesis of ammonia- realized the nitrogen fixation, and the Ziegler-Natta catalyst for polymerization of olefins boosted the modern oil-based industry.

2. Policy Concerning Selection and Screening

The target of this research area is not simply an extension of research to date, or a combination of existing research principles, or research towards improvements on existing technologies. Bearing in mind the background above, this research area will promote research leading to the design and creation of innovative catalysts based on original ideas and concepts with reactions that can efficiently convert methane and the lower alkanes to higher added value chemicals and energy. In this way, this research area aims to pioneer new methodologies in the research of nanotechnology and materials for catalysis, and pursue unique, challenging research that could become the new mainstream science and, transform the chemical industry in the future.

1) Types of catalyst

This research area will accept proposals about all type of catalysts, whether homogeneous, heterogeneous or microorganisms. Research proposals about a wide range of catalysts including metals, oxides, metal complexes and organometallic complexes, molecules, proteins and other active substances, taking various structures such as nanoparticles, nanowires, nanosheets, porous substances, baskets, core shells are included in the scope of this research area.

In addition, considering catalysts in a broad sense, research proposals including processes and reaction fields that have not been used in the conventional chemical industry, such as light, plasma, electric fields, etc., will be pursued.

Priority will be given to highly original research on nanotechnology and materials that has the potential to change the chemical industry in the future.

2) Target reactions

In this call for proposals, there are not restrictions concerning the type of reaction. However, priority will be given to proposals concerning groundbreaking catalysts that can convert methane as a reactant directly and efficiently into useful chemicals such as methanol, olefin and aromatics. On the other hand, ethane, propane and other lower alkanes show greater reactivity than methane, and their chemical activation have been widely investigated. Therefore, while reactions using ethane, propane and other lower alkanes as reactants will not be excluded from the scope of this research area, the proposals will be considered only if the activity and/or the selectivity of the reaction are innovatively high compared to the existing ones.

3. Selection policy

The target of this research area is not simply an extension of research to date, or a combination of existing research principles, or research towards improvements on existing technologies. It is expected that researchers will seek genuinely innovative new approaches to achieve the activation of methane and lower alkanes. For this reason, the applicant is asked to describe the trends in international research and indicate the superiority and originality of the research proposal compared with research to date.

It is expected that the researcher achieves the targets set for the PRESTO ("Sakigake") research during the approximate research period of three years, but at the same time, it is expected that this PRESTO research can become an important foundation in the careers of the researcher. This research area is looking for research themes that could become the mainstream of new science, and the wellspring of science and technology innovation. Since it is expected that the researcher him/herself achieves a significant advance during the period of the PRESTO program, this research area will select only proposals that that strongly reflects the purpose of the PRESTO program. In other words, greater emphasis will be placed on proposals containing new concepts developed by the individual researchers themselves, rather than the research concepts of the laboratories to which they were affiliated.

While it is desirable that research proposals regarding new catalyst substances or materials show preliminary experimental results, if the research proposal is still in the concept phase and lacks of experimental data, please provide information on the validity of the research proposal and how it complies with the purpose of this research area. In addition, please indicate how and when the applicant will verify the relevant catalytic function of the target substance or material. Moreover, if it is difficult for the researcher him/herself to verify the catalytic activity, it will be acceptable to the researcher to cooperate with another party, but it is a condition that the researcher him/herself conducts the experiment in accordance with the purpose of the program.

In this research area, cooperation with other researchers with the aim of maximizing the research output is recommended. Therefore, please state in the research proposal, the information on the cooperating researcher, the nature of the collaboration, and the expected results. However, please note that since this project aims to support individual researchers, there is no allocation of research expenses for other cooperating parties.

Although research proposals focused on the development of analysis and prediction methods of catalytic reaction using data science, theoretical calculation and measurement methods must also be established as individual research themes, the researchers in this area will be required to collaborate actively with other research themes selected in this research area.

Also, this research area will consider providing opportunities for discussion and collaborations with researchers participating of the PRESTO research area "Establishment of Basic Technology for Advanced Materials Informatics Integrating Theoretical, Experimental and Computational Science" starting in 2015. Moreover, active collaboration will be promoted with the CREST research area "Innovative Catalysts and Creation Technologies for the Utilization of Diverse Natural Carbon Resources" undertaken under the same strategic goals.

Moreover, according to the progress in the research, collaboration and cooperation with research institutes and programs nationwide, such as the MEXT's "Nanotechnology Platform Japan" will be promoted.

4. Research area management and fostering of young researchers

It is expected that the researchers who are selected for this research area will fully understand the social background of their research, and will develop their own PRESTO research, growing into researchers who are able to support future collaboration with industry. Consequently, the participating researchers are required to consider the acquisition of intellectual property during the research period.

In addition, over the six years that the research area will continue, it is expected that the participating researchers will be able not only to advance their own research significantly, but also, to contribute to the development of the research area through discussion and collaboration with researchers participating in the related PRESTO and CREST research areas.

Briefings on the call for proposals in this research area will be held according to the following schedule.

Date & Time	Venue
July 1 (Wed) 13:00-14:30	<Kanto-Area> JST Tokyo Headquarters Science Plaza B1 Hall
July 2 (Thu) 13:30-15:00	<Kansai-Area> Campus Plaza Kyoto 4th Floor Lecture room 3

For more information, please visit the following site: http://www.senryaku.jst.go.jp/teian.html.

Research area in the strategic objectives "The invention of innovative catalysts using diverse natural carbon resources", "Creation, advancement, and systematization of innovative information technologies and their underlying mathematical methodologies for obtaining new knowledge and insight from use of big data across different fields", "Creation of new functional materials by means of technology for controlling spaces and gaps in advanced materials in order to realize selective material storage, transport, chemical separation, and conversion, etc.", and "Establishment of molecular technology, which is the free control of molecules to bring innovation to environmental and energy materials, electronic materials, and health and medical materials"

4.2.4 Advanced Materials Informatics through Comprehensive Integration among Theoretical, Experimental, Computational and Data-Centric Sciences

Research Supervisor: Shinji Tsuneyuki (Professor, School of Science, The University of Tokyo)

Overview

Through the high-precision knowledge obtained through progress in measurement and analytical techniques, advances in combinatorial synthesis and other high-throughput experimental approaches, dramatic improvements in computing capability, first-principle calculation and other powerful computational science, understanding of the principles of materials science is advancing, and large amounts of related data is being obtained in a short time. In addition, some areas of infomation technology are making remarkable progress in extracting meaning and new knowledge from this large amount of complex data.

In this research area, we aim to establish advanced materials informatics platform tackling new materials design using knowledge obtained through the collaboration and merger of experimental science, theoretical science, computational science, and data-centric science, using the strengths of each approach. We also aim to produce young research leaders who can perform on a global level in future.

Specifically, this includes the following research;

1) Promotion of the discovery of new materials that will realize functions to meet social and industrial requirements, and establishment of guiding principle for materials design
2) Development of inductive methodologies clarifying structure-property correlations and physical law from large-scale, complex data, and discovery and design of novel materials using them
3) Establishment of high-throughput screening of candidate materials that will contribute to high-precision forecasting of the physical properties of unknown substances and experimental design of synthesis and evaluation
4) Development of new physical concepts and methodologies to comprehensively describe, store, and visualize diverse materials data
5) Development of data acquisition, storage and management technology that will contribute to the integration of data-intensive science and materials science, and maintenance of databases, and development of tools for various statistical analysis, machine learning, visualization, etc.

We aim to promote pioneering and innovative research that will dramatically accelerate the materials design and

discovery to contribute to many industrial applications in energy, medicine, chemistry and so on, stimulating a paradigm shift in materials science.

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

1. Background

Materials have latent functions that far exceed human imagination, and competition is heating up globally to discover and put them to use with science and technology. The research and development of new materials is a source that supports various industries and the evolution of society, and continuously promoting this development is necessary in order for Japan to grow and advance into the future. In addition, the discovery of high temperature superconductors has caused the physics of strongly-correlated electrons systems to flourish, and as development trends towards devices based on new operating principles, the discovery of novel materials represents a cradle for the progress in basic science as well as the development of innovative technologies based on scientific knowledge.

In recent years, in the field of materials science, measurement and analytical techniques that enable unprecedentedly sophisticated analysis of composition and structure, combinatorial synthesis and other high throughput experimental approaches, first-principle calculation and other numerical approaches enabled by high-performance computer, have driven the interaction among the so-called first, second and the third paradigm of science, resulting in rapid advances in the development of materials science.

However, when aiming to design materials with specific functions, the determinaion of precise element composition and stable structures from an enormous range of possibilities presents a very difficult task. Even if a candidate substance is specified, the material structure and its characteristics will differ according to the manufacturing process, so materials development is a very empirical trial-and-error situation based on experience and intuition.

On the other hand, there are some areas of information science and technology making remarkable progress in extracting meaning and new knowledge from large amounts of complex data. Analysis of large amounts of data obtained by high-throughput synthesis and large scale simulation and so on, given meaning with knowledge from materials science —in other words introducing fourth paradigm data-centric science—is expected to provide unprecedented new knowledge, leading to breakthroughs in materials research and development.

(2) The required research

With this background, in this research area, we aim to establish advanced materials informatics tackling new material design using knowledge obtained through the integration of experimental science, theoretical science, computational science, and data-centric science, using the strengths of each approach. We also aim to produce young research leaders who can perform on a global level in future.

Specifically, we are assuming research examples such as those shown in Outline of the Research Area 1) to 5), but not necessarily restricted to those topics. We expect challenging research that will bring about significant impact in future materials desing.

The targeted materials include organic and inorganic compounds, metals and alloys, high polymer compounds, and amorphous substances. In fact, we encourage the selection of comprehensive candidate materials with a reverse design concept of making chemical compositions, crystal structures, electronic states, synthetic methods, microstructures and so on, taking the required functions such as electromagnetic, optical, thermal, reactive, mechanical strength and other characteristics as a starting point.

In the proposal, it is desirable to include the impact on science and technology arising from the materials development, the new knowledge that can be expected to be obtained from the proposed method, the functions of the new materials, and the contribution to industry society. This fiscal year, we have strong expectations for advanced materials informatics, which is thought to be the key to connecting the third paradigm of science (computational science) with the fourth (data-intensive science).

We are requesting proposals for achieving dramatic rationalization of material development time and cost through the discovery of new materials with the desired functions, a deeper understanding of the principles of properties expression, and systematic materials design that surpasses trial-and-error know-how.. We hope for challenging proposals based on fresh concepts that do not simply follow previous research from overseas, and we are seeking research that will give Japan a continuous edge in global competition.

(3) Research implementation organization

For this request for proposals, we are accepting proposals that include collaboration between PRESTO researchers. As shown below, proposals are submitted individually, but the research proposal includes collaboration between researchers. In this way, we aim to enable proposals to be submitted that unite different fields to pursue results that cannot be addressed in a single field. In this case, the proposals must be on an equal footing and be worthy of PRESTO researchers. On the research proposal, separately indicate the individual research to be undertaken as a PRESTO researcher and the content of collaboration. Screening for selection will be based on individual research and collaboration. In some cases, only one or the other may be adopted. Of course we are also accepting proposals that do not include collaboration.

(4) Activities in the research area after selection

While collaborative proposals as in (3) above are possible, we will also actively support cooperation after selection that is deemed necessary for the research area. In addition, we will also promote collaboration with various research projects in Japan and overseas including related CREST and PRESTO research areas. Furthermore, we will discuss how this research area can contribute to open science such as sharing data and data analysis tools in the area as a whole.

* Please note that the application forms of this research area are different from those of the other research areas.

Research area in the strategic objective "Establishment of environmentally-adaptive-plant design systems for stable food supply in the age of climate change"

4.2.5. Creation of next-generation fundamental technologies for the control of biological phenomena in field-grown plants

Research Supervisor: Kiyotaka Okada (Professor, Faculty of Agriculture, Ryukoku University; Executive Director, National Institutes of Natural Sciences (NINS))

Overview

This area promotes research on the creation of next-generation fundamental technologies for designing, from the molecular level on up, of plants adaptable to environmental changes in the field and therefore capable of stable growth. Specifically, the relationship between phenotypes and the action of plant gene(s) would be analyzed quantitatively in both temporal and spatial terms, in order to achieve a comprehensive understanding of the physiological systems of plants adaptable to their environments. In addition, models of environmental response mechanisms would be constructed and biomarkers and the like would be identified in order to build the foundation for new plant production technologies. Technologies for the introduction of new genetic modifications would also be developed to enable the artificial design of complex genes/genotypes relating to environmental responses, with the aim of applying them in a diverse array of plants.

From the standpoint of quantitative analysis of plant environmental response mechanisms, rather than response mechanisms in single plant genes, the primary emphasis of research in this area will be on determining complex response mechanisms by means of multifactorial or quantitative trait locus (QTL) analysis. In addition, to meet the needs of analysis of, and model construction from, various types of large-scale data and the need of verification of the model constructed, we welcome the participation of individual researchers from a diverse array of fields, not only plant science but also information science, engineering and so on. In order to maximize achievements for the realization of the strategic objective, management of this research area will also be coordinated with the CREST research area "Creation of fundamental technologies contribute to the elucidation and application for the robustness in plants against environmental changes"" and the PRESTO (Sakigake) research area "Innovational technical basis for cultivation in cooperation with information science".

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

Background

In the future, global temperature increases and regional irregular rainfall and droughts and so on, which are partly the result of socioeconomic activity that places a large burden on the environment, are expected to be exacerbated worldwide. For this reason, there is concern in many parts of the world about the impact of environmental changes on crop production. As one way of dealing with these changes, there is a growing societal need for breeding

technologies to create crops which can adapt to environmental changes. In order to achieve this objective, basic studies are needed to be conducted on a comprehensive analysis of the mechanisms for efficient plant growth under various environmental conditions, particularly those of adaptive responses to environmental stresses, as well as on quantitative assessments of the impacts of interactions among physicochemical and biological environmental factors in the field.

Accordingly, research in this area should be promoted with the goal of innovative technical development of environmentally adaptable plants, developed through the integration of plant science knowledge and collaboration with technologies and research achievements in the fields of information science, engineering and so on.

Innovation based on scientific and technological achievements that are not limited to the plant field will require collaboration and cooperation among researchers from different fields. With this in mind, we welcome the participation of researchers from many different fields in this research area..

Examples of Specific Research Proposals

In order to develop a quantitative understanding of molecular mechanisms relating to the diverse environmental responses of plants, we are seeking research proposals into the creation of statistical analysis technologies that show the relationship between phenotypes and the temporal and spatial manifestation patterns of gene(s), the construction of models for environmental response mechanisms, the identification of biomarkers that show growth status coordinated with environmental conditions and so on, in order to serve as the foundation for next-generation technologies to control and predict plant growth in the field.

Below are specific examples of the research anticipated. (These are mere examples of research and development; we will welcome a wide range of proposals, including those that span multiple categories and new and creative research proposals relating to environmental response other than the ones shown here.)

① Quantitative analysis of plant environmental response mechanisms

Research into the molecular systems of physiological functions relating to plant environmental responses will be pursued. The environmental factors to be studied, which affect plant growth, include the concentration of carbon dioxide, temperature, humidity, pH level and other physicochemical factors in the atomosphere and/or in the soil, in addition to biological factors. Also targeted will be biotic factors such as interactions among plants during community formation and defense reactions against disease, pests and microorganisms. In addition, based on a quantitative analysis ranging from the molecular level to the individual plant and community level, a comprehensive understanding will be provided on plant growth and metabolic mechanisms, such as photosynthetic capability and the intake and accumulation of mineral nutrients. In each of these analyses, the main focus will be on the response network made up of multiple genes.

② Construction of mathematical models for environmental response mechanisms and development of biomarkers

Informatics research into plants using large-scale data will be pursued. The results of statistical analyses of the level of environmental factors, the expression of genes and the correlations between these and plant phenotypes will be

used to construct mathematical models of environmental responses for the purpose of establishing technologies to predict phenotypes based on environmental and genetic information. Moreover, following the development of techniques for data mining and clustering and so on and theory formation, the common elements and particular characteristics of individual varieties will be determined in order to identify crucial factor(s) that provide the foundation for application development, in order to study the value of these factors as biomarkers.

③ Study of new technologies for genetic engineering and gene introduction

Research into genetic engineering technologies for use in breeding plants adaptable to environmental stresses will be pursued. In recent years, new plant breeding techniques (NBT) such as genome editing, oligonucleotide-directed mutagenesis and so on have been developed. However, the efficiency and speed of gene introduction vary depending on plant species and variety, and new technologies must be developed. In this research area, the development of elemental technologies that will form the foundation for next-generation technologies of plant genotype designing will be conducted with the aim of creating plants adaptable to environmental changes and capable of stable growth. Examples of the elemental technologies to be developed include those for the modification and introduction of many genes, those to dramatically improve operational efficiency, and those to enable gene transfer for plant species in which genetic transformation is difficult.

In addition to grain crops, fruits, vegetables and other economic plants, this research area may target plant varieties which grow wild in field environments, as well as *Arabidopsis thaliana, Lotus japonicas,* and other model plants. In the case of research using such wild or model plants, however, the application of research achievements to economic plants should be added to the research plan to the extent possible. The locations where the research is conducted may include not only farm fields and the like but also artificial climate incubators, artificial climate chambers and other small enclosed environments with completely artificial light where a stable environment can be ensured, as well as plant factories and so on. When the research is executed entirely within such controlled environments, however, the research proposal should note the future deployment of the achievements into the field.

Management of the Research Area Following Selection

At an early stage following research plan selection in this research area, a meeting shall be set up between the research supervisor, etc. and the PRESTO researchers in order to reconsider the research plan. This will enable the smooth creation of achievements not only for individual research but for the research area as a whole. In order to achieve synergy among research areas, cooperation with research area advisors and the like who concurrently advise the relating CREST and PRESTO research areas established at the same time shall also be planed.

Discussion will be made on infrastructure measures for this research area in order to promote shared use of data and data analysis tools, and other open science activities. For example, when a database is compiled and made available, stating clearly the policy for database compiling and provision, a research infrastructure may be established in cooperation with the JST National Bioscience Database Center (NBDC) and other organizations.

Furthermore, there will also be active collaboration with programs being implemented by the Cabinet Office's Cross-ministerial Strategic Innovation Promotion Program (SIP) and other ministries and agencies, as well as with related international institutions. Specifically, joint workshops and symposiums will be held with these institutions in an effort to promote the achievements created in this research area.

Considerations when Submitting Proposals

When submitting research proposals, please confirm 1) and 2) below.

1) Differences from researches to be pursued in the PRESTO research area "Creation of Technological Infrastructure for Achieving Innovative Crop Cultivation Methods through Collaboration with Information Science"

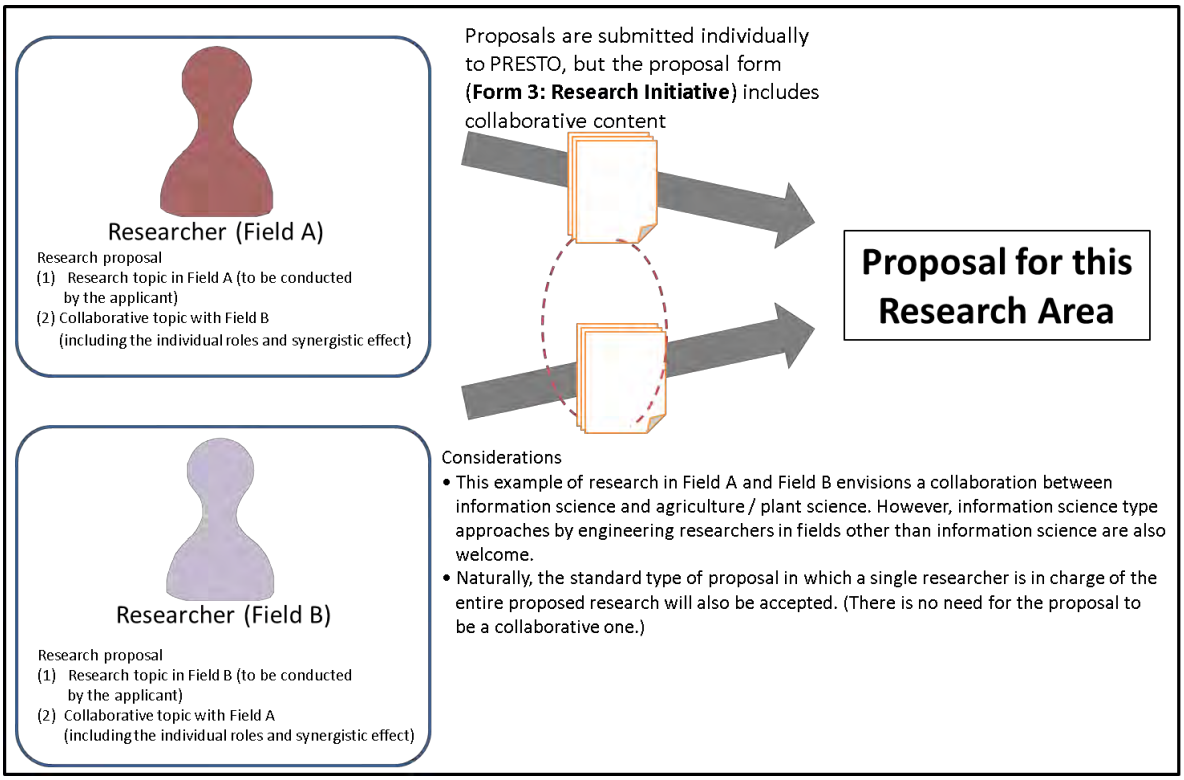
JST has established the present research area and the "Creation of Technological Infrastructure for Achieving Innovative Crop Cultivation Methods through Collaboration with Information Science" research area as independent PRESTO research areas, based on the Strategic Objective "Establishment of an Environmentally Adaptive Plant Design System to Achieve a Stable Food Supply in the Age of Climate Change". The present PRESTO research area is established in the life innovation field, and will involve a quantitative exploration of the physiological (and genetic) functions of plant environmental responses to aid in the effective (molecular) design of plants with the desired traits. In contrast, the other PRESTO research area mentioned above is established in the information science field, and will have a primary emphasis not on physiological functions but rather on recognizing the "black box" nature of the topic and extracting the ideal conditions for a plant growth environment. This will help to create the infrastructure for the design of sustainable agricultural production.

2) Collaborative research proposals

PRESTO research programs are designed to bring out the ideas and capabilities of individual researchers thoroughly and free them from organizational limitations. However, in this research area, a high level of collaboration is needed between different fields including plant science and information science. Accordingly, in addition to the standard type of proposals (from individual researchers), collaborative proposals involving two or more PRESTO proposal researchers will be accepted.

Specifically, when it is difficult for the researcher proposing the research topic to conduct the research alone, an information science researcher, for example, may discuss the possibility of collaboration with another researcher in plant science or other fields in advance. Then each researcher may submit a separate proposal in this research area, noting their individual roles and the anticipated synergistic effect in their proposals (see figure below). Even in such cases, however, each researcher will be considered to be an independent "PRESTO researcher," and each research proposal must include its own creative ideas. Please note that proposals of collaboration with other research areas are not allowed. When submitting collaborative proposals, please note in the proposal (Form 3:

Research Initiative) the status of coordination with the collaborative researcher as well as the research content that will be conducted individually by the submitting party, and differentiate it from the collaborative research content. Even in the case of a collaborative proposal, depending on the content of the collaborative research, it is possible that only one of the research proposals will be selected.



Collaborative Proposal

Note: The briefing sessions for the call for proposals in this research area (to be held jointly with the newly inaugurated PRESTO areas for FY 2015 relating to strategic objectives in the plant field) will be held on the following dates at the following locations. The doors will be opened 30 minutes before starting. Please bring your business card for the registration. We hope that many interested parties will attend.

Time & Date	Venue
July 7 (Tue) 14:00-16:00	<Kanto-Area> Waseda University Nihonbashi Campus Hall
July 13(Mon) 10:00-12:00	<Kansai-Area> TKP Garden City Kyoto “Tachibana”

For more information, please visit the following site: http://www.senryaku.jst.go.jp/teian.html

Research area in the strategic objectives "Establishment of an Environmentally Adaptive Plant Design System to Achieve a Stable Food Supply in the Age of Climate Change" and "Construction of Models for Mathematical Notation and Elucidation of Various Phenomena whose Ruling Principles and Laws in Society are Unclear"

4.2.6 Innovational technical basis for cultivation in cooperation with information science

Research supervisor: Seishi Ninomiya (Vice Director, Professor, Institute for Sustainable Agro-ecosystem Services, Graduate School of Agricultural and Life Sciences, The University of Tokyo)

Overview

The aim of this area is to achieve advanced cultivation techniques that will enable sustainable high-yield, high-quality agricultural production even under the various limitations resulting from climate change and the need for reduced environmental load and so on. To this end, collaboration between agricultural and plant science and information science (state-of-the-art measurements, data-driven science and so on) will be promoted to achieve the cultivation of plants adapted to various environments as well as control of plant growth to match production quality.

Specifically, these will include technologies for nondestructive measurement of plant biological functions, technologies to extract knowledge for ideal cultivation from diverse, large-scale data, general growth models capable of going beyond the site-specificity of plant cultivation, growth models that can consider uncertainty, complex system models that describe farm field ecosystems, technologies for precise control of growth in outdoor environments and so on.

For the pursuit of research in this area, the emphasis will be on the exchange of information, discussion and collaboration by researchers in information science and those in agricultural and plant science. Collaboration by PRESTO (Sakigake) researchers, each employing the strength of his or her specialist field, will be promoted to obtain the synergy resulting from mutual stimulation, in order to resolve food issues that will arise in the future. Furthermore, in order to maximize achievements for the achievement of the strategic objective, management of this research area will also be coordinated with the CREST "Creation of fundamental technologies contribute to the elucidation and application for the robustness in plants against environmental changes" research area and the PRESTO "Creation of Next-generation fundamental technologies for the control of biological phenomena in field-grown plants" research area.

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

1. Background

Even with the continued explosive growth of the world's population, economic development has made it possible for many more people to obtain a richer supply of food. For this reason, agricultural production requires not merely a simple increase in productivity but also improved quality. However, a variety of factors stand in the way of the

achievement of this type of agricultural production, such as concerns regarding biodiversity and environmental preservation, quantitative limitations on the amount of water and arable land and the like, an increase in areas that have been rendered unsuitable for cultivation due to climate change and so on.

Research in this area will focus on the resolution of issues despite various restrictions, with the aim of achieving cultivation technologies to support the sustainable production of high-yield, high-quality crops, as well as the achievement of basic and foundational research to enable the control of plant growth to match the target production volume and quality even in outdoor environments, based on collaboration between information science and agricultural and plant science. Although past efforts to integrate information science and agricultural science, etc. have produced several outstanding achievements, it has not been possible to sufficiently draw out the capabilities of plants grown amidst the complex interactions between cultivation conditions and farm field environments. Accordingly, basic and foundational research combining advanced agricultural science and plant science knowledge with measurements of plant biological functions that consider external environments, as well as state-of-the-art data-driven science and so on, are needed to achieve environmental adaptation and growth control for plants in a variety of environments.

2. Approach to call for proposals

As noted earlier, there is a need to achieve sustainable agriculture that provides both high productivity and quality under a variety of restrictions that include global climate change, the need to reduce environmental load, limited amounts of water and arable land and so on. In Japan, this problem is compounded by issues such as inefficient production due to small-scale farming operations, an inadequate number of farm workers and the loss of exemplary farming knowledge due to the aging population, the increased number of abandoned fields that are no longer cultivated, and an extremely low rate of self-sufficiency for food production including livestock feed. In addition to these problems, production loss, leftover food, the food distribution system and so on are also intertwined in complex ways with various socioeconomic factors to make up the food problems facing humanity.

Applicants should begin by considering on their own which of the various issues should be resolved by proposed research in the future, and to what degree, in order to achieve sustainable agricultural production that ensures both high productivity and high quality, and should note a long-term scenario for their own research. Next, please note the PRESTO research topic and the means of resolving the issue, the objectives to be achieved when the research is completed, and the research exit strategy. We are really hoping for innovativebasic research proposals that are based on a problem-solving approach. This research area will target primarily research that contributes to cultivation in the outdoor environments that are expected to be still the center for crop production in the future, but proposals for research into cultivation in plant factories and other artificial environments will also be accepted. The target scale for research is the level of individual plants and plant communities, but we also welcome proposals for research within organisms and those on a farm, regional or global scale and so on. However, it is essential that each research proposal be related to environmental adaptation of plants to farm fields and other outdoor environments and control of plant growth. When submitting proposals, please also confirm the points listed in 1) and 2) below.

1) Differences from PRESTO (Sakigake) “ Creation of Next-generation fundamental technologies for the control of biological phenomena in field-grown plants” research area

JST has established this research area (“Innovational technical basis for cultivation in cooperation with information science”) and the “Creation of Next-generation fundamental technologies for the control of biological phenomena in field-grown plants” research area as independent PRESTO research areas, based on the “ Establishment of environmentally-adaptive-plant design systems for stable food supply in the age of climate change” Strategic Objective. Research in the “Creation of Next-generation fundamental technologies for the control of biological phenomena in field-grown plants”” research area targets the control of complex plant gene functions. Specifically, a quantitative approach is used to elucidate plant environmental response mechanisms, in order to conduct informatics research that will help to develop effective methods of (molecular) design of plants with the desired traits. In contrast, research in this research area targets the development of growth models and simulations to derive the target yields and traits. Specifically, in addition to research into innovative technologies to measure plant biological functions, even if the specific environmental adaptation mechanisms are unknown, their “black box” nature is recognized and research is conducted into robustmodels and simulations that can precisely describe plant environmental adaptation. The objective in this area is research and development that can contribute to the design of sustainable agricultural production. As a rule, the data used for research should be data obtained from the cultivation of useful plants, whether in outdoor farm fields or plant factories or the like. However, methods that use large-volume simulation data and the like will also be accepted.

2) Collaborative proposals

PRESTO research programs are designed to bring out the ideas and capabilities of individual researchers thoroughly and free them from organizational limitations. However, in this research area, a high level of collaboration with a combination of fields including agricultural science, plant science and information science is needed. Accordingly, in addition to the standard type of proposal (from an individual researcher), it is possible to submit collaborative proposals involving multiple PRESTO proposal researchers.

In this research area, we are actively seeking proposals from state-of-the-art agricultural science, plant science and information science researchers. However, it is possible that information science researchers will have concerns regarding their ability to establish research topics and obtain data regarding the targets for analysis in the fields of agricultural and plant science, which up to now have been outside their area of speciality. Similarly, agricultural and plant science researchers may have an interest in data-driven research based on their own measurement data but may feel that there is some distance between themselves and a knowledge of state-of-the-art information science.

Accordingly, in cases in which it is difficult for the researcher proposing the research topic to conduct the research alone, an information science researcher and an agricultural or plant science researcher may hold discussions in advance regarding the possibility of collaboration and then each submit a separate proposal in this research area, noting their individual roles and the anticipated synergistic effect in their proposals (see figure below). Even in such cases, however, the individual researchers will need to be on an equal footing and the proposals must be

appropriate ones for PRESTO research. Please note that collaborative proposals with other research areas are not allowed. When submitting collaborative proposals, please note in the proposal (Form 3: Research Initiative) the status of coordination with the collaborative researcher as well as the research content that will be conducted individually by the submitting party, and differentiate it from the collaborative research content. Even in the case of a collaborative proposal, depending on the content of the collaborative research, it is possible that only one of the research proposals will be selected.

Researchers who are submitting proposals at the stage at which they are still studying the researchers for collaboration and the collaborative research topic should note in as much detail as possible the type of researcher with whom they anticipate collaborating and the types of collaborative topics they would like to study.

In addition, in the event that data will be used to pursue research toward the resolution of the target issue, please clearly note in the proposal (Form 3: Research Initiative) the type of data that will be used and the status of coordination with the data management institution in terms of data acquisition.

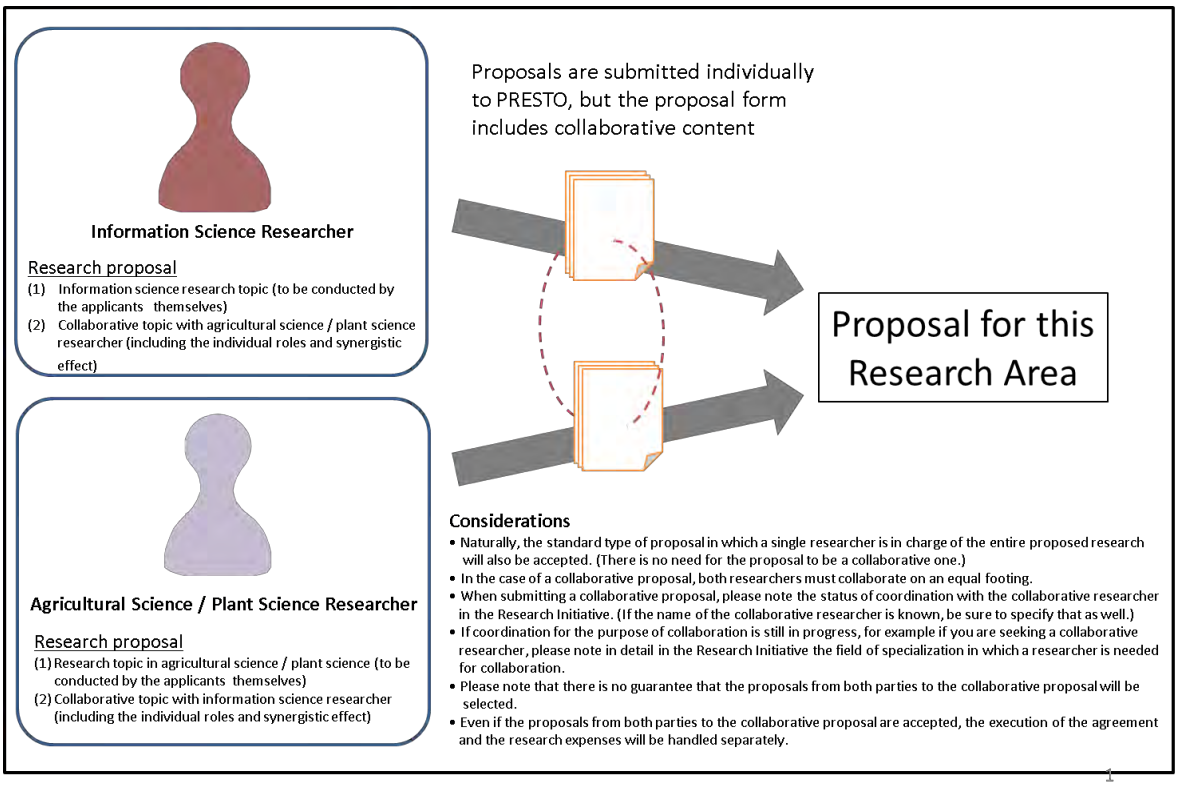


Figure: Collaborative Proposal

3. Examples of Specific Topics Anticipated in this Research Area

In this research area, we welcome innovative proposals that will contribute to cultivation technologies for the achievement of plant environmental adaptation and growth control.

Firstly, this research area targets the innovative research proposals, aiming at non-destructive/efficient measurement methods for plants biological functions. We place emphasis on that the proposed methods are available in the fields.

Secondly, research proposals relating to the construction of models and simulations of plant growth or farm field ecosystems, by means of information science/ mathematical analysis of data that include the measurement data for these plant functions, the legacy data stored at agricultural testing centers and the like, meteorological observation data, publicly available data in various statistical databases and satellite images and so on, will be considered. Although this type of model and simulation research is currently underway, there are many issues that need to be resolved in order to achieve models and simulations that are highly generalized to enable use in various regions and that can accurately predict growth even when data with a high level of uncertainty are incorporated. We are seeking efforts aimed at constructing robust models and simulations.

Furthermore, proposals aimed at achieving sustainable agriculture that convert implicit knowledge of cultivation into explicit knowledge and conduct total energy simulations and the like in agricultural fields and regions, etc., using data-driven science that is not bound by existing techniques to produce innovative achievements with respect to agricultural issues, will also be accepted. We consider it important for proposals that focus primarily on information science analysis to extract knowledge from data efficiently, and to include discussions of research achievements from an agricultural and plant science perspective, and researchers should keep these points in mind when submitting proposals.

Please note that the aforementioned examples of the specific research topics that are envisioned in this research area are only examples, and the topics will not be limited to these examples. We welcome innovative proposals that are based on the applicant's own creative ideas.

Please also note that this research area considers collaborations with CREST/PRESTO research areas promoted in the fields of life innovation as described hereinbelow, through utilization of knowledge based on such research areas. Therefore, please note that the targeted plants on the research proposal for this research area are limited to practical ones since this research area aims at practical use towards plants cultivation.

4. Approach to Administration of the Research Area Following Selection

In order to increase synergy through collaboration among the selected topics in the research area, a venue should be established that will allow thorough debate on the part of PRESTO researchers, the research supervisor, the research area advisors and so on. Active assistance will be provided for necessary collaboration even after selection. Applicants should understand that they may be asked to revise the initially proposed research plan as a result of discussions.

Along with the progress of research, in order to strengthen research capabilities, the sharing of knowledge relating to control of plant growth will be promoted through the establishment of a venue for the exchange of information and views with researchers promoting research in the CREST "Creation of fundamental technologies contribute to the elucidation and application for the robustness in plants against environmental changes" research area and the PRESTO (Sakigake) "Creation of Next-generation fundamental technologies for the control of biological phenomena in field-grown plants" research area, in the field of life innovation under the aforementioned "Establishment of an Environmentally Adaptive Plant Design System to Achieve a Stable Food Supply in the Age of Climate Change" Strategic Objective.

Although we are not seeking the commercialization of systems or services using the achievements in this research area, we will value discussion that keeps these objectives in mind, and we may want to study the implementation of such objectives depending on the progress of research. Discussions encompassing the entire area will also be conducted to determine what contribution this research area can make to the shared use of data and data analysis tools and other open science initiatives. As one example, cooperation in providing the data to the JST National Bioscience Database Center (NBDC) may be requested. Moreover, as it is anticipated that information science researchers will have difficulty acquiring agricultural data for analysis, A support might be conducted within this research area for the acquisition of such data.

PRESTO researchers will also be asked to cooperate in general outreach activities. Within this research area, we plan to hold workshops, seminars and the like that bring together agricultural and plant science and information science, and we hope that researchers will actively participate in these events.

At present, the number of researchers in fields that integrate agricultural and plant science and information science is extremely limited, and we hope that participants in this research area are committed to the effort to create a new field of study. We ask that agricultural and plant science researchers actively strive on their own to learn about the field of information science during the period of research —and that information science researchers do the same for the fields of agricultural and plant science) — and that both work to bring about an evolution in their own research as they incorporate knowledge from a different field. Each of these fields is enormous, and a considerable amount of time will be needed to learn even a part of the field. We suggest that researchers begin by participating in exchanges with researchers from the different fields in order to gain clues to how to go about this. It is our fervent desire that, in the course of research activities in this PRESTO research area, researchers will learn from and improve one another, eventually becoming a bridge between the two fields and drivers of the new integrated field.

* Please note that the application forms of this research area are different from those of the other research areas.

Note: The briefing sessions for the call for proposals in this research area (to be held jointly with the newly inaugurated PRESTO areas for FY 2015 relating to strategic objectives in the plant field) will be held on the following dates at the following locations. The doors will be opened 30 minutes before starting. Please bring your business card for the registration. We hope that many interested parties will attend.

Time & Date	Venue
July 7 (Tue) 14:00-16:00	<Kanto-Area> Waseda University Nihonbashi Campus Hall
July 13(Mon) 10:00-12:00	<Kansai-Area> TKP Garden City Kyoto “Tachibana”

For more information, please visit the following site: http://www.senryaku.jst.go.jp/teian.html

Chapter 5 Strategic Objectives

5.1 Pioneering next-generation photonics through the discovery and application of novel optical functions and properties

Overview

Technologies making use of light have served not only as means for observing substances, but also as cross-disciplinary technologies covering a wide range of fields, including material processing, telecommunications, and medical care. Along with the recent rapid advances in lasers and precision control and high-sensitivity measurement methodologies, light-based technologies are now an essential part of the social infrastructure, pioneering new frontiers of knowledge, which include the creation of new materials, the discovery of new functions and the control of quantum states by serving as advanced sciences and technologies. On the other hand, many aspects related to the essence of light behavior remain unexplained, such as diverse nonlinear optical phenomena and elementary excitation properties in material-light interactions. Systematic acquisition of new knowledge is inevitable to gain a deeper understanding of this field and develop applications therein.

Therefore, this strategic objective is to accelerate progress in new fields of photonics that will meet future demands of society and industry through cross-disciplinary, multilayered integration and development of conventional optical sciences achieved by clarifying, applying, and controlling novel optical functions and properties. At the same time, by working to clarify the fundamental principles sustaining the creation of new technological ideas, we will strive to create basic technologies and systems for complex light through the synthesis of optical functional materials, development and application of innovative optical communication technology, visualization of microstructures with high temporal and spatial resolution, and integration with advanced mathematical sciences.

This cross-disciplinary and coordinated approach toward further supporting a broad range of fields that includes the environment, energy, manufacturing, telecommunications, and medical care will lead to the formation of a higher-order social and industrial infrastructure capable of meeting various aspects of social demands, including precision, sensitivity, capacity, and power consumption.

Targets to Achieve

The strategic objectives is aimed at developing fields for next-generation photonics that have the flexibility to support a broad range of social and industrial demands through the development of nano-devices achieved by elucidating properties related to crystal structures and dynamic behavior in elementary excitations, and the development of optimal light sources and photodetection systems suited to a wide variety of objectives, from the noninvasive observation of deep tissue to the recording of high-speed electron motion. Specifically, we aim to achieve the following.

(1) The invention of new optical functional materials and nanostructures and the development of high-performance optical devices through precision control of various photoresponse properties

(2) The improvement of noninvasive *in vivo* observation and imaging techniques within organisms and soft matter through applications of nonlinear, organic photonics

(3) The implementation of fundamental research on interactions between light and diverse elementary excitations in materials

(4) The pioneering of extreme photonics, including ultra-high-density strong EMF science, attosecond laser technology, and ultra-high-precision optical frequency comb technology

Future Vision of a Society to be looked at during the research promotion

The achievements of the targets listed under “3. Targets to achieve” contribute to realize a society with the following characteristics.

- A society in which photonics technologies employing unexploited optical functional materials and advanced light sources contribute to the resolution or mitigation of grave social issues, such as environmental and energy-related problems, and make it possible to reform the manufacturing industry and create new key industries, thereby strengthening Japan’s intellectual infrastructure and industrial competitiveness on the global stage.

- A society in which advances in photonics technology concerned with the use and control of light, such as new optical communication technologies or sensing technologies, redefine an “information society” and alter our perception of space by achieving a more sophisticated and secure telecommunications infrastructure and closer links between information technology and the real world through cyber-physical systems (CPS) and the Internet of Things (IoT).
- A society in which the development of light sources and photodetectors having a low impact on humans and the environment and the establishment of control technologies for these devices stimulates greater sophistication in life sciences and medical systems and promotes the development of advanced equipment, enabling more advanced healthcare and stress-free diagnostics that are quick and inexpensive and place little burden on the patient.

Specific Research Examples

(1) The invention of new optical functional materials and nanostructures and the development of high-performance optical devices through precision control of various photoresponse properties

Develop optical functional materials based on new principles not previously considered in conventional optical sciences and conduct R&D on their wide-ranging applications, as in the preceding example of metamaterials with controlled permittivity and magnetic permeability. Specifically, control light waves using structural features that are smaller than the wavelength of light and attain a resolution beyond the diffraction limit of light, develop nanoscale laser micromachining and measuring technologies, and conduct research on creating new materials. For clarifying basic principles identified as future challenges and establishing future technologies for high-volume manufacturing, conduct research on processes for discovering new functions and processes for creating new materials based on theoretical approaches involving simulations and on the elucidation of currently unknown physical properties, and develop techniques and the necessary equipment for freely designing and fabricating substances or materials possessing a specific refractive index, transparency, and permittivity.

(2) The improvement of noninvasive *in vivo* observation and imaging techniques within organisms and soft matter through applications of nonlinear, organic photonics

In order to develop applications for the broad range of advanced life sciences, develop optical imaging technologies that enable noninvasive observations in real-time for biological functions from the molecular to the whole-body level as far down as deep tissue, develop practical coherent light sources that are small and stable for use in this imaging technology, and conduct research aimed at elucidating mechanisms of interaction occurring under light irradiation between a biologically-relevant substance (the detection target) and a non-biological substance (the probe). This research will help develop a high-quality, high-resolution microscope enabling the direct observation and analysis of biomolecules and the interior of soft matter.

(3) The implementation of fundamental research on interactions between light and diverse elementary excitations in materials

With the aim of clarifying and deepening our understanding of the basic properties of solids required for an extensive range of basic research and industrial applications and of attaining next-generation high-performance optical devices, develop techniques for observing and controlling the dynamics of quasiparticles (collective excitations) in the interior and on the surface of solids and such ultra-fast dynamic processes as electrons emitted from a solid, and establish control technologies for various photoresponses and photochemical reactions, including a technology for controlling coherent light with an extremely short pulse duration. Specifically, conduct research on improving techniques for observing electron states at high resolutions in both temporal and spatial dimensions and techniques for controlling the oscillation and propagation of plasmons and phonons. In plasmonics, for example, a goal is to develop subwavelength photonic devices below the diffraction limit of light and nano-optical devices, such as surface plasmon-based circuits and interferometers.

(4) The pioneering of extreme photonics, including ultra-high-density strong EMF science, attosecond laser technology, and ultra-high-precision optical frequency comb technology

Conduct research using relativistic high-density plasma generated through ultra-intense laser-matter interactions, and pioneer advanced optical sciences for use under extreme environments and conditions,

such as a technique for generating and controlling attosecond pulses, terahertz polarization pulse shaping with arbitrary field control, an optical frequency comb for ultimate measurements of time and space, and a laser acceleration technology. These endeavors will help amass knowledge on advanced laser science to clarify basic principles and will contribute to a deeper understanding of atomic physics and material properties. These efforts will also lead to R&D on improved and commercially viable optical lattice clocks that are ultra-precise and ultra-stable, the recording of ultrahigh-speed electron motion during chemical reactions, and the development of technologies for manipulating electrons in matter with attosecond precision.

While the above targets share common technologies for controlling the conditions of light (phase, pulse, intensity, wavelength, etc.), we would like to radicalize photonics technology and expand its applications through multifaceted approaches that involve predictive techniques based on our knowledge of computational science and mathematics for complex systems that could help in development and verification for constructing and optimizing systems based on these technologies.

Domestic and Foreign Research Trends

(Trends in Japan)

In Japan research on applications relevant to optical sciences has unfolded in such projects as the Center of Innovation (COI) program and the Photon Frontier Network program. In particular, these programs are conducting new R&D on the establishment of element technologies for photonic crystals capable of producing revolutionary semiconductor lasers that transcend conventional operating principles and a laser acceleration system and to apply these technologies and system toward the development of an ultra-small X-ray free-electron laser.

(Trends overseas)

Following the 7th Framework Programme (FP7), Europe has launched Horizon 2020, the EU Framework Programme for Research and Innovation, in an effort to further develop optical sciences and technologies aimed at renovating its information and communcation networks and strengthening its industrial competitiveness. Germany has also promoted R&D at the Fraunhofer Society on optical sciences related to industrial technology as a national policy. In the U.S., the Fast-Track Action Committee on Optics and Photonics under the National Science and Technology Council (NSTC) outlined America's future direction in its report "Building a Brighter Future with Optics and Photonics" in April 2014, declaring that the U.S. would focus on imaging and faint photonics.

Background of Consideration

The following study was conducted based on the Expert Panel Report on the Envisioned State of Strategic Basic Research (June 27, 2014).

(Preparation of analytic materials regarding research trends in Japan and overseas using the Science Map and Database of Grants-in-Aid for Scientific Research)

We prepared analytical materials on research trends in Japan and overseas using information in Science Maps 2010 and 2012 (July 31, 2014; National Institute of Science and Technology Policy (NISTEP)) and the database of Grants-in-Aid for Scientific Research.

(Implementation of a questionnaire for specialists using analytical materials and preparation of notable research trends)

We created a questionnaire on noteworthy research trends based on the analytical materials we had prepared and administered the questionnaire to the JST Center for Research and Development Strategy and to experts participating in the expert network operated by the Science and Technology Foresight Center of NISTEP. We then analyzed responses to the questionnaire and identified the "development of new fields in photonics based on ultra-precision control of light" as a noteworthy research trend.

(Holding of workshops and preparation of strategic objectives)

We held a workshop to bring together experts from industry and academia involved in the development of new fields in photonics based on ultra-precision control of light identified as a noteworthy research trend. At the workshop, we discussed particularly notable trends in Japan and overseas, the social and economic

impacts of progress in research and technological development, visions of a society arising from such impacts, and objectives that should be met during the research period. We then prepared strategic objectives based on the discussions in the workshop.

Relevant Matters in Cabinet Decisions etc.

Comprehensive Strategy on Science, Technology and Innovation 2014 (approved by the Cabinet on June 24, 2014)

Chapter 2, Section 1, I.3 (4)1)

We will promote the research and development and systematization of ultra-low-loss power devices (SiC, GaN, etc.), which significantly reduce the power consumption of motors and information devices, ultra-low-power-consumption semiconductor devices (three-dimensional semiconductors, nonvolatile elements, etc.), and optical devices to advance technologies in efficient energy utilization, and will contribute to the significant reduction of energy consumption by expanding the applications of these technologies to devices in the transportion, industrial, and consumer sectors. … With this measure, we will realize a society possessing advanced technologies for efficient energy use and intended for international expansion.

Chapter 2, Section 2, 1. Basic Understanding

It is necessary to sufficiently utilize mathematical sciences, systems science, and photonics and quantum sciences, all of which support cross-cutting technologies.

Other

- Under the FY2008 Strategic Objective “Enhancing advanced materials science and life science toward innovations using new light sources, including state-of-the-art laser technology,” we have strived to merge research in the utilization of light developed in each individual field thus far, to conduct basic research on optical sciences related to the interaction of light and matter, and to produce technological ideas having a great rippling effect on other fields. It is necessary now to accelerate commercialization of advanced optical sciences by concentrating our efforts on expanding these excellent research ideas through research under the current strategic objectives.
- The goal of the Project to Develop Basic Technologies Aimed at Establishing Research Bases for Photonics and Quantum Sciences is to conduct R&D on state-of-the-art light sources, beam sources, beam control techniques, and measuring techniques that merge the technological ideas in fields of photonics and quantum sciences with the needs in priority areas and industry. The new light sources and element technologies developed through this project form the foundation for R&D conducted under the current strategic objectives.
- The program entitled the “Development of Systems and Technology for Advanced Measurement and Analysis” has promoted the development of element technologies and equipment for innovative and advanced measurement and analysis and their peripheral systems, resulting in the development of detectors and new light sources. Through coordination with research under the current strategic objectives, we can expect swift results in commercialization of advanced equipment, and particularly in optical sensing.

5.2 Elucidation of principles for innovative energy conversion functions, and generation of new substance creation, new device creation, and other core technologies, that will contribute to the high-efficiency conversion and advanced application of microenergy

Overview

There are many forms of untapped energy in the natural world and a significant volume of research is being undertaken on technologies for putting them to work by converting them to electric energy. Development of technology capable of converting microenergy to electric energy with output in the range of μW～mW has become the focus of attention in the U.S. and Europe, and growth is being seen in investments targeting two areas. One is sensors that, because of their ability to freely use energy in the environment, are anticipated to be applied in numbers ranging from the hundreds of millions to trillions. The other is independent power supplies for mobility devices, biodevices, and other applications in environments where drawing power from a power grid is impractical.

In contrast, amid the need for new principles for the highly efficient conversion of untapped microenergy from the natural world into electric energy and for the creation of new substances based on those principles, Japan has technological seeds for innovative research on new principles (e.g. the spin Seebeck effect) and the creation of new substances (e.g. high-ZT materials and multiferroics).

Under this strategic objective, therefore, attention will be focused on applying Japan's strengths to the elucidation of principles for innovative energy conversion functions, and generation of new substance creation, new device creation, and other core technologies, that will contribute to the high-efficiency conversion, and advanced application, of microenergy, and in so doing accomplish two goals: 1) Acceleration of the adoption of sensors and other applications that do not have high energy requirements; and 2) Contribution to the realization of next-generation environmental protection and manufacturing applying cutting-edge Internet of Things (IoT) technologies and big data.

Targets to Achieve

The focus of this strategic objective is not only to elucidate basic principles, and create new materials and new structures and devices, but also to promote research strategically including fundamental analysis, design technology, and theoretical approaches, and, in so doing, create technology that converts microenergy to electrical energy, surpassing existing principles and conversion materials. In more specific terms, the following will be achieved:

(1) Elucidation of new principles contributing to the highly efficient conversion of, and advanced application technologies for, microenergy

(2) Development of theories, fundamental analysis, and design technologies for the highly efficient conversion of, and creation of advanced application technologies for, microenergy

Future Vision of a Society to be looked at during the research promotion

The achievements of the targets listed under "3. Targets to achieve" contribute to we realize a society with the following characteristics.

- A society in which the ability to create electrical energy from microenergy leads to the rapid adoption of sensors, mobility devices, biodevices, and other technology that are not suited for receiving power from an electrical grid and do not require large amounts of energy, and next-generation environmental protection and manufacturing applying IoT technology and big data are being realized.

5. Specific Research Examples

(1) Elucidation of new principles and generation of innovative substances and devices that will contribute to the high-efficiency conversion of, and advanced application technology for, microenergy

Develop core technologies for the high-efficiency conversion into electric energy, and advanced application, of heat, light, electromagnetic wave, biological body, phonon, spin, and other types of energy, and elucidate the underlying principles in creating new substances and devices with outstanding physical properties far surpassing the characteristics and functions of substances to date. More specifically, elucidate principles contributing to innovative energy conversion such as that taking the form of the interrelationship of spin and topology, and create new substances applying such innovative

energy conversion, functional substances from inorganic compounds and/or organic compounds or inorganic / organic hybrid compounds, or new substances contributing to innovative energy conversion with an eye toward lowering environmental impact.

(2) Development of theories, fundamental analyses, and design technologies for the high-efficiency conversion of, and creation of advanced application technologies for, microenergy

Create analytical standards and analytical technologies for physical phenomena (physical properties of materials, interfaces, transport phenomena, etc.) that are associated with energy conversion and are required for elucidating new principles and creating innovative materials. More specifically, establish theoretical calculation and computer simulation methods contributing to new principles and new substance creation, and generate principles and design criteria for innovative devices based on new principles and substances. In addition, control interactions, for example, as in the independent control of two energy forms (e.g. phonon and spin current transfer), and perform an analysis based on electron-phonon and magnon-phonon separation.

Domestic and Foreign Research Trends

(Trends in Japan)

In Japan, large-scale projects focusing on applications of microenergy have not been implemented, and research investment is far behind that of other countries. Nevertheless, Japan has strengths in basic research and development in ferroelectrics and other branches of physics and thermoelectric conversion and other areas of conversion materials. Potential exists for the creation of innovative technologies through the combination of unrelated fields and combination of basic and applied fields.

(Trends Overseas)

In Europe, numerous projects on the application of microenergy are underway. In 2014, the U.K. made the decision to provide 50 million pounds (approx. 8.9 billion yen) in funding for work in seven emerging technologies over a four-year period. Energy harvesting is among the seven targeted fields of technology, and sights have been set on the commercialization of wireless sensors and autonomous power supplies. In the U.S., Fairchild Semiconductor, the University of California, Berkley, and other parties established the “Trillion Sensors Universe” in 2013, accelerating industry-academia collaboration with this project aimed at bringing about a society that puts one trillion sensors into use every year.

Background of Consideration

Based on the Expert Panel Report on the Envisioned State of Strategic Basic Research (June 27, 2014) an examination was carried out as described below.

(Preparation of analytic materials regarding research trends in Japan and overseas using the Science Map and Database of Grants-in-Aid for Scientific Research)

Materials for the analysis of domestic and overseas research directions were prepared using information from the Science Map 2012 & 2010 (National Institute of Science and Technology Policy, July 31, 2014) and information from the Database of Grants-in-Aid for Scientific Research.

(Implementation of a questionnaire for specialists using analytical materials and preparation of notable research trends)

Experts associated with the JST Center for Research and Development Strategy and experts participating in the expert network of the Science & Technology Foresight Center of the Japan Science and Technology Agency were asked to respond to a survey on notable research directions. This survey was constructed using prepared analysis materials. Survey results were analyzed and “creation of core technologies related to high-efficiency energy conversion for the construction of small, distributed power supplies and applications for such power supplies” was identified as the most notable research direction.

(Holding of workshops and preparation of strategic objectives)

Workshops bringing together experts from industry and academia to discuss the “creation of core technologies related to high-efficiency energy conversion for the construction of small, distributed power

supplies and applications for such power supplies" were held. Discussions focused on notable domestic and overseas research directions, the potential social and economic impacts of research and technology development advances and visions of the future society that could emerge as a result, and objectives that should be achieved during research periods. Strategic objectives were prepared based on workshop discussions.

Relevant Matters in Cabinet Decisions etc.

Fourth Science and Technology Basic Plan (approved by the Cabinet on August 19, 2011) (August 19, 2011 Cabinet Decision)
III. 2. (2) ⅰ)

Promote research and development of, and advance strategies for appropriate open access to, core technologies required for development and application of advanced materials and components for which high rates of added value, high market share, and future growth are expected and for which Japan has a wealth of technologies with international competitive advantage, core technologies supporting the use and application of high-performance electronic devices and information communication, and other innovative common core technologies.

Comprehensive Strategy on Science, Technology and Innovation (Cabinet Decision June 24, 2014)
Chapter 2, Section 1, I. 3. (7) 1)

In order to further improve energy usage efficiency, work to advance technology for the application of cogeneration, which produces both heat and electricity, and technology for the application of low temperature heat emission and other forms of energy that have not been used to date.

Other

- It is imperative that the creation of core technologies contributing to the high-efficiency conversion and advanced application of microenergy and commercialization of results be pursued while also carrying out the following related R&D and research under the strategic objectives described herein.
  - Through a portion of the research being conducted under the fiscal 2011 strategic objective, "Realization of breakthroughs in phase-interface phenomena and creation of basic technologies for high-functionality interfaces that will result in dramatic advancements in highly-efficient energy utilization," the fiscal 2012 strategic objective, "Establishment of molecular technology, which is the free control of molecules to bring innovation to environmental and energy materials, electronic materials, and health and medical materials," and the fiscal 2013 strategic objective, "Creation of new functional materials by means of technology for controlling spaces and gaps in advanced materials in order to realize selective material storage, transport, chemical separation, and conversion, etc.," efforts are being made to create basic science and technology related to the conversion and transport of energy. In research being conducted under the fiscal 2014 strategic objective, "Development of innovative materials and devices based on atomic or molecular two-dimensional functional films, and their applications to practical uses," work is being pursued to create device design technology using topological insulators. In addition, in research moving forward under the fiscal 2013 strategic objective, "Creation of innovative core technologies by merging material technology, device technology, and nano-system optimization technology toward the realization of information devices with ultra-low power consumption and multiple functions," efforts are being made to link and merge new functional materials, electronic devices, and system optimization.
  - At the New Energy and Industrial Technology Development Organization (NEDO), the "Project to Advance the Implementation of Clean Devices in Society" (two-year project beginning in 2014) is underway. The purpose of this project is to widen the definition of clean devices that contribute to energy saving (environmental power devices and other innovative devices contributing to energy saving) from those devices traditionally imagined, to include devices used for new applications in the form of products and services, thereby maximizing energy-saving impacts. This project is targeting the development of directions for device installation and testing, reliability and safety, and standards and standardization.
  - At the Center of Innovation (COI), efforts are being made to develop and apply nano sensing devices in projects such as "the center of innovation for creation of platform on big life data from unconscious sensing to support human and social well-being."

5.3 Creation of innovative catalysts using diverse natural carbon resources

Overview

The worldwide chemical industry which depends on oil is undergoing a rapid transformation. In the U.S., as a result of the shale revolution, ethylene, manufactured using ethane with cheap natural gas as a feedstock, is beginning to gain a strong competitive edge. In China, methanol is being synthesized using coal. In the meanwhile,, it is very difficult to create innovative catalysts that efficiently activate methane and lower alkanes which are found abundantly in natural gas, but if it can be achieved, it will have a major impact internationally. In particular, there are growing expectations for manufacturing technologies with low carbon dioxide emissions and energy input, and it is a matter of urgency to develop these very advanced technologies.

For this reason, this strategic objective aims to create innovative catalysts that use various resources such as methane (CH_4) and lower alkanes (CnHx: n = 2, 3) as chemical feedstocks and energy, leveraging Japan's highly competitive catalyst research capabilities. The target is to establish a common platform for material research using advanced substance synthesis, measurement and calculation technologies and data science, strategically promoting the discovery of catalytic principles and the creation of catalysts, enabling a society that uses diverse natural carbon resources with high efficiency.

In recent years, calculation and measurement technologies have been making advances. If we can leverage them to design and invent innovative catalysts, we will be able to establish a platform for new catalyst research. Beyond this, we also expect to develop new methodologies in nanotechnology and materials research, further reinforcing the competitiveness of Japan.

Targets to Achieve

This strategic objective aims to create innovative catalysts that use various resources as chemical feedstocks and energy, such as methane (CH_4), which accounts for the majority of the content of natural gas, and lower alkanes (CnHx: n = 2, 3). Specifically, we aim to achieve the following;

(1) The invention of catalysts that realize C1 chemistry in order to convert methane into chemical feedstocks and energy

(2) The invention of catalysts that efficiently convert lower alkanes into chemical feedstocks and energy

(3) The establishment of a common platform for identifying the guiding principles of catalytic reactions through collaboration in materials research leveraging material creation, measurement, analysis, theoretical calculation, and test and calculation data,.

Future Vision of a Society to be looked at during the research promotion

The achievements of the targets listed under "3. Targets to achieve" will contribute to realize a society with the following characteristics.

- A society in which a key industry supporting the foundation of Japan has been formed through the ability to use diverse carbon resources other than oil such as the methane contained abundantly in natural gas and lower alkanes, converted into chemicals and fuel..
- A society in which a future path to resource-rich nation status has been opened if that is somewhat freed from resource risk by establishing diverse feedstock and energy sources that do not rely on oil and the exploitation of methane hydrate is achieved.

Specific Research Examples

(1) The invention of catalysts that realize C1 chemistry in order to convert methane into chemical feedstocks and energy

Using methane as a reactant, develop highly active, highly selective catalysts that achieve direct synthetic reactions to produce methanol and other chemicals with high added value.

(2) The invention of catalysts that efficiently convert lower alkanes into chemical feedstocks and energy

Using ethane or propane as a reactant, develop innovative, highly active, highly selective catalysts that react to produce ethylene glycol, acetic acid, propanol, acrylic acid and other chemicals with high added value.

(3) Through collaboration in material research leveraging material creation, measurement, analysis,

theoretical calculation, and test and calculation data, build a common platform for identifying the guiding principles of catalytic reactions.

Realize onsite dynamic surface measurement of the actual operating conditions of the catalytic reaction. Realize multiscale, multiphysics analysis of catalytic reactions using large scale theoretical calculation. Realize material research leveraging test and calculation data through the use of materials informatics.

Domestic and Foreign Research Trends

(Trends in Japan)

Catalyst research in Japan is highly competitive in relation to other countries. Japan is diligently pursuing research and development into the solubilization and conversion of biomass to sugar, chemical catalysis, water splitting and hydrogen generation using sunlight, artificial photosynthesis to convert carbon dioxide into fuel and feedstocks and other similar areas. However, research into the use of methane and lower alkanes for chemical feedstocks and energy is an unexplored field. Recently, new concepts have emerged in catalyst research, such as research into electride catalysts that enable synthesis of ammonia at room temperature (Hosono et al., 2012). There is increasingly active research that promises to contribute to the conversion of methane and lower alkanes to feedstocks and energy. It is necessary to incorporate the knowledge from these peripheral research areas, as well as from the rapid progress in measurement, calculation and data science, and quickly build a framework for addressing the conversion of methane and lower alkanes to feedstocks and energy.

(Trends Overseas)

In response to the shale revolution, the development of technologies for utilizing methane and lower alkanes is having a direct impact on the industrial competitiveness of each country, with research and development being undertaken in Europe, America and other countries.

For example, Russia researchers reported that they have achieved successful results in selective synthesis of methanol from methane using nitrous oxide at 160 °C with maximum yields of 96%. In America, since 2003, the Department of Energy's ARPA-E funding program for innovative advanced research has provided support for a project to develop small scale processes for converting methane to liquid fuel using methane assimilating microorganisms. In addition, venture companies are working on manufacturing chemicals from methane using microorganisms.

Background of Consideration

The following study was conducted based on the Expert Panel Report on the Envisioned State of Strategic Basic Research (June 27, 2014).

(Preparation of analytic materials regarding research trends in Japan and overseas using the Science Map and Database of Grants-in-Aid for Scientific Research)

Analytic materials regarding research trends in Japan and overseas using information in the Science Map 2012 & 2010 (July 31, 2014 National Institute of Science and Technology Policy) and the Database of Grants-in-Aid for Scientific Research were prepared.

(Implementation of a questionnaire for specialists using analytical materials and preparation of notable research trends)

A questionnaire concerning future notable research trends was conducted for the specialists participating in the expert network of the Japan Science and Technology Agency Center for Research and Development Strategy and the National Institute of Science and Technology Policy Science and Technology Foresight Center, using the analytical materials prepared. The results of the questionnaire were then analyzed and then the creation of innovative catalysts for efficient conversion of energy was identified as a noteworthy research trend.

(Holding of workshops and preparation of strategic objectives)

A workshop gathering experts from industry and academia related to the noteworthy research trend towards the invention of innovative catalysts for efficient conversion of energy was held. Particularly

notable trends in Japan and overseas, the social and economic impacts of research and technology development and the future society to which they may give rise, and the targets that should be achieved during the research period were discussed. The strategic objectives were prepared based on the discussions in the workshop.

Relevant Matters in Cabinet Decisions etc.

Comprehensive Strategy on Science, Technology and Innovation 2014 (approved by the Cabinet on June 24, 2014)

Chapter 2, Section 1, I. 3. (3) 1)

Conduct research and development into innovative catalyst technologies for efficient production of energy and chemicals from diverse feedstocks such as shale gas, unconventional crude oil, and carbon dioxide, as well as energy resources from microorganisms and biomass

Other

- The research areas covered by catalysts are broad, and the areas targeted by each project are different. The main targets of major projects are as follows.
  - The main research fields targeted under the 2012 strategic objective of the creation of advanced catalytic-transformation technology to solve various challenges related to the environment, energy and drug design are chemical catalysts for conversion of carbon dioxide and water splitting and hydrogen generation using sunlight.
  - The Japan Science and Technology Agency Advanced Low Carbon Technology Research and Development Program (ALCA) targets solubilization and conversion of biomass to sugar, and chemical catalysts.
  - The Ministry of Economy, Trade and Industry's Japan Technological Research Association of Artificial Photosynthetic Chemical Process (ARPChem) is working on artificial photosynthesis for converting carbon dioxide into feedstock using hydrogen generated by a water splitting reaction using sunlight and photocatalysts.
  - Some of the research conducted under the FY2012 strategic objective "The establishment of molecular technology, using the free control of molecules to bring innovation to environmental and energy materials, electronic materials, and health and medical materials", and the FY2013 strategic objective "Creation of new functional materials by means of technology for controlling spaces and gaps in advanced materials in order to realize selective material storage, transport, chemical separation, and conversion, etc.", targeted solubilization and conversion of biomass to sugar, and chemical catalysts.
- As indicated, despite the importance of this strategic objective of converting methane and lower alkanes to chemical feedstock and energy, it is a hitherto unexplored field with no projects to address it, and it is anticipated that an organization will be built with other institutes to conduct research under this strategic objective.

5.4 Establishment of environmentally-adaptive-plant design systems for stable food supply in the age of climate change

Overview

To resolve the global food problems faced by Japan and other countries around the world, technologies for the development and the cultivation of agricultural crops that can adapt to climate change and other environmental changes must be established. In order to achieve these technologies, the knowledge in the area of basic plant science that is gained through model plant research in Japan must be linked to crop development and cultivation, and various biological data in plant science must be gathered and analyzed from new perspectives including technologies in engineering, information science and other different fields.

To this end, the strategic objective is focused on an information science approach to conduct an integrated analysis of genome, transcriptome, metabolome and other omics data accumulated in plant science, phoneme and other quantitative data obtained using state-of-the-art measurement technologies, and environmental factors and the like that have been quantified in numerical terms, in order to build prediction models for plant growth and environmental response. Subsequently, plants with the improved environmental adaptability that have been designed by using these prediction models will be developed, and demonstration cultivation in actual environments will be conducted, in order to achieve “environmentally-adaptive-plant design systems” which are based on “growth and environmental response prediction models”

This will make it possible to design, manufacture and cultivate crops able to grow under a variety of environmental conditions, thus ensuring a stable food supply.

Targets to Achieve

The strategic objective is to establish “environmentally-adaptive-plant design systems” which will make it possible to predict growth and environmental response of plants based on environmental conditions, various plant-related factors and other quantitative data, and to design, manufacture and cultivate plants with improved environmental adaptability. Specifically, we aim to achieve the following:

(1) Development of quantitative measurement technologies that can make a detailed characterization of growth, physiological state and environmental response of plants

(2) Identification of biological markers (biomarkers) for each target plant that can respond to fluctuations in phenotypic character

(3) Establishment of “growth and environmental response prediction models” that work by means of bioinformatics, integrating technologies in plant science and different fields such as engineering

(4) Design, manufacture and verification of plants with improved environmental adaptability based on the “growth and environmental response prediction models”

Future Vision of a Society to be looked at during the research promotion

The achievements of the targets listed under “3. Targets to achieve” contribute to we realize a society with the following characteristics..

- A society in which crop and plant varieties developed based on the predictions made using the “growth and environmental response prediction model” will make it possible to ensure stable food production even in areas unsuitable for the cultivation of existing crops, under increasing concern that rapid climate change may convert regions that are conducive to the cultivation of existing crops into regions that are unsuitable for the cultivation of those crops.
- A society in which it contributes to resolve food shortages due to population increase and environmental degradation that the “environmentally adaptive plant design system” based on the “growth and environmental response prediction model” and the crop improvement technologies, environmental monitoring technologies and integrated omics analysis technologies and the like developed by Japan will be provided to other countries in the form of a comprehensive agricultural technology package, andthat will enable stable crop cultivation even in countries in which most of the land area is unsuitable for the cultivation of existing crops, and countries with reduced yields due to the effects of climate change.

Specific Research Examples

(1) Development of quantitative measurement technologies capable of detailed determination of plant growth, physiological state and environmental response

Improve phoneme analysis technologies that are capable of making quantitative determinations of plant phenotypes.. Also improve advanced sensing technologies and imaging technologies that can determine the precise physiological state of plants.

(2) Identification of biomarkers for individual plants that can respond to fluctuations in phenotypic character

Conduct research on the Identification of biological markers (biomarkers) that can respond to fluctuations in phenotypic character. Also conduct research on the accumulation of data on gene expression and metabolic changes that are linked to the phenotypic character of plants under various environmental conditions, such as outdoor settings and controlled environments.

(3) Establishment of a “plant growth and environmental response prediction model” through bioinformatics that integrates plant science with engineering and other technologies in different fields

Conduct research on the prediction of phenotypic character such as plant growth, flowering and so on in presumed environments will be conducted. Also conduct research on the prediction of responsiveness to environmental stress, genes that can improve tolerance, and prediction of related traits.

(4) Design, manufacture and verification of plants with improved environmental adaptability based on the “growth and environmental response prediction model.”

Development and advance plant engineering technologies for the manufacture of plants that are designed to have improved environmental responsiveness based on the “growth and environmental response prediction model.” The cultivation in outdoor settings and controlled environments of the plants designed and manufactured based on the “growth and environmental response prediction model” will be verified, and data on phenotypic character during the period of cultivation and changes in physiological state will be prepared and provided as feedback to the “plant growth and environmental response prediction model.”

Domestic and Foreign Research Trends

(Trends in Japan)

Progress has been made in Japan in recent years in numerical analysis based on genome, transcriptome, metabolite and other types of “big data” in the field of plant science, and expression analysis that incorporates climate change, individual differences at the ecological level and so on is now the trend (Overview Report (of the specialist biology study team), FY 2013 Study of Trends in Academic Research, Japan Society for the Promotion of Science). But although the level of research in Japan in the field of plant science is extremely high and (as can be seen in the achievements in the International Rice Genome Sequencing Project) ranks with that being conducted in the United States and Europe, it has been reported that Japan lags behind the West in the application of such achievements, in terms of both the level of technical development and industrial technology capabilities (2009 International Comparison of Science and Technology Research and Development, Life Science Field, Center for Research and Development Strategy, Japan Science and Technology Agency).

(Trends Overseas)

In the United States, genetic analysis of the Arabidopsis (thaliana) has been pursued as part of the Plant Genome Initiative, and genetic analysis research of crops and vegetables has also been pursued in recent years. In Europe, the achievement of an integrated understanding through systems biology is being pursued based on certain specific systems, and in recent years research and development aimed at developing crops and vegetables has been conducted in the form of crop performance and improvement (“Environmental Response Mechanism and Breeding Technologies for Plants in the Field” 2009 Workshop Report, Center for Research and Development Strategy, Japan Science and Technology Agency). Overseas, there has been a notable trend in which major biotechnology companies, which can develop its own unique DNA marker technologies and genetic analysis technologies, have absorbed midlevel seed and seedling manufacturers and expanded into the area of vegetable seed and seedling development. Furthermore, due to the widespread use of next-generation

sequencers, the genome sequencing of non-model crops has been progressing rapidly in Europe, the United States and China (Panoramic View of the Life Science and Clinical Research Field (2013) 2nd Edition, Center for Research and Development Strategy, Japan Science and Technology Agency).

Background of Consideration

The following study was conducted based on the Expert Panel Report on the Envisioned State of Strategic Basic Research (June 27, 2014).

(Preparation of analytic materials regarding research trends in Japan and overseas using the Science Map and Database of Grants-in-Aid for Scientific Research)

We prepared analytic materials regarding research trends in Japan and overseas using information in the Science Map 2012 & 2010 (July 31, 2014 National Institute of Science and Technology Policy) and the Database of Grants-in-Aid for Scientific Research.

(Implementation of a questionnaire for specialists using analytical materials and preparation of notable research trends)

We conducted an opinion survey concerning future notable research trends for the specialists of the Center for Research and Development Strategy (Japan Science and Technology Agency) and experts participating in the S&T Experts Network operated by the Science and Technology Foresight Center (National Institute of Science and Technology Policy), using the analytical materials we had prepared. Then we analyzed the survey results and identified the “development of a system for the design of in silico plants to accelerate the elucidation of plant life phenomena” as a noteworthy research trend.

(Holding of workshops and preparation of strategic objectives)

We held a workshop to gather experts from industry and academia related to the noteworthy research trend of “development of a system for the design of in silico plants to accelerate the elucidation of plant life phenomena.” We discussed particularly notable trends in Japan and overseas, the social and economic impacts of research and technology development and the future society to which they may give rise, and the targets that should be achieved during the research period. Then we prepared strategic objectives based on the discussions in the workshop.

Relevant Matters in Cabinet Decisions, etc.

The 4th Science and Technology Basic Plan (approved by the Cabinet on August 19, 2011)

III. 2. (1) ii)

To improve the food self-sufficiency rate, enhance food safety, and ensure a stable supply of water, the government will promote R&D concerning the production, distribution, and consumption of safe and quality food materials and products, and R&D concerning stable supplies of food and water, which will include the utilization of advanced technologies such as genetically modified organisms (GMO) and the adoption of industrial viewpoints.

III. 2. (5) i)

The government will promote R&D into nanotechnology and optical / quantum technologies that will lead to the development of advanced techniques for measurement and analysis, advanced information & communication technologies such as simulation and e-science, S&T that is cross-sectionally available in multiple areas such as mathematical science and system science technologies, and S&T for integrated areas.

Comprehensive Strategy on Science, Technology and Innovation 2014 (approved by the Cabinet on June 24, 2014)

Chapter 2, Section 1, IV. 3. (1) 1)

Considering such factors as the target market and technology competition in the world, while bridging between fundamental research and research for commercialization to achieve their mutual collaboration, this measure is aimed at strategically promoting the development of new breeding technology, etc., that realizes the provision of revolutionary products in the following fields: analysis of genomes and metabolites, development of an information base such as database creation; identification of useful genes, development of DNA markers, bioinformatics and engineering technology, and utilization of genome editing techniques.

Other

- For this strategic objective, the active participation of researchers in fields other than basic plant science — such as information science, engineering and agriculture — will be needed, and efforts to achieve substantive collaboration will be essential. It will be particularly important to ensure the participation and training of researchers in the field of bioinformatics, in which the lack of researchers has been pointed out as a problem. Moreover, in order to ensure the efficient use of research data and achievements in the life science field in Japan, maximum use must be made of the Japan Science and Technology Agency National Bioscience Database Center (JST-NBDC) and other resources.

In order to design projects that involve verification, we are hoping for the participation of institutions that are equipped with environments in which plants can be cultivated and managed under the same conditions as in actual crop cultivation environments. In addition, we also hope there will be organic collaboration with the Strategic Innovation Program (SIP) “Next-generation Agriculture, Forestry and Fisheries Industry Creation Technologies” and other exit strategies, and that the achievements of research conducted for this strategic objective will be deployed effectively.

5.5 Development of mathematical sciences to describe and analyze social issues in which basic principle is unclear

Targets to Achieve:

Among various phenomena in our society, for the phenomena whose controlling principles/laws are unclear at present, a profound impact to society can be expected if their mathematical models can be developed. The strategic objective aims to achieve the followings by utilizing the nature of the mathematics of universality and abstractness and by finding out the *essence* of complex structures that lurk behind the phenomena through interdisciplinary cooperation among the researchers of mathematics, mathematical science and the researchers of application fields.

○ Derivation of a model that mathematically describes a phenomenon
○ Building of mathematical theory for demonstration, verification, and evaluation of the derived mathematical model

Vision for Reaching Achievable Important Goals in the Future:

By carrying out this strategic objective and obtaining the research results described in section 2 "Targets to Achieve," mathematical models can be derived for the phenomena whose controlling principles/laws are unclear at present.

New mathematical theory for the demonstration, verification, and evaluation of the mathematical models will also be built. Furthermore, it is expected that the verified mathematical models will be usable under various situations due to their universality of being free from changes in targets and the times.

For example, assumed target phenomena and application fields are as follows.

- Social phenomena (economic changes, propagation of infection, traffic flow, changes in power/communication network, resident behavior in disasters, aging of various social infrastructures, etc.)
- Natural phenomena (climate change, accidental natural phenomena such as torrential rain, land slide, tornado, tsunami, etc.)
- Life phenomena (interaction mechanism between genes, perceptual recognition/information processing mechanism in the brain, etc.)

By deriving mathematical models for the phenomena as stated above, it is expected that, for example, the following will be achieved in the future.

○ Extraction of the part of the essence of complex structures lurk behind the phenomena and streamlining of processing backed by mathematics

In order to avoid various difficulties when modeling the phenomena of complex structures (growing complexity of model, etc.), works with a large amount of information and high computer processing load can be streamlined substantially by mathematically finding out the part of the essence and describing it in a simplified manner according to mathematical grounds. For example, it is expected to achieve the creation of a new material with a relatively simple and stable structure, which is expected to manifest new functions by mathematically finding out the part of the essence of its structure and controlling the part precisely, a substantial reduction in the processing time for image analysis, and a substantial reduction in the time required for data analysis.

○ Clarification of signs before manifestation of a risk, smart preventive responses, and effective control

By modeling a phenomenon mathematically by considering it as a change of its network structure, as for a power supply system, economic system, manufacturing system, various information system, etc., with a network structure, for example, it is expected that a sign of becoming unstable can be detected and this will lead to prior measures and effective control. It is also expected that it becomes possible to detect the sign of a phenomenon that has not occurred yet and cannot be assumed with an empirical model using limited information only.

Specific Content:
(Background)

In recent years, with the informatization and the growing complexity of society, the development of measuring equipment, dramatic improvement in computer performance, etc., it has become possible to obtain information related to life phenomena, natural phenomena, and social phenomena and to understand the complexity of these phenomena well. However, the models of these phenomena cannot be created because their controlling principles and laws are not clear. Therefore, many of them are understood based on the accumulation of empirical knowledge that applies well without knowing the reasons why they occur. Additionally, even though some sort of models are already used in the fields, such as economy, energy, and disaster prevention, there is a growing number of phenomena that cannot be described by models based only on a theoretical framework that is unique to a specific field. Thus, cooperation with the researchers of mathematics and mathematical science, which is indispensable to understanding the essence of phenomena, is not necessarily sufficient. Furthermore, due to the development of mathematics in recent years, there is a possibility remaining that the theories of modern mathematics, which have not been applied, will provide a clue to understanding the essence of these phenomena and deliver a revolutionary result.

In such a situation, Japan set a strategic objective of ***"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)"*** in 2007 to promote cooperation between the researchers of mathematics and mathematical science and the researchers of other scientific fields. From this project, it was reported that the notable results of the cooperation include the application of the methods of pure mathematics developed into the resolution of problems and, in particular, building of mathematical models to describe various phenomena.

With this situation in mind, this strategic objective addresses social problems that are difficult to resolve as an extension of the conventional science and technology, expects the researchers of pure mathematics to take up mathematical problems among problems in the real world, and to participate in the realization of a breakthrough, as well as focuses on the mathematical modeling of phenomena, which can exert the power of mathematics and mathematical science. Additionally, since it is also necessary to integrate the techniques from different mathematical fields and create a completely new formulation beyond the framework of existing models, cooperation among researchers from various fields within mathematics and cooperation among theoretical researchers related to different mathematical modeling is also indispensable.

(Research Theme)

1) Derivation of a model that mathematically describes a phenomenon

By integrating the existing modeling technologies in social phenomena and the engineering field and the knowledge and logics of mathematics and mathematical science, find out the part of the essence of complex structures that lurk behind various phenomena, and derive mathematical models for phenomena with enough data as well as phenomena without sufficient data.

The target phenomena and application fields may include, for example, economic changes, propagation of infection, traffic flow, changes in power/communication network, resident behavior in disasters, aging of various social infrastructures, etc., for the social phenomena; in addition, climate change, accidental natural phenomena, such as torrential rain, land slide, tornado, tsunami, etc., for the natural phenomena; and interaction mechanism between genes, perceptual recognition/information processing mechanism in the brain, etc., for life phenomena.

Examples of the frameworks of mathematical models describing these phenomena are as follows.

1: Network models representing the structure and dynamics of complex network in the real world such as power network, communication network, nerve system network and human contact relation
2: Multi-scale models for integrated handling of systems consisted of hierarchies by subsystems with different spatial-temporal scales and mesoscopic models positioned between micro models and macro models
3: Hybrid models and multi-physics models to describe systems in which heterogeneous systems interact,

such as electronic circuits, including continuous variables and discrete variables, and tissue formation of organisms, including physical actions and chemical actions

By utilizing the universality of the derived mathematical model and applying the model to phenomena other than the initial target phenomena, the additional aim is to develop a modeling technique into one that can be applied to various fields in a cross-sectoral manner.

2) Building of mathematical theory for demonstration, verification, and evaluation of a mathematical model

For the mathematical models derived in 1) above and existing mathematical models, the aims are to demonstrate and verify that the models describe the actual problems and phenomena and to build mathematical theories and techniques for model evaluation.

Policy Positioning (positioning within the policy system and necessity/urgency in terms of policy etc.):

The 4th Science and Technology Basic Plan (endorsed by the Cabinet on August 19, 2011) clearly states, in "(5) Enhancement & strengthening of common bases of science and technology" of "III. Response to key problems which Japan is facing," "mathematical science" is positioned as "scientific technology that can be utilized over multiple fields in a cross-sectoral manner" and the research and development related to it shall be promoted.

Additionally, in the Mathematics Innovation Strategy (Interim report) (Issued on August 2012 by Advanced Research Base Division, Science and Technology/Science Council), problems that lead to "Clarification of structure complex phenomenon, system, etc.," "risk management," "forecast of future changes," etc. are organized and listed as problems that are expected to be resolved through the use of mathematics and mathematical science.

Coordination with Related Policies, Division of Roles, and Differences in Policy Effects:

In the research area for "**Alliance for Breakthrough between Mathematics and Sciences (ABMS)"** of the Japan Science and Technology Agency (JST), an independent administrative agency, which was inaugurated based on the strategic objective for "***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 FY 2007), excellent results, such as new mathematical models, are beginning to be obtained through cooperation with the researchers from a wide range of fields, such as pure mathematics. This strategic objective will accelerate the efforts to resolve social problems through cooperation between mathematics and various fields while cooperating with the research area and incorporating the researchers from a wide range of fields, such as pure mathematics.

Additionally, in the workshop for cooperative research of mathematics and mathematical science and various sciences/industries (57 times in FY 2011 and 2012 in total; total number of participants: 3,211) which has been co-hosted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) with universities and other organizations since 2011 and the research promotion program for creating innovation through cooperation between mathematics and mathematical science and various sciences/industries (started in FY 2012), a project sponsored by the MEXT, activities to actively find problems which are expected to be resolved by utilizing the knowledge of mathematics and mathematical science in the various sciences/industries, to concretize research themes by cooperation with the various sciences/industries to lead them to concrete research. It is expected that the problems and research themes with deeper discussions through these activities develop into the research in this strategic objective.

Background to Deliberations:

According to the report *1 by JST's Center for Research and Development Strategy (CRDS), research of modeling and analysis technology in Japan are conducted at mathematics and engineering department and complexity science and engineering department of universities, in the most advanced mathematical model project of the Funding Program for World-Leading Innovative R&D on Science and Technology by the Cabinet Office, etc. and it can be thought that the level of basic research is high. Today it becomes possible to obtain a large amount of data in various fields such as accumulation of high-throughput data

like genome information in biomedical science, acquisition of multi-measurement electroencephalographic data in brain science and measurement of real-time traffic/transport information data in geographic-information science, therefore the problem in the future is to establish the technology for extracting the essence of an actual system from these data and creating a mathematical model.

The report also states that the five-year project on the ecology and evolution of infection was initiated jointly by the NSF, NIH, and USDA of the United States and the BBSR of Britain from 2012 by investing about 1.5 billion yen and that mathematical modeling of ecological, evolutionary and socio-ecological principle for infection inhibition is set forth as a part of the targets and, in the guideline of the framework for project orchestration in the field of applied mathematics, how the DOE of the United States will distribute its funds to what sort of mathematical modeling research and algorithm research in the future.
By setting this strategic objective that places mathematical modeling as its core, it is necessary to gather the researchers of various application fields, researchers of mathematical science and researchers of mathematics to let them focus on mathematical modeling research to further improve international competitiveness.

*1 “Survey report of research and development: System science and technology field (2013),” Center for Research and Development Strategy, Japan Science and Technology Agency

Background of Consideration

In the survey sponsored by the MEXT in FY 2009 (commissioned to Kyusyu University), the survey results based on a questionnaire survey of university mathematics and mathematical science research organizations (175 organizations), researchers of other fields (5,000 researchers), and companies (1,000 companies) and the interview survey of domestic and foreign experts (65 experts) were reported and evolutionary continuation of the research area for “**Alliance for Breakthrough between Mathematics andSciences (ABMS)”**, which is underway in the JST Strategic Basic Research Programs was proposed.
In the Mathematics Innovation Strategy (Interim report), problems that lead to the clarification of structure complex phenomenon, system, etc., risk management, forecast of future changes, etc., are considered problems that are expected to be resolved through the use of mathematics and mathematical science.

In the report of the CRDS released in 2013, the most advanced mathematical modeling was taken up as one of the five research and development areas. In this report it was pointed out that mathematical modeling is a cross-sectoral academic area covering the modeling process of phenomena and behaviors itself and, since adequate modeling of the target is the premise for the control of the phenomenon, future forecasts, and scientific decision making, many academic or social problems can be achieved through constrained optimization of model elements such as parameters. This strategic objective was prepared based on the results of these considerations.

Other

When implementing the research based on the strategic objective, it is also important to hold places where the researchers of this area related to mathematical modeling, the domestic and foreign researchers of related application fields and others can gather for a certain period to discuss topics such as phenomena for which mathematical modeling in the real world should be achieved and mathematical approaches intensively and to grasp social key problems and research trends in the world, in order to lead this research to a new development.

5.6 Creation of innovative core technologies by merging material technology, device technology, and nano-system optimization technology toward the realization of information devices with ultra-low power consumption and multiple functions

Targets to Achieve:

Faced with the limits to further miniaturization and integration of conventional silicon devices, this program, with the common objective of developing information devices with at least double-digit improvements in total performance(consumption power and speed) , aims to create technologies necessary for establishing a foundation of the future electronics industry, including the creation of material technology pursuing the applicability of new functional materials (core technology necessary for developing and using advanced materials and components), the development of device technology by verifying the operation of logic and memory devices employing new materials, new principles, and new structures, and the creation of nano-system* optimization technology for implementing advanced nanotechnologies, etc., and then the fusion of these various technologies. The program aims to achieve the following targets to these ends.

○ Creation of new functional materials supporting innovative devices and creation of material technologies in pursuit of their applicability
○ Creation of innovative device technologies based on logic and memory devices, etc., employing new materials, new principles, and new structures to enable ultra-low power consumption, ultra-high speed, ultra-large capacity, etc.
○ Creation of core technologies for optimal design of nano-systems by accumulation, integration, and fusion of element technologies from various fields

*In this Strategic Objective nano-systems are defined as parts, equipment, or systems that accumulate, integrate, and fuse element technologies from other fields based on nanotechnology so that taken as a whole they are able to provide advanced functions that contribute to the solution of important issues, as well as being recognized by society.

Vision for Reaching Achievable Important Goals in the Future:

In this Strategic Objective, the research achievements noted in the Section"Targets to Achieve," will be linked to practical application research at private sector companies, etc. to enable the development of innovative devices that use these technologies to achieve information and telecommunications devices and system components that offer ultra-low power consumption, advanced functions and multiple functions. More specifically, they will lead to the creation of the type of society described below and help to achieve objectives such as "Highly efficient and smart use of energy" "Strengthening common infrastructure for the enhancement of industrial competitiveness" "Enhancement of cross-sectional science & technology" etc. as noted in the 4th Science and Technology Basic Plan (approved by the Cabinet on August 19, 2011).

1) Creation of various ultra-low power consumption information and communication terminals, information devices etc., making a major contribution to the formation of a sustainable advanced information and telecommunications network in keeping with the age of energy conservation
2) Fusion of devices based on new operating principles to enable multifaceted applications that include touch panels, flexible displays, solar batteries and biosensors, achieving a true "Ubiquitous Society"
3) Development of end products with social added value that are in keeping with the knowledge-based society, low-carbon society, advanced information society and so on, in order to maintain Japan's international competitiveness and nurture key industries that open the way to a new industrial structure

Specific Content:

The semiconductor industry is currently facing fierce competition worldwide. In recent projections,*[1] the scale of the market in 2012 was USD 289.9 billion, just slightly down from the previous (record-setting) year. However, gradual growth is expected to continue, and this sector serves as a foundation for industrial competitiveness. For example, it is introduced in the following manner: "The semiconductor industry has a profound impact on Japanese society, economy and environment through both its 'visible impact' and 'invisible impact.'"*[2] In addition, with the full-fledged introduction of information and telecommunications technologies in the future, the quantity of information in Japan is expected to experience explosive growth (the "information explosion"). It is estimated that in 2025, 100 to 200 times the current amount of information will be exchanged

over the Internet. It has been pointed out that, in order to deal with this information explosion, the number of IT units to process this information must be greatly increased, and the information throughput of each unit will increase dramatically, and the rapid increase in the power consumption of IT units in the future will become a serious problem.*[3] In addition, according to estimates by a private research institute,*[4] by 2020 the quantity of global information is expected to grow to approximately 40 zettabytes (approximately 50 times the quantity in FY 2010), and in order to process this ever-increasing information, integration and miniaturization of existing silicon devices will also become a vital trend in the future. With existing silicon devices, however, the increased power consumption of devices due to integration, the physical limits to miniaturization, the increased variations in characteristics and so on is becoming an urgent problem. The search for measures to overcome these restrictions has taken two approaches. One approach is to improve performance by employing nanoelectronics technologies, which have seen remarkable progress worldwide in recent years, in an effort to add materials and devices with new functions that are in line with existing complementary metal-oxide semiconductor (CMOS) technologies. The other approach is to achieve devices and systems based on new operating principles that go beyond conventional CMOS technologies.
Under these circumstances, rather than independent efforts to achieve miniaturization, increase speed, reduce power consumption or provide multiple functions, state-of-the-art nanotechnologies and other basic technologies are being mobilized in this Strategic Objective to create innovative "seeds" with the aim of establishing the foundation for the electronics industry of the future. The specific research projects that are being conducted are shown below. In this Strategic Objective, an organization must be established to enable specialists in each field (materials, devices, systems etc.) to coordinate and collaborate from the earliest stages of the project, in order to conduct strategic and agile research toward the achievement of the common goals of developing information devices that offer a double-digit or greater reduction in power consumption and a double-digit or greater increase in speed as compared to existing devices.

1) Creation of new functional materials that provide underlying support for innovative devices and development of basic technologies through the pursuit of possible applications

Examples
- Creation of measurement, analysis and processing technologies relating to the structure and physical properties of new functional materials
- Research into crystal growth, determination of functions and construction of scientific theory relating to graphene and other atomic thin films that are expected to find applications in innovative devices

2) Creation of innovative devices by means of new materials, new principles, logic devices of new structures, memory devices etc. that enable ultra-low power consumption, ultra-high speed, ultra-large integration, etc.

Examples
- Research into technologies for applying new materials and new functional materials with outstanding properties to devices
- Proposals for devices provided with new functions through integration of heterogeneous materials, etc. and proof of concepts
- Invention of innovative device architecture technologies that enable miniaturization and large integration

3) Integration, convergence and fusion of basic technologies such as those in 1) and 2) in order to create core technologies for achieving optimal nanosystem design

Examples
- Design of material structures and device structures to produce and optimize device functions and creation of computer simulation technologies
- Creation of ultra-low power consumption technologies through linkage and coordination of materials, circuits etc. at various technology layers

*[1] World Semiconductor Trade Statistics (WSTS), "WSTS Semiconductor Market Forecast Autumn 2012," November 2012.
*[2] Semiconductor Industry Research Institute Japan, "Social Science Analysis of the Impact of the Semiconductor Industry on Society, Economy and the Environment in Japan (Final Report)," July 2009.

*[3] Ministry of Economy, Trade and Industry, "Workshop on Energy Conservation and Increased Competitiveness for Information and Telecommunications Equipment."
*[4] International Data Corporation (IDC), "Big Data, Bigger Digital Shadows, and Biggest Growth in the Far East," December 2012.

Policy Positioning (positioning within the policy system and necessity/urgency in terms of policy etc.):
The 4th Science and Technology Basic Plan states that "...since information and telecommunication technologies are basic technologies in promoting energy supply, energy use, and low carbon generation from social infrastructure, R&D will be advanced with regard to next-generation information and telecommunication networks, further energy-savings for information and telecommunication equipment and system components, and technical development for optimized control of entire network systems." Moreover, under "Strengthening common infrastructure for the enhancement of industrial competitiveness," the Plan states that "R&D will be promoted into innovative common basic technologies, including basic technologies required for the development and utilization of advanced materials and components of high added-value, large market share or future growth potential. Japan has many technologies of high global competitiveness, and many basic technologies that support the utilization of high-performance electronic devices, information and telecommunications. Therefore, a strategy for appropriately opening up those technologies will be promoted."
Moreover, the "Action Plan for the Implementation of Important Science and Technology Policy Measures" (July 19, 2012, Special Subcommittee for the Promotion of Science and Technology Innovation Policy, Council for Science and Technology Policy (CTSP), Cabinet Office) lists "Innovation of energy use" aimed at achieving large-scale reductions in energy consumption as a policy issue, and establishes "Dramatic reduction in energy consumption through technical innovation" as a priority effort. In addition, the Key Issues and Efforts in the FY 2013 Priority Policy Package" (same as above) states that Japan should become the first country in the world to apply carbon nanotubes (first discovered by Japan) and graphene and other new nanocarbon materials to a variety of components and products (heat exchangers, batteries, electronic devices, composite materials etc.) to increase the industrial competitiveness of components, parts and products in a wide variety of industries and create new growth industries, and that for these and other reasons, "the application of carbon nanotubes (CNT), graphene and other new nanocarbon materials to a variety of fields and the development of technologies for commercial use" should be a priority effort aimed at increasing Japan's industrial competitiveness.
For these reasons, developing low energy consumption devices through the use of innovative materials is needed from a policy standpoint as well, in order to achieve the objectives of "Promotion of green innovation" and "Strengthening the industrial competitiveness of Japan."

Coordination with Related Policies, Division of Roles, and Differences in Policy Effects:
The achievements of efforts conducted up to now at universities and the like and existing Strategic Basic Research Programs, etc. should be actively utilized, and close coordination with related projects should be secured, in order to ensure that achievements are quickly turned into practical applications. Specifically, from the standpoint of establishing an industrial infrastructure for the electronics of the future, intellectual property relating to achievements produced in this Strategic Objective should be appropriately secured, even during the period of research, and then quickly deployed in industrial-academic collaboration projects and the like as well as private sector company projects whose aim is to develop practical applications for research achievements. The framework of the Tsukuba Innovation Arena (TIA), which gathers together a wide range of researchers from industry, academia and government, and other research and development centers in particular, should be used to maximum advantage, in order to build an organization that can link basic research achievements in this Strategic Objective directly to increased industrial competitiveness for Japan.

Scientific Justification for the Research and Development Goals (need, urgency, achievability etc. based on domestic and international research trends):
"A Strategy for American Innovation" which was revised in February 2011 includes the expression "acceleration of nanotechnology" among its priority items and states that there is a need for investment in nano-electronics in particular. In addition, the EU has established Joint Technology Initiatives (JTI) to provide priority support for high-risk research that requires large quantities of funds on a long-term basis, in research domains for which there is clear support from the industrial world, and this Initiative includes "nano-electronics." In China, nanotechnology research is included as a key scientific research topic for basic research sectors in the National Outline for Medium and Long Term Science and Technology Development

Planning (2005 - 2020), and "Notional and principle-oriented nanodevices, nano-electronics, nano-biology and nano-medicine" are listed among the specific priority issues.
The status of Japan, based on an international comparison with various foreign countries, has been assessed as follows. "In terms of nano-electronics, Japan maintains a high level overall, but based on a comparison of activity worldwide, optimism is not necessarily warranted. Particularly in the area of nano-CMOS technology which drives the field of nano-electronics, there has been a significant drop in research and development activity on the part of Japanese manufacturers — this at a time when the establishment of research and development centers and alliances is progressing worldwide. The fact that basic research and development on the part of academia has lagged as compared to other countries is particularly serious. Unless human resources development measures and systems for industry-academia cooperation are established from a long-term perspective, ultimately Japan will be unavoidably overtaken by South Korea or China." *[1]
In the light of this situation, progress in nanoelectronics research and development in this Strategic Objective that results in the achievement of more compact devices with greatly reduced power consumption and new functions will be needed in order to achieve the low power consumption systems that will be indispensable for the age of "Big Data," as well as increased competitiveness for the electronics industry and other sectors.
*[1] JST Center for Research and Development Strategy, "International Comparison of Science and Technology & Research and Development 2009, Nanotechnology and Materials Field, 2011 Edition," 2011.

Background to Deliberations:
The Future Strategies for Science and Technology Workshop sponsored in March 2009 by JST/CRDS entitled "Nano-electronics, Opening up the Next Generation: Looking Beyond 2030" reconfirmed the importance of (1) research and development of nano-electronics core technologies to get around or break through the boundaries to miniaturization and integration, and (2) the search for new materials for nano-electronics devices and demonstration of the potential for application in devices. Based on the discussions at this workshop as well, a JST/CRDS Strategic Proposal entitled "Construction of Fundamental Technologies for Nanoelectronics: Towards a technological breakthrough overcoming limitations in scaling, integration and power consumption reduction" (July 2009) was formulated, calling for the need for long-term efforts to search for new principles, structures and materials and conduct research and development of devices for their use. With graphene and other two-dimensional thin films attracting a great deal of attention, a JST/CRDS Future Strategies for Science and Technology Workshop entitled "Creation and Development of Atomically Thin Functional Films and Molecular Thin Films" was held in February 2012, at which it was pointed out that the ideal way to minimize energy loss during electronic motion was through the use of thinnest-possible films — in other words, atomically thin films and molecular thin films. Based on the discussion at this workshop, a JST/CRDS Strategic Proposal entitled "Development of New Materials and Innovative Devices Using Atomically Thin 2D Functional Films" was formulated, recommending that the "creation of innovative device core technologies through atomically thin functional films that meet application needs" and the "creation of functional research and scientific principles for device design for atomically thin films with new structures to help radicalize 'seeds' technologies" as specific research and development issues.
Based on these discussions, the "Research and Development Policy for Nanotechnology and Material Science Technologies (Interim Report)" (July 2011) prepared by the Nanotechnology/Material Committee under the Research Program and Evaluation Subcommittee of the Council for Science and Technology established "Reducing energy consumption and achieving multifunctional capabilities for electronics" as a priority research and development issue in order to resolve problems, and indicated that it was important to improve energy-saving performance and accelerate research and development efforts with a view to the global competitive environment. In addition, the interim report entitled "Policy for Promoting Research and Development in the Field of Information Science Technologies" (September 2011) compiled by the Committee on Scientific and Technical Information (CSTI) listed "Ultra-low power consumption (greening) of IT systems" as an approach that would be needed in the future for information science technologies. Subsequently, ongoing discussions have been held by the two committees.
The objectives for this Strategic Objective will be prepared based on the results of these studies.

Other:
With countries around the world currently engaged in fierce competition, it is essential for Japan to use its accumulated academic, technical and human resources to maximum advantage, working in cooperation with the Tsukuba Innovation Arena (TIA) and other global centers for concentrated industrial, academic and government collaboration, to build organizations that can link the achievements of basic research in this Strategic Objective directly to the strengthening of Japan's industrial competitiveness. To this end, the

achievements of efforts at universities, etc. up to now and existing Strategic Basic Research Programs must be actively used, and close cooperation among related projects must be maintained, in order to quickly turn these achievements into practical applications.

5.7 Creation, advancement, and systematization of innovative information technologies and their underlying mathematical methodologies for obtaining new knowledge and insight from use of big data across different fields

Targets to Achieve:

This program, by carrying out research in collaboration between the information science/mathematical science fields and various research fields (application fields) that are having a major impact on society by utilization of big data, aims to create and advance next-generation application technologies that, by solving issues in the application fields, can obtain new knowledge and insight from big data; and it further aims to build common core technologies enabling integrated analysis of big data from a variety of fields. To these ends the program aims to achieve the following targets.

○ Creation and advancement of next-generation core application technology that, while promoting use of big data in individual application fields, assumes expansion to a variety of fields
○ Creation, advancement, and systematization of next-generation core technology for integrated analysis of big data from a variety of fields

Vision for Reaching Achievable Important Goals in the Future:

By achieving the research results stated in the Section "Targets to Achieve" for this Strategic Objective, it is possible to construct common core technologies for integrated analysis of big data from a variety of fields and realizes the use of big data across fields. Using the constructed technology would enable the high-degree application of academic paper data in research fields where use of big data is effective, experimental/simulation data, and observation data; this in turn would enable acceleration of generation of innovation in integrated fields combining multiple different areas, including social sciences and humanities.

Following completion of this project, the aim is to realize the following, for example, through the promotion of research and development and practical application using common core technologies enabling integrated analysis of big data in various fields by academia and industry.

- In the field of life science, establish order-made medical care, early diagnosis, and effective treatment methods using efficient techniques for seeking disease-associated genes utilizing whole-genome data for 100,000 people (3 billion base pairs) linked to treatment information.
- In the global environment field, establish basic information technology that connects the relationships between different data—such as global warming; natural environment issues such as forest and water cycles, ecosystems, and geographical space—at a high level in order to contribute to the resolution of global-scale issues in which various factors are complexly intertwined and create a sustainable society.
- In the field of disaster prevention, promote strengthening of exhaustive disaster prediction and disaster prevention functions as well as optimal planning methods for cities using technology that accumulates and structures meteorological data obtained from disasters and accidents as well as geospatial data in a form that can be easily analyzed.

The aim of this strategic objective is to, by realizing the above, create new industries and markets through innovation and promote the strengthening of Japan's international competitiveness, as well as contribute to the achievement of "strengthening the industrial competitiveness of Japan" and "development of research information infrastructure" as prescribed in the 4th Science and Technology Basic Plan (approved by the Cabinet on August 19, 2011).

Specific Content:

With the progression of the advanced information society, we have arrived in the era of big data (information explosion) in which digital data is increasing explosively. According to statistics compiled by a private-sector survey institution, [*1] the amount of digital data worldwide is expected to grow to approximately 35 zettabytes in 2020 (approximately 35 times the amount in FY2010). Furthermore, according to a survey conducted by the Institute for Information and Communication Policy, [*2] the amount of data distributed in Japan in FY 2009 was 7.61E21 bits (equivalent to approximately 290 million DVDs per day) (for example, E18 bits indicates that a bit is 10 to the power of 18), but the amount of data consumed was 2.87E17 bits (equivalent to approximately 11,000 DVDs per day), and so it is said that the amount of information consumed is only 0.004% of the amount distributed.

While this qualitative and quantitative flood of data (big data) enables the acquisition of new knowledge and insight, when attempting to combine various data (a diversity of data ranging from natural science data such as

bio and astronomical observations to social science data on human observations) and process it on a large scale, in many cases there is a large amount of unanticipated data and data that cannot be analyzed correctly, and so the current situation is that much of this data is not organized or structured and cannot be utilized effectively.

For this reason, there is growing international awareness of the importance of effectively and efficiently collecting and consolidating this data as well as discovering new knowledge and creating new value through innovative scientific methods. Alongside the first scientific method of empirical science (experiments), second scientific method of theoretical science, and third scientific method of computational science (simulations), data centric science (=e-science) is said to be the fourth scientific method,[*3] and is gaining attention as a method for opening up new scientific frontiers in the big data era.

This Strategic Objective aims to realize two objectives to be achieved in order to conduct research and development of innovative methodologies for smoothly carrying out big data analysis. Specifically, the following research is being pursued.

(1) Creation and advancement of next-generation core application technology that, while promoting use of big data in individual application fields, anticipates expansion to a variety of fields

In addition to resolving issues in individual application fields, strengthening of the expansion of individual technologies into other fields and the introduction of new core elements are being promoted. For this reason, it is expected that systems of cooperative research teams comprising researchers in the fields of information science/mathematical sciences and application will be created. Specifically, the following research is being promoted.

- Research and development aimed at easy realization of the transfer, compression, and storage of a large amount of diverse data (health/medicine data, earth observation data, disaster prevention-related data, social data, etc.)
- Research and development aimed at extracting significant information by searching, comparing, and analyzing image data, three-dimensional data, and various other data
- Research and development aimed at more accurately discovering and gaining insight into new topics from application data (clarification of disease factors, forecasting climatic changes, disaster mitigation using real time analysis, forecasting people's needs, etc.)
- Establishment of research and development infrastructure for promoting a heuristic search-style research approach that provides new knowledge or expertise by constructing a diversity of mathematical models related to living organisms and natural phenomena, etc., from quantitative data and combining this with actual measurement data.

(2) Creation, advancement, and systematization of next-generation core technology for integrated analysis of big data from a variety of fields

Development of new and original core elemental technologies and of new elemental technologies that spread across multiple application fields by researchers in the fields of information science, mathematical sciences, and humanities is carried out. Specifically, the following research is being pursued.

- Data cleansing technology (noise removal, data normalization, absorption of unnecessary data changes, etc.) and technology that automatically creates annotations of meaning or content of data
- Advanced compression technology, technology enabling searches to be made for data while still compressed, technology enabling data mining without losing confidentiality or anonymity
- Upgrading of data mining technology and machine learning (technology for modeling from large amounts of diverse data, technology for searching for relationships between different types of data)
- Visualization technology for gaining insights from the correlations and relationships between various application data
- System technology for sharing and distributing big data (data processing, metadata management, traceability, creating anonymity, charging, security, etc.)
- Mathematical and computational methods for discovering the essence of issues and structure of big data

In addition, in (1) creating and advancing next-generation core application technology, it is effective to proceed while also incorporating next-generation core technology obtained through the research conducted in (2); moreover, in (2) creating, advancing, and systematizing next-generation core technology, it is effective to proceed while also sharing and utilizing next-generation application technology obtained through the research conducted in (1). For this reason, the research conducted in (1) and (2) needs to be mutually coordinated.

*1 IDC, "Big Data, Bigger Digital Shadows, and Biggest Growth in the Far East", December 2012

*2 Institute for Information and Communication Policy Survey Division, “Results of Survey Research on the State of Japan’s Information and Telecommunications Market and Measurement of Information Distribution Amounts (FY2009): Measurement of Information Indexes”, August 2011

*3 Tony Hey, Stewart Tansley, and Kristin Tolle. *The Fourth Paradigm: Data-intensive Scientific Discovery* (Microsoft Research 2009)

Policy Positioning (positioning within the policy system and necessity/urgency in terms of policy etc.)

Under the section “Responses to Essential Issues Facing Japan” in the 4th Science and Technology Basic Plan, promoting research and development of innovative common core technologies such as core technologies for supporting the utilization and application of electronic devices and information-telecommunications, as well as promoting strategies for appropriately opening up these technologies are given as means of “strengthening the industrial competitiveness of Japan”. Furthermore, promoting research and development related to advanced information and communication technologies such as simulation and e-science, science and technology that can be applied across multiple fields such as mathematical science, and science and technology for integrated fields is given as a means of “improvement and reinforcement of common infrastructure for Science and Technology”. In addition, under the section “Enhancement of Basic Research and Human Resource Development”, constructing and expanding “knowledge infrastructure” systems that enable integrated searching of and data extraction from all research information in order to promote efforts to strengthen research information infrastructure is given as a means of “development of research information infrastructure”.

In order to promote the necessary discussion and consideration of “academic clouds”, which enable researchers at universities and other institutions nationwide to easily access online and utilize data, information, and research materials from many fields that can be applied to scientific research and use the latest “data science” methods to obtain scientifically or socially significant research results, the Ministry of Education, Culture, Sports, Science and Technology established the “Conference for Reviewing Academic Clouds” under the Director-General of the Research Promotion Bureau. From April through June 2012, three topics for consideration were discussed—“Coordination of databases”, “Construction of system environments”, and “Research and development contributing to the enhancement of data science”; proposed in July, the “Challenges for Academia in the Era of Big Data” summarized the direction that research and development of core technologies is important at each stage of big data processing (data collection, accumulation/structuring, analysis/processing, and visualization) as research and development of common core technologies related to big data.

Coordination with Related Policies, Division of Roles, and Differences in Policy Effects

In October 2012, the Minister of State for Science and Technology Policy and executive members of the Council for Science and Technology Policy selected “FY2013 Science and Technology Budget Priority Policy Packages” and the “Improvement of infrastructure aimed at generating new industries and innovation using big data” proposal made jointly by three ministries—the Ministry of Internal Affairs and Communications; Ministry of Education, Culture, Sports, Science and Technology; and Ministry of Economy, Trade and Industry—was identified as a priority policy package that should be prioritized for resource allocation. Under this priority policy package, the three ministries will collaborate to promote in an integrated manner human resources training as well as research and development of core technologies related to the collection, transfer, processing, usage/application, and analysis of big data in certain fields aimed at realizing these technologies by around 2016.

Of these three ministries, the Ministry of Education, Culture, Sports, Science and Technology has positioned one of its Research and Development for Next-generation Information Technology programs, “Research on Systems for Utilizing and Applying Big Data” as an individual priority within the priority policy package. In addition to promoting human resources training of data scientists and other specialists through international cooperation using research centers integrating different scientific fields, this program conducts investigations of issues concerning the development of technologies such as data-related technologies and the ways academic cloud environments (environments for coordinating and sharing cloud bases between universities) are constructed. Furthermore, in order to construct models for utilizing big data, the Japan Science and Technology Agency is endeavoring to dig up enormous amounts of data that is lying idle and improving rules in order to promote database coordination amongst research organizations and usage of databases by the privates sector, etc. In addition to the above policies, research

and development aimed at the advancement and systemization of common core technologies aimed towards the resolution of next-generation issues from a medium- to long-term perspective is undertaken under this Strategic Objective to enable the usage and application of big data across fields.

Furthermore, in May 2012, the ICT Basic Strategy Board of Information and Communications Council, Ministry of Internal Affairs and Communications, summarized "Usage of Big Data", remarking that, since construction of information/communication infrastructure is underway, this infrastructure test bed (JGN-X) constructed and operated by the National Institute of Information and Communications Technology (NICT), may also be used as necessary when promoting research in this Strategic Objective.

Scientific Justification for the Research and Development Goals (need, urgency, achievability etc. based on domestic and international research trends)

In the United States, the President's Committee of Advisors on Science and Technology (PCAST) determined in 2011 that the Federal Government's investment in big data technology was insufficient, and in response, the Office of Science and Technology Policy (OSTP) announced a Big Data Research and Development Initiative on March 29, 2012. This initiative aims to improve and strengthen technology for accessing and organizing data and gleaning discoveries through a total investment of 200 million US dollars by 6 Federal departments and agencies (NSF, NIH, DOD, DARPA, DOE, and USGS). In Europe and Asia, too, investment is being made in big data research, and intense international competition is expected in the future. Specifically, in Europe public expenditure for ICT research and development is being doubled from 5.5 billion euros to 11 billion euros by 2020 and large-scale pilot projects are being carried out as part of endeavors to develop innovative and interoperable solutions in fields that are of public interest (ICT for conserving energy and resources, sustainable healthcare, electronic government, and intelligent transportation systems, etc.). Furthermore, in China centers have been established for sharing information resources, and technology is being developed for creating metadata and automatic classification in order to establish mutual relationships between collected data. In addition, South Korea is to commence construction in 2013 of a National Scientific Data Center for promoting sharing of research data, including big data, and data science. Consequently, there is an urgent need for research and development advancing the use and application of big data across fields with the aim of promoting innovation in the science and technology field through collaboration that transcends the division of roles between the public and private sectors as well as ministerial and agency frameworks.

In Japan, various types of sensor information are evolving and there are related research fields where the standard of research is world-class, such as high-performance computing and natural language processing; efforts are also being undertaken in fields that handle large-scale data requiring research in regional units, such as genetic information. For these reasons, expanding these strengths into a broad range of fields and areas when utilizing large-scale data creates an environment in which common core technologies in science and technology as well as industrial competitiveness can be strengthened.

Background to Deliberations:

The "Conference for Reviewing Academic Clouds" established under the Director-General of the Research Promotion Bureau of the Ministry of Education, Culture, Sports, Science and Technology summarized the "Challenges for Academia in the Era of Big Data", proposed on July 4, 2012, as well as specific research and development items and the direction that research and development of core technologies is necessary at each stage of big data processing (data collection, accumulation/structuring, analysis/processing, and visualization) for research and development of common core technologies related to big data.

Based on this, the Committee on Information Science and Technology, operated under the Subdivision on R&D Planning and Evaluation, Council for Science and Technology (77^{th} and 78^{th} sessions) (July 5 and August 2, 2012) also expressed the opinion that research and development of common core technologies for utilizing and applying big data is necessary based on shared awareness of the importance of "data science" that creates new intellectual value through the efficient and effective gathering and accumulation of large quantities of data generated as the results of intellectual activity in various fields and processing of information using innovative scientific methods.

Furthermore, the "Mathematical Innovation Strategies (Interim Report)", which was compiled by the Advanced Research Base Working Group of the Council for Science and Technology (5th session) (August 7, 2012), states that, in order to develop innovative methods and technologies for effectively utilizing big data, it is important that not only do mathematical researchers proactively collaborate with researchers in information science fields and various areas of application but also that the diverse knowledge and potential of

mathematical researchers themselves is fully utilized and efforts are made to create common core technologies for identifying essence and structure for efficiently utilizing big data.

This Strategic Objective was formulated based on consideration of the above factors.

Other:

In promoting this Strategic Objective, it is expected that the creation of flexible networks for researchers in big data-related fields and the construction of new human resource training schemes and innovation-generating cycles (environments in which innovation is constantly being created) will also be pursued through the fusion of information/mathematical science fields and various research fields in which big data is effectively utilized.

5.8 Establishment of molecular technology, which is the free control of molecules to bring innovation to environmental and energy materials, electronic materials, and health and medical materials

Targets to Achieve:

Establishment of molecular technology is to be achieved, which is a series of techniques to exploit fully features of molecules to create the desired functions by designing, synthesizing, operating, controlling, and integrating molecules on the basis of scientific findings in fields of physics, chemistry, biology, mathematics, etc. For this, the following technology systems are established, which are basic technologies to realize super-low-power consuming and ultra-light devices utilizing molecules for battery device, organic thin-film solar cells, and etc. and to establish innovative methods of treatment such as drug delivery systems, functional medical materials, etc.

- Establishment of technology systems of *molecular technology for designing and creating molecules*, which freely design and create new functional materials in cooperation with precision synthesizing technology and the theory-computational science.
- Establishment of technology systems of *molecular technology for shapes and structure control*, which leads to creation of new functions through accurately control molecular shape and structure.

Vision Reaching Achievable Important Goals in Future:

As represented by organic EL displays, various parts and devices are already shifting to soft materials, which are molecular materials. This trend implicates that soft materials gives fundamental solutions to issues that the entire human society faces, such as the reduction of environmental burdens, responses to restricted resources, and high biocompatibility; in other words, molecular technologies that realize soft materials give solutions to such problems.

Under this Strategic Objective, obtaining research outcomes described in section "Targets to Achieve" enables the designs of functions as molecular materials, which consequently enables the application of the outcomes to solving a variety of problems associated with social needs. Green innovation and life innovation described in the 4th Science and Technology Basic Plan are to be promoted by building a cooperative structure between research of relevant academic fields and industries. For example, efforts will be made to achieve the following outcomes within about five years after the completion of projects.

- **Electronic devices build with soft materials**

  Organic materials with conductivity control capability are used as components of electronic devices in place of the conventional semiconductors and metals, and computers with low environmental burden and ultra-low energy consumption and ultra-light portable information terminals are created.
- **Resource-recycling solar cell films with ultra-low energy consumption**

  Solar cells that are ultra low cost and produce low environmental burdens are created with components that use molecular materials and conversion of manufacturing processes.
- **Medical treatments using drug delivery system, etc.**

  Safe and effective medical treatments are realized through the development of sophisticated drug delivery system equipped with detection functions and functions to regulate the discharge of active ingredients and three-dimensional structuring of functional medical materials needed for regeneration of tissues and organs.

Besides these aspects, practical applications in fields such as reduced use of fossil resources, high-density secondary cells, advanced environmental monitoring, low-cost water production, and purification are possible.

Specific Content:

(Background) From molecular science to molecular *technology*!

In the recent years, for instance, the use of thin membrane, n-type semiconductor made with molecular called fullerene is resulting in rapid progress in the development of organic solar cells that are receiving attention as power generation technologies with low environmental burdens. Meanwhile, in the field of pharmaceutical development, designing molecular structures and shapes with computers has drastically reduced side effects and enabled the production of molecularly targeted agents that specifically work on lesions.

Basic science called molecular science exists in the background of such achievements. Conventional

molecular science has discovered and analyzed various molecules by observing and exploring in nature and obtained similar functions as natural molecules by artificially mimicking their features. With the rapid progress in computer performances and drastic progress of measurement and analytical technologies in the recent trends, however, research and development that design intended functions and obtain suitable materials without seeking models in nature have emerged.

Given these circumstances, this Strategic Objective aims to deliver a radical breakthrough to the series of material development technologies that support environmental and energy technologies, information communication technologies, and medical material technologies by developing molecular technology.

(Contents of study) For the establishment of basic technologies shared by life innovation and green innovation!

In order to produce innovative outcomes involved with green innovation and life innovation, this Strategic Objective aims to accelerate research and development of individual policies and fusion of different fields by building a solid foundation of molecular technologies that can be applied to a various fields separately from research and development in individual tasks of application. Research and development of molecular technologies cannot be easily implemented only by using the knowledge of independent academic fields, such as conventional chemistry, physics, biology, and mathematics. Thus, it is important to recognize the bottleneck in the tasks of application as a common problem and establish a system that overcomes this problem through the approach which integrates different fields. This Strategic Objective perceives molecular technologies as the technology consisting of the following six elemental technologies. 1) Molecular technology for design and creation, 2) molecular technology for controlling shapes and structures and 3) molecular technology for conversion and processes, which are trans-boundary technologies. Then, 4) molecular technology for controlling electronic state, 5) molecular technology for controlling aggregations and compounds and 6) molecular technology for controlling transportation and transfer, which are intended for the use in a specific field of application. This Strategic Objective specifically puts emphasis on *molecular technology for design and creation* and *molecular technology for controlling shapes and structures*, which are the most basic of all these technologies. Examples of specific topics of research and development are described below.

- **Molecular technology for design and creation**

  Molecular technology for design and creation is the technology that aims to freely design and create new functional materials. In other words, in addition to the conventional method that largely depends on instincts and experiences, this technology gives governing principles to freely design and synthesize materials which have the target functions through tight cooperation between syntheses and theoretical analyses.

  (Examples of topics of research and development)

- Production of theories for creating molecules from functions and development of simulation technologies
- Cultivation of molecular design methods which enables forecasting of molecular structures
- Development of methods for precision syntheses based on functional designs and forecasting
- Development of high-purity purification method of molecular substances

- **Molecular technology for controlling shapes and structures**

  Molecular technology for controlling shapes and structures freely creates one-dimensional, two-dimensional, and three-dimensional macro structures for building practical materials based on molecular-level nano structures produced from molecular sequences, molecular assemblies, and self-organization. This technology also leads to the production of new functions by tightly controlling molecular shapes and structures.

  (Examples of topics of research and development)

- Technologies to create spatial and pore structures through build-up and top-down methods including self-organization
- Technologies to expand sizes from nano to macro structures
- Observation and analytical technologies of physical phenomena in materials consisting of macro structures
- Designs and analyses of macro-level structures and functions using computer simulations

Policy Positioning (positioning within the policy system and necessity/urgency in terms of policy etc.):

Soft materials produced by molecular technologies have various capabilities that satisfy various tasks of the 21st century, such as low environmental burden, energy and resource efficiency, low cost, and compatibility with the people and the society. The greatest goal of this Strategic Objective is to solidify the

position of molecular technologies that realize these aspects as the basic technology of Japan. Industries with added values that molecular technologies produce will support the economic growth of Japan and make great contributions to solving problems such as global environmental and energy issues, safety and security issues, and medical and health issues.

The 4th Science and Technology Basic Plan (Cabinet decision on August 19, 2011) states, "Research and development concerning innovative common basic technologies with high rate of added values and market share, high possibility of future growth, and international competitiveness that favors Japan such as basic technologies needed for the development and use of cutting edge materials and basic technologies that support the use and utilization of advanced electronic devices and information and communication shall be promoted while promoting proper strategies to make these technologies open to others" in order to solidify common grounds for the reinforcement of industrial competitiveness. It also states, "Research and development shall be promoted on scientific technologies that can be horizontally used in multiple fields and science and technology of integrated fields such as nano-technology and photo quantum science which lead to development of advanced measurement and analysis technologies, advanced information communication technologies such as simulation and e-science, mathematical science, and system science technology" in order to strengthen cross-boundary scientific technologies. In addition, "Policies on research and development of nano-technology and material science technologies <interim summary>" (July 2011, Nano-Technology and Material Science and Technology Committee, the Subcommittee of Research Plan and Evaluation, the Council for Science and Technology) stipulates, "Development of innovative technologies is essential for remaining internationally competitive; thus, efforts such as research and development toward the production of potential possibilities should also be promoted based on the mid- to long-term perspectives rather than emphasizing on technologies which are available when setting up social issues." Molecular technology is listed as one of "technologies for designing and controlling substances and materials," which is a focused research and development task for solving problems.

Coordination with related policies, Division of Roles, and Differences in Policy Effects:

Policies that try to solve problems in individual application themes, such as solar battery, storage battery, and pharmaceutical development have been the mainstream. This Strategic Objective, however, is intended to reevaluate technical problems that have become bottlenecks in various fields using a cross-boundary technical concept called "molecular technology" and to promote joint studies by researchers from different fields. Molecular technology constructively reorganizes the achievements of basic sciences that Japan has been accumulated over many years and constructs an unprecedented and new technical structure. Contributions from basic sciences, such as physics, chemistry, biology, and mathematics as well as engineering fields such as nano-technology, information technology, and bio-technology are essential in the process of implementing and structuring molecular technology. These academic fields need to be integrated, and various technologies must be utilized as an integrated unit; therefore, these fields must be integrated at technological levels such as material design technologies and process technologies.

The Strategic Objective to be established in fiscal year 2012, "Advanced Catalytic Transformaiton program for Carbon utilization" plans to start a development of new catalyst for material conversion. This technology can supplement molecular technology for conversion and processes, which is an important elemental technology for establishing molecular technology and thus is expected to arrange necessary coordination.

Scientific Justification for the Research and Development Goals (need, urgency, achievability etc. based on domestic and international research trends):

This Strategic Objective is a new material technology strategy for Japan to take initiatives in contributing to solving problems such as environmental and energy problems and problems on medicine and health. Japan has strong material industries grounded on nano-technology and material science and is especially competitive in molecular technology as a part of this Strategic Objective. For example, Japan's market share for many molecular materials used in display products is overwhelmingly high in the global market. Neither Japan nor other countries has implemented strategic and comprehensive investment in research to academically explore fundamental aspects of this new technological field and improve its innovativeness. There is a possibility that Japan can lead the world if we worked on this field ahead of other countries.

Background to Deliberations:

The Center for Research and Development Strategy (CRDS) of Japan Science and Technology Agency held the Substance and Material Field Overview Workshop in July 2008 in which participants discussed

outcomes of nano-technology, effects of integration, and future issues and proposed the establishment of the concept of molecular technology. The Science and Technology Future Strategy Workshop “Molecular Technology” was held in December 2009. This workshop aimed to discuss whether molecular technology could become an important key technology through intensive discussions of specialists and find future directions and specific research and development topics. Based on discussions in the workshop, participants further examined research domains and themes to be intensively promoted in the future and summarized the strategic initiative, “Molecular technology, production of new functions from the molecular level - Contribution to sustainable societies with the integration of different fields” in March 2010.

Based on above discussions, Nano-Technology and Material Science and Technology Committee, the Subcommittee of Research Plan and Evaluation, the Council for Science and Technology of Ministry of Education, Culture, Sports, Science and Technology listed molecular technology as one of “technologies for designing and controlling substances and materials,” a focused research and development task for solving problems, in “Policies on research and development of nano-technology and material science technologies” prepared as an interim summary in July 2011.

This Strategic Objective was prepared based on the outcomes of these examinations.

Other:

The development of molecular technology requires the environment for researchers from different fields to actively participate and effectively work together. It is also important to perceive molecular technology as a common basic technology in precompetitive domains for expanding the outcomes of this Strategic Objective toward the establishment of molecular technology and to actively use places such as Tsukuba Innovation Arena for the cooperation among the industry, the academia, and the government.

Chapter 6　Key Points in Submitting Proposals

○ Violation of the guidelines provided in this chapter or any other inappropriate behavior may result in withdrawal of approval for the research project or cancellation of the research; return of all or part of the project's research funding, and measures taken to publicize the facts of the matter.

○ Violation of related laws or guidelines, etc., in conducting research may result in cancellation of your research funding allocation or withdrawal of the research funding allocation decision.

6.1　Enrolling in and Completing the Educational Program for Research Integrity

The research project applicant must complete the educational program for research integrity as a prerequisite for application. Note that if completion of the program cannot be confirmed, the application will be disqualified for failing to meet the requirements (For the CREST program, enrollment in and completion of the research integrity educational program by the time of application is not a prerequisite for Lead Joint Researcher applicants).

To enroll in the educational program for research integrity and to submit a declaration of completion, follow either procedure (1) or (2) below. For application instructions using e-Rad, refer to Chapter 8, "Recruiting via the Cross-ministerial R&D Management System (e-Rad)."

(1) For applicants who have completed an equivalent program at their institution

Applicants who have already completed an e-learning program or educational seminar on various aspects of research integrity (including the CITI Japan e-learning program) by the time of their application are requested to make the declaration on the e-Rad application information entry screen.

(2) For applicants who have not completed an equivalent program at their institution (including for applicants at institutions that do not have such a program)

a. Applicants who have in the past completed a CITI Japan e-learning program in a JST program.

Applicants who have in the past completed a CITI Japan e-learning program in a JST program by the time of their application are requested to make the declaration on the e-Rad application information entry screen.

b. For other applicants for whom a. above does not apply.

(1) Applicants who find it difficult to enroll in an educational program for research integrity because their institution does not offer such a program at their institution or for other reasons may enroll in and take the condensed version of the CITI Japan e-learning program offered through JST. Instructions for enrolling in this program may be found on the Invitation of Research Proposal website: http://www.senryaku.jst.go.jp/teian.html

There is no cost for enrolling in and completing the program, which will take between one to two hours to complete. Once enrolled, applicants are expected to complete the program without delay and then to declare the completion of the program and to also enter the certificate completion number from the completion certificate (the Ref # to the right of the completion date) in the e-Rad application information entry screen.

(2) Applicants for whom (1) above applies and who have not been able to enroll in and complete the program by the time of their application are requested to submit their status on the e-Rad information entry screen and to enroll in and complete the program without delay. A JST representative will contact the applicant via email to confirm completion of the program and for the completion number (the Ref # to the right of the completion date). The declaration deadline is within 30 days from the application deadline (CREST: 12 P.M., Thursday, June 18, 2015; PRESTO: 12 P.M., Thursday, June 11, 2015).

■ Contact for consultation on the educational program for research integrity

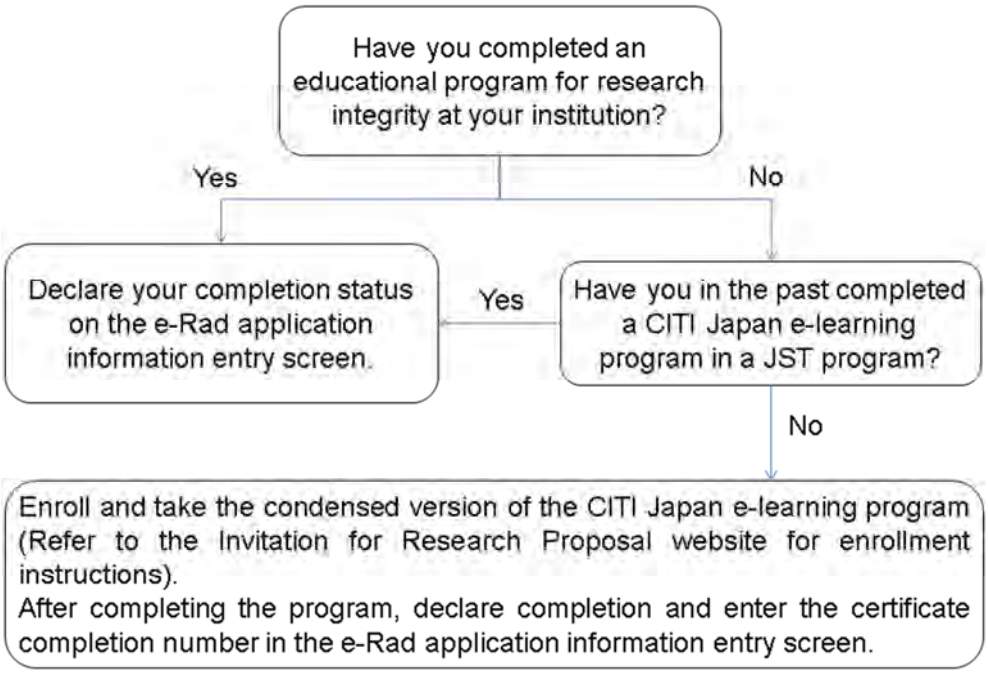
Japan Science and Technology Agency
Department of General Affairs, Office of Research Integrity,
E-mail： ken_kan@jst.go.jp

■ Contact for consultation on the public invitation for application

Japan Science and Technology Agency
Department of Innovation Research
E-mail： rp-info@jst.go.jp

* Include the program name, e-Rad project ID, research applicant name and the project name in the body of the email.

Flow chart for declaring enrollment and completion of the educational program for research integrity.



From FY2013 onward, JST has required researchers participating in CREST and PRESTO research projects to enroll in and complete seven designated modulesof the CITI Japan e-learning program. Since the requirement will remain unchanged for FY2015, in principle all research participants (including CREST Lead Joint Researchers) will be required to enroll in and complete the seven designated modules from the CITI Japan e-learning program (excluding applicants who have already completed the seven designated modules from the CITI Japan e-learning program at their institution or in a JST program).

6.2 Handling of Information Provided in Research Proposals, Etc.

○ From the standpoint of maintaining the interests of the applicant, the “Act on the Protection of Personal Information Held by Independent Administrative Agencies, etc.”, and other standpoints, research proposals shall not be used for any purpose other than the selection process. Confidential information regarding research proposal details shall be strictly maintained. For details, please refer to the following website.

http://law.e-gov.go.jp/htmldata/H15/H15HO059.html

○ Handling of Information Regarding Selected Projects

Information regarding individual projects that have been selected (name of system, name of research project, name of affiliated research institution, name of Research Director, budget amount, implementation period, etc.) shall be deemed to be "information that is scheduled to be made public" as prescribed under Article 5, Paragraph 1, Item (a) of the "Act on Access to Information Held by Independent Administrative Agencies" (Act No. 140 of 2001).

The name of the researcher, name of the affiliated research institution, name of the research project, and the research project overview summary are scheduled to be made public. In addition, the research proposals of selected applicants may be used by the JST to promote the research after the proposal's approval.

○ Provision of Information from the Cross-ministerial R&D Management System (e-Rad) to the Government Research and Development Database

Various information may be provided to the Government Research and Development Database being developed by the Cabinet Office through the Cross-ministerial R&D Management System (e-Rad), which is managed and operated by the Ministry of Education, Culture, Sports, Science and Technology.

Furthermore, you may be required to provide cooperation with regard to various work tasks and checking in order to prepare this information. Please see the following portal site for the Cross-ministerial R&D Management System (e-Rad).

http://www.e-rad.go.jp/

6.3 Measures against Unreasonable Duplication and Excessive Concentration

○ In order to eliminate unreasonable duplication and excessive concentration, to the extent necessary information regarding some proposals (or selected projects/programs) may in some cases be provided through the Cross-ministerial R&D Management System (e-Rad) to other departments in charge of competitive funds, including other government ministries. (Furthermore, when it is required that checks be made for duplicate project applications under other funding programs, information may be provided in a like manner.)

【Measures against Unreasonable Duplication and Excessive Concentration】

(a) Measures against "Unreasonable Duplication"

In the case that a researcher is unnecessarily receiving competitive funding from multiple sources for the same research project (name or content of research receiving competitive funding; hereinafter the same shall apply) being undertaken by the same researcher and any of the following applies, the researcher shall be made ineligible to apply for this program, selection of

their research project withdrawn, or their research funding reduced (hereinafter referred to as "withdrawal of research project selection").

1) In the case that simultaneous proposals have been submitted for multiple competitive research funds and duplicate approval granted for essentially the same research project (including cases in which there is a considerable degree of research content duplication; hereinafter the same shall apply).
2) In the case that a duplicate application is made for funding of a research project that is essentially the same as another research project that has already been selected and has already received competitive research funding.
3) In the case that there is overlap in the intended application of research funding between multiple research projects.
4) Other cases equivalent to the above

Although at the application stage for this program there are no limitations regarding the submission of proposals to other competitive funding programs, etc., in the case that a research project is selected by another competitive funding program, please report this promptly to the JST at the contact address given at the end of this document. If reporting is omitted, the approval decision for the research project may be revoked.

(b) Measures against "Excessive Concentration"

Even if the content of the research proposed for this program differs from the content of research being carried out under another competitive funding program, in the case that the overall research funding allocated to the same researcher or research group (hereinafter referred to as "researchers") in the relevant fiscal year exceeds an amount that can be utilized effectively and efficiently and cannot be used within the research period, and any of the following applies, selection of the research project under this program may be withdrawn.

1) In the case that an excessive amount of research funding is being received in light of the capabilities of the researchers and the research methods being used, etc.
2) In the case that an excessive amount of research funding is being received in comparison with the amount of effort (percentage of the researchers' overall working time[*5] that is required for carrying out the said research project) being allocated to the research project.
3) In the case that highly expensive research equipment is purchased unnecessarily.
4) Other cases equivalent to the above

[*5] This is based on the Council for Science, Technology and Innovation's definition of 'effort', which is "the percentage of working hours required for conducting the relevant research when the researcher's total annual working hours are 100%". Note that "total working hours" does not refer only to the number of hours spent in research activities but to the substantive total working hours, including educational and medical activities.

For this reason, in the case that you submit proposals to other competitive funding programs, after submitting your application for this program, and the research project is selected by another competitive funding program, or if any information provided on your application changes, please report this promptly to the JST at the contact address given at the end of this document. If reporting is omitted, the approval decision for the research project may be revoked.

○ In the case that the researcher is receiving Grants-in-Aid for Scientific Research or other competitive research funding operated by the national government or national research and development agencies, or other research grants (including funding for which applications have been submitted), please provide information about this funding on the research proposal in accordance with the prescribed format (CREST: Form 10; PRESTO: Form 5).

Based on information regarding the content of the research proposal and effort (research time allocation rate), in the case that either unreasonable duplication or excessive concentration of competitive funding has occurred, the research proposal may not be selected or selection may be withdrawn, or research funding may be reduced. Furthermore, the research proposal may also not be selected or selection may be withdrawn, or research funding may also be reduced in the case that the information provided on the research proposal is found to be false.

○ In order to eliminate the unreasonable duplication or excessive concentration of competitive funding mentioned above, in the case that a researcher is receiving other competitive funding operated by the national government or national research and development agencies or other research grants, or in the case that a researcher has been selected for such funding, the researcher may not submit proposals for this program for research with the same project name or content.

○ In the case that the applicant is scheduled to receive 100 million yen or more in research funding under other systems or research grants, etc. in FY2015 or 2016, in view of the purpose of eliminating unreasonable duplication and excessive concentration, as a general rule final selection of the research project and budget amounts are decided in an integrated manner. In the case that the applicant is scheduled to receive a total of 100 million yen or more from multiple funding systems/grants, he/she is given individual consideration accordingly within the selection process.

Although not relevant for research projects at the application stage, the research proposal may be removed from the selection process for this program or the selection decision withdrawn depending on the outcome of selection for other competitive funding or research grants.

Furthermore, when it is discovered, during the selection process for this program, that the research project has been approved/rejected for another competitive funding system, please report this promptly to the JST at the contact address given at the end of this document.

6.4 Measures against Inappropriate Usage of Research Funds

○ In the case that research funds intended for use under this program are used for other purposes, the conditions stipulated by the JST for payment of research funds are violated, research funds are received through fraudulent means, or research funds are otherwise used in a manner that runs counter to the objectives of the program, the research project in question may be cancelled; all or part of the project's research funding returned, and measures taken to publicize the facts of the matter. Furthermore, limitations shall be placed for a certain period of time on application to or participation in this program for different projects by researchers found to have used research funds inappropriately (including coconspirator researchers).

○ With regard to researchers who make inappropriate usage of the program's research funds, any coconspirator researchers, and researchers who although they are not deemed to be involved in inappropriate usage and so on are in breach of their duty for diligence[*6] will be liable, to the extent of the malpractice according to the table below, to measures restricting their applications to and participation in this program, or to serious warning measures. The period of restriction will in principle be for one to ten years running from the fiscal year after the fiscal year in which the contract funds etc. concerning the inappropriate usage of funds have been returned. However, "application and participation" shall refer to the submission of proposals, applications and requests for new research projects by the researcher, or participation in new research as research collaborators etc.

○ Limitations shall be placed for a certain period of time on eligibility for application to or participation in this program for researchers who have received funding under MEXT-related or national government ministry competitive funding programs[*7] or programs other than competitive funding programs that are under the jurisdiction of the JST and have used these research funds inappropriately and to whom limitations on application/participation eligibility for

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[*6] "Researchers in breach of their duty for diligence" shall refer to researchers who, although they are not deemed to have taken part in inappropriate usage of funds or fraudulent receipt thereof, are in breach of their duty to run the programs with care and as good managers.

[*7] For specific information regarding other funding programs, please refer to the list of competitive funding programs on the following website.
http://www8.cao.go.jp/cstp/compefund/
Additionally, this provision also covers programs that will initiate public calls in the 2015 Fiscal Year. Since the programs subject to this provision and the handling of the other funding programs above may change, please verify with JST at the time of your application.

the relevant program have been applied.
(Limitations shall also be placed on participation for the fiscal year in which the inappropriate usage of research funds is deemed to have occurred. Moreover, limitations may be applied retroactively.)

○ In the case that research funds under this program are used inappropriately, information regarding the details of the inappropriate usage by the researcher in question and their coconspirator researchers is provided to those in charge of MEXT-related or national government ministry competitive funding programs (including independent administration agencies). Consequently, limitations may be placed on application to or participation in MEXT-related or national government ministry competitive funding programs[*9].

Limitations shall be placed on the period of application and participation in this program on researchers who have used research funds inappropriately and their coconspirator researchers in accordance with the degree of inappropriateness. The period of the limitations shall as a general rule be between one and ten years from the fiscal year following the year in which the contract funds related to the inappropriate usage of funds are reimbursed. “Application and participation” refers to the submission of proposals, applications, and requests for new research projects by the researcher or participation in new research by the researcher as a joint researcher.

○ In the event that inappropriate usage etc. of the program’s research funds has occurred, the outline of the said fraudulent matter (researcher name, program name, affiliated organization, fiscal year of research, nature of the fraudulent activity and details of the punitive measures conducted) of the researchers in question and the coconspirator researchers whose applications and participation have been restricted will in principle be publicly announced.

Details of Research Funding Usage	Period Deemed Appropriate
1. Cases in which the extent of the inappropriate use of research funds, etc. is deemed to have had minimal effect on society and the maliciousness of the action is deemed to be low.	1 year
2. Cases in which the extent of the inappropriate use of research funds, etc. is deemed to have had a large effect on society and the maliciousness of the action is deemed to be high.	5 years
3. Cases apart from 1 and 2 in which the impact of the action on society and its	2-4 years

maliciousness are taken into consideration.	
4. Cases in which the research funds were used to attain personal economic gain, regardless of 1 to 3.	10 years
5. Cases in which dishonest means, such as deceit, were used to have the research project in question selected for the program.	5 years
6. Although not directly involved in the inappropriate use of research funds, cases in which the use of research funds is deemed to have violated the due care of a prudent manager.	1-2 years

Note: The latest revision of JST regulations on misconduct, which applies to new research projects selected in FY2013 or later (including continuing projects) and updates the periods of limitations that are imposed on researchers, was revised as of Dec. 28, 2012 (and took effect on Jan. 1, 2013) in response to the major changes for tougher sanctions against misconduct introduced with the Oct. 17, 2012 revision to the *Guidelines for the Appropriate Implementation of Competitive Research Funds* (by consensus of the Relevant Ministries and Agencies Liaison for Competitive Funding). The guideline revisions are reflected in the periods of limitations in the table above.

6.5 Regarding management and auditing systems and responses to misconduct at research institutions

○ Regarding implementation of systems for managing and auditing public research funds

In implementing the program research institutions must appreciate that the capital is public funds, stringently observe the relevant national laws, and make every effort to implement the program in an appropriate and efficient manner. In particular, there is a need for measures to be taken in order to prevent misconduct[*8]concerning research and development activities and inappropriate accounting practices[*9] etc. (hereinafter "misconduct etc.").

In concrete terms this means that there is a need for the research institutions to take responsibility, having implemented a system for managing and auditing public research funds, to make every effort to properly spend the contract research funds and take measures against misconduct etc. including compliance education, in line with the ”Guidelines for Responding to Misconduct in Research Activities" (August 26, 2014, adopted by the Minister of Education,

[*8] Fabrication, falsification or plagiarism in the course of research and development activities.

[*9] Cases in which research funds etc. are used for other purposes; cases in which research funds are paid according to a false invoice; cases in which the remuneration etc. of research assistants etc. are fraudulently used according to the intervention of researchers etc.; instances in which research funds are paid in violation of other laws, and cases in which research is adopted as a subject for a research program through dishonesty or any other fraudulent means.

Culture, Sports, Sciences and Technology) and the "Guidelines of Management and Audit of Public Research Funds in Research Institutes (Implementation standards) " (decided by the Minister of Education, Culture, Sports, Science and Technology on February 15, 2007). Please refer to the websites (only in Japanese) indicated below for details of the "Guidelines of Management and Audit of Public Research Funds in Research Institutes (Implementation standards)."

http://www.mext.go.jp/b_menu/houdou/26/08/1351568.htm

http://www.mext.go.jp/b_menu/shingi/chousa/gijyutu/008/houkoku/07020815.htm

http://www.mext.go.jp/a_menu/kansa/houkoku/1343904.htm

Regarding the "Self-evaluation Checklist for Implementation of Proper Systems"

Each research institution[*10] is obliged to regularly report to MEXT the circumstances of the implementation of its system for the management and auditing of public research funds using the "Self-evaluation Checklist for Implementation of Proper Systems" (hereinafter "the checklist"), and to respond to various investigations regarding the system implementation. (The implementation of research will not be approved without the submission of the checklist.)

In principle, research institutions commencing work on the program due to being newly selected and research institutions participating in a research team for the first time must, prior to commencing research (by the date of conclusion of a contract research agreement), in line with the format provided on the web pages below, submit the checklist using the Cross-ministerial R&D Management System (e-Rad system) to the Promotion Policy Division, Office of Research Funding Administration of the Ministry of Education, Culture, Sports, Science and Technology, Research Promotion Bureau. For more details on how to submit the checklist please refer to the following web page on the MEXT website (only in Japanese).

http://www.mext.go.jp/a_menu/kansa/houkoku/1301688.htm

In the event that a checklist has been submitted after the previous fiscal year as the result of applying for a program etc., there is no need to submit the checklist again when concluding a new contract research agreement, but since the submission of the checklist once a year is stipulated in Guidelines of Management and Audit of Public Research Funds it must be submitted again in subsequent years by institutions implementing the program.

Submission of the checklist will require an environment in which it is possible to utilize the

[*10] In CREST, this is not only the research institution to which the Research Director is affiliated but also the research institutions to which any other Main Research Collaborator allotted research funds are affiliated.

e-Rad system; institutions that have not yet completed the procedures for registering with e-Rad are therefore requested to do so at the earliest possible opportunity. Please note that it usually requires an interval of around two weeks for the registration process to be completed. Further details of the procedures please refer to the e-Rad system's website pages, indicated below, on preliminary preparations for using the system (only in Japanese).

http://www.e-rad.go.jp/shozoku/system/index.html

NB: In addition to request for the submission of the checklist, MEXT will send an e-mail detailing the hosting of briefing sessions and training meetings regarding the guidelines, so please ensure that the mail address of the "Chief administrative staff" is properly registered with e-Rad.

NB: Please complete the checklist after duly checking the latest information from MEXT and the MEXT website. It is essential that the checklist is examined by the auditor of the research institution or by somebody of similar rank before it is submitted.

- Regarding submission of the Self-evaluation Checklist for Implementation of Proper Systems (notification)(only in Japanese)
  http://www.mext.go.jp/a_menu/kansa/houkoku/1324571.htm

As the guidelines were altered on February 18, 2014, to include the perspectives of transmitting information and promoting greater sharing of it, research institutions are asked to provide coverage of the checklist on their websites and be enthusiastic in their transmission of information.

Where necessary, after the submission of the checklist research institutions may be asked to cooperate in on-site investigations regarding the state of the system implementation conducted by MEXT (including funding agencies).

○ Regarding imposition of management conditions for public research funds and the reduction of indirect costs

If it is judged that reports or investigations of the implementation of systems relating to the management and auditing of public research funds suggest there are faults in the implementation of these systems, or if an institution is deemed as having been involved in misconduct, management conditions displaying items for improvement and time limits (one year) for their execution many be imposed according to the Guidelines of Management and Audit of Public Research Funds. In the event that the management conditions are not executed despite this, the research institution in question will be subject to measures including having the

indirect costs of their competitive funds reduced (by up to 15% according to stage) and the allotment of their competitive funds stopped.

○ Cooperation in reporting of misconduct, and in investigations

In the event that an accusation of misconduct is leveled at a research institution (including through media reports or accusations by the Board of Audit or other such external organizations), in line with the "Guidelines of Management and Audit of Public Research Funds" and within 30 days of the accusation having been received, examine the reasonableness of the accusation, decide whether or not there is a need to conduct an investigation, and report the need or otherwise of any investigation to JST.

In the event that is judged that an investigation is necessary, institutions must convene an investigative committee, and discuss with JST the investigation guidelines, scope of investigation and its methods.

Within 210 days of an accusation having been received, please make a final report to JST including the investigation results, the causes of the occurrence of misconduct, the state of the management and auditing system of any competitive funds that those guilty of the misconduct are involved with, and a plan to prevent the occurrence of any further such misconduct. Note that even during the investigative phases if misconduct is partially ascertained it must be swiftly acknowledged and a report made to JST; furthermore, even if the investigation is uncompleted a progress report and interim report must be submitted to JST if they so request.

In addition, unless it will interrupt the investigation or there is a justifiable reason, the institution must cooperate by providing material related to the matter in question or by letting it be perused, and cooperating with on-site investigations.

In the event that the deadline for the final report is extended measures such as reducing a certain proportion of indirect costs and suspending contract research funds will be taken. Please refer to the "Guidelines of Management and Audit of Public Research Funds" for a detailed account of the items that should be incorporated in the final report.

6.6 Measures regarding Misconduct in Research Activities

In applying to this funding program and conducting research activities, research institutions are required to adherence to the ““Guidelines for Responding to Misconduct in Research Activities”(decided by the Minister of Education, Culture, Sports, Science and Technology on August 26, 2014, hereinafter referred to as the “guideline”).

If there is misconduct (fabrication, manipulation, plagiarism) in research activities in this funding program, the following measures will be taken based on the guideline.

○ With regard to research projects under this program, in the case that misconduct (fabrication, manipulation, plagiarism) in research activities is discovered, the research project in question may be cancelled; all or part of the project's research funding returned, and measures taken to publicize the facts of the matter. Furthermore, limitations shall be placed for a certain period of time on the eligibility of those listed below to apply to or newly participate in this program.

As a general rule, the period of limitations shall be between one and ten years. Note that "application or participation" refers to the submission of proposals, applications, and requests for new research projects by the researcher or participation in new research by the researcher as a joint researcher.

<table>
<tr><td colspan="3">Persons incurring limitations on applications due to misconduct</td><td>Extent of Misconduct</td><td>Period of limitation on applications (Imposed from the fiscal year following the year in which misconduct is officially recognized*1)</td></tr>
<tr><td rowspan="3">Person Involved in the Misconduct</td><td colspan="2">1. Especially malicious individual who intentionally engages in misconduct from the outset of the research</td><td></td><td>10 years</td></tr>
<tr><td rowspan="2">2. Author of academic paper, etc. related to research in which there has been misconduct</td><td rowspan="2">The author responsible for the academic paper in question (supervisor, first author, or other position of responsibility deemed equivalent)</td><td>The impact on the advancement of research in the relevant field or society is large, and the maliciousness of the misconduct is deemed to be high.</td><td>5-7 years</td></tr>
<tr><td>The impact on the advancement of research in the relevant field or society is small, and the maliciousness of the</td><td>3-5 years</td></tr>
</table>

			misconduct is deemed to be low.	
		Author other than that listed above		2-3 years
	3. An individual involved in misconduct other than that stipulated in 1 or 2			2-3 years
An author responsible for academic papers, etc. related to research in which there has been misconduct but who was not involved in the misconduct (supervisor, first author, or other position of responsibility deemed equivalent)			The impact on the advancement of research in the relevant field or society is large, and the maliciousness of the misconduct is deemed to be high.	2-3 years
			The impact on the advancement of research in the relevant field or society is small, and the maliciousness of the misconduct is deemed to be low.	1-2 years

*1 Limitations on participation will also be imposed in the fiscal year that the misconduct is officially recognized.

Note: The latest revision of JST regulations on misconduct, which applies to new research projects selected in FY2013 or later, was revised as of Dec. 28, 2012 (and took effect on Jan. 1, 2013) to harmonize with the Oct. 17, 2012 revision to the *Guidelines for the Appropriate Implementation of Competitive Research Funds* (by consensus of the Relevant Ministries and Agencies Liaison for Competitive Funding) for the purpose of aligning the periods of limitations that are imposed on researchers with that of other competitive funds. The guideline revisions are reflected in the periods of limitations in the table above.

○Limitations shall be placed for a certain period of time on eligibility for application to or participation in this program for researchers who have been reprimanded for misconduct in

research activities conducted under MEXT-related or national government ministry competitive funding programs other than this funding program or programs other than competitive funding programs that are under the jurisdiction of the JST and to whom limitations on application/participation eligibility for the relevant program have been applied.

(Limitations shall also be placed on participation for the fiscal year in which the misconduct in research activities is deemed to have occurred. Moreover, limitations may be applied retroactively.)

○In the case that misconduct in research activities conducted under this program is discovered, information regarding the details of the misconduct by the researcher in question is provided to those in charge of MEXT-related or national government ministry competitive funding programs (including independent administration agencies). Consequently, limitations may be placed on application to or participation in MEXT-related or national government ministry competitive funding programs (see Footnote *9).

6.7 Measures for Protecting Civil Rights and Complying with Laws and Regulations

In the case that, in implementing a research initiative, the initiative involves research requiring the consent/cooperation of other parties, research requiring particular care in handling personal information, research requiring bioethical or safety measures to be taken, and other research requiring procedures required by laws and regulations, be sure to carry out the necessary procedures, such as obtaining the approval of an external and internal ethics committee of a research institution. If research activities are conducted overseas or collaborative research activities with institutions overseas are conducted, please confirm the regulations and laws in advance adhere to them.

With regard to life science-related research in particular, the main laws and regulations prescribed by each government ministry are as follows. Please note that, depending on the research content, there are also cases in which laws and regulations other than these have been established.

- Act on Regulation of Human Cloning Techniques (Act No. 146 of 2000)
- Guidelines for Handling of a Specified Embryo (Public Notice of Ministry of Education, Culture, Sports, Science and Technology No. 173 of 2001)
- Guidelines on the Derivation and Distribution of Human Embryonic Stem Cells (Public Notice of Ministry of Education, Culture, Sports, Science and Technology No. 156 of 2009)
- Guidelines on the Utilization of Human Embryonic Stem Cells (Public Notice of Ministry of Education, Culture, Sports, Science and Technology No. 157 of 2009)
- Ethical Guidelines for Human Genome/Gene Analysis Research (Public Notice of Ministry of Education, Culture, Sports, Science and Technology/ Ministry of Health, Labour and Welfare/

Ministry of Economy, Trade and Industry No. 1 of 2001)

- Ministerial Ordinance on Good Clinical Practice for Drugs (Ordinance of Ministry of Health, Labour and Welfare No. 28 of 2009)
- R&D Using Human Tissue Extracted during Operations, Etc. (Report of the Health Science Council 1998)
- Ethical Guidelines for Epidemiological Research (Public Notice of Ministry of Education, Culture, Sports, Science and Technology/ Ministry of Health, Labour and Welfare No. 2 of 2002)
- Guidelines for Gene Therapy Clinical Research (Public Notice of Ministry of Education, Culture, Sports, Science and Technology/ Ministry of Health, Labour and Welfare No. 1 of 2002)
- Ethical Guidelines for Clinical Studies (Public Notice of Ministry of Health, Labour and Welfare No. 225 of 2003)
- Act on the Conservation and Sustainable Use of Biological Diversity through Regulations on the Use of Living Modified Organisms (Act No. 97 of 2003)
- Ethical Guidelines for Medical and Health Research Involving Human Subjects (Public Notice of the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Health, Labor and Welfare No. 3 of 2014)

-Laws and regulations on access or distribution of hereditary resources in each country

For information regarding Ministry of Education, Culture, Sports, Science and Technology measures on bioethics and safety assurance, please refer to the following website.

- Life Sciences no Hiroba “Measures on Bioethics and Safety Assurance” (only in Japanese)

http://www.lifescience.mext.go.jp/bioethics/index.html

In the case that the research plan includes research or surveys that require consent/cooperation of other parties and/or social consensus, be sure to take appropriate measures for protecting civil rights and interests prior to applying to this program.

6.8 Security Export Control (Measures against the Leakage of Technology Internationally)

○ Many cutting-edge technologies are studied at research institutions. Universities in particular have seen an increase in the number of international students and foreign researchers due to internationalization, and there is an increasing risk of cutting-edge technologies and/or research materials/equipment being leaked or used for bad purposes such as the development and production of weapons of mass destruction. For this reason, in carrying out their various

research activities, including the relevant contract research, research institutions are required to take organizational measures to ensure that research results that could be used for military purposes do not fall into the hands of people who could carry out fearful activities such as developers of weapons of mass destruction or terrorist groups.

○ In Japan there are export controls* based on the Foreign Exchange and Foreign Trade Act (Act No. 228 of 1949) (hereinafter referred to as the “Foreign Exchange Act”). Accordingly, when attempting to export (provide) goods or technologies controlled by the Foreign Exchange Act, as a general rule it is necessary to obtain the license of the Minister of Economy, Trade and Industry. Be sure to comply with the Foreign Exchange Act and other laws, ministerial ordinances, and notices issued by government ministries and agencies.

*Currently, Japan’s security export control system mainly comprises two systems based on international consensus: (1) systems under which the license of the Minister of Economy, Trade and Industry is required as a general rule when attempting to export (provide) goods (technologies) with specifications/functions that are above certain criteria, such as carbon fibers or numerically-controlled machine tools (list control); and (2) systems under which the license of the Minister of Economy, Trade and Industry is required when attempting to export (provide) goods (technologies) to which list controls do not apply and certain requirements (use application requirements, end-user requirements, and notification (inform) requirements) have been met (catch-all control).

○ Not only the export of goods but also the provision of technology is subject to Foreign Exchange Act controls. When providing list control technologies to foreigners (non-residents), license to provide the information must be obtained in advance. “Technology provision” includes the provision of technology information such as blueprints, specifications, manuals, specimens, and prototypes by means of storage media such as paper, e-mail, CD, and USB memory, and also includes the provision of operational knowledge through technical guidance and skills training as well as technological support through seminars. There are also cases in which technology provision includes a large amount of technology exchange that could be subject to Foreign Exchange Act controls in the acceptance of international students and joint research activities.

○ Detailed information about security export control is provided on the website of the Japanese Ministry of Economy, Trade and Industry (METI) and other organizations. Please see the list below for details.

- Ministry of Economy, Trade and Industry (METI)：Security export control (general)

http://www.meti.go.jp/policy/anpo/

- Ministry of Economy, Trade and Industry (METI) : Security Export Handbook

  http://www.meti.go.jp/policy/anpo/seminer/shiryo/handbook.pdf

- Center for Information on Security Trade Control

  http://www.cistec.or.jp/index.html

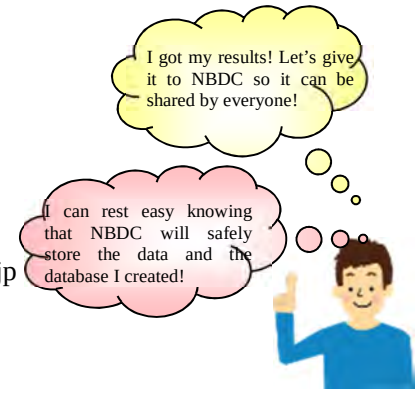
- Guidance on machine technology control in relation to security export control (for universities/research institutions)

  http://www.meti.go.jp/policy/anpo/law_document/tutatu/t07sonota/t07sonota_jishukanri03.pdf

6.9 Cooperation with the National Bioscience Database Center

The National Bioscience Database Center (NBDC)[*11] hosts the Life Science Database Archive (http://dbarchive.biosciencedbc.jp), an archive that provides access to wholly downloadable datasets generated by researchers in Japan in the life sciences. Another hosted database is the NBDC Human Database (http://humandbs.biosciencedbc.jp), a platform for sharing various human data produced from human-derived specimens such as human genome data.

We ask all researchers to provide NBDC with their data for publishing on the Life Science Database Archive and the NBDC Human Database so that data results from your life sciences research may be used extensively for a long time.



Contact information
Japan Science and Technology Agency
The National Bioscience Database Center (NBDC)
Life Science Database Archive contact: dbarchive@biosciencedbc.jp
Human Database contact: humandbs@biosciencedbc.jp

Feel free to contact us with any questions you may have on using/publishing life sciences databases.

6.10 Regarding Registration with researchmap

As the largest directory of researchers in Japan, researchmap (formerly called

[*11] The National Bioscience Database Center (http://biosciencedbc.jp/en/) researches, develops, and provides services for integrating and easily accessing life sciences databases generated in Japan. The objective is to stimulate research and development through extensive sharing and broad use of research data.

"ReaD&Researchmap"*; http://researchmap.jp/?lang=english) is a researcher information database of approximately 240,000 registered researchers as of March 2015. The information registered by the researcher on his/her research track record can optionally be made accessible to the Internet. Additionally, the compatibility of researchmap with other systems, which enables seamless access to its registered information, allows it to link with e-Rad and many university faculty databases, thereby saving researchers from repetitiously entering the same research record information on multiple applications and databases. With its single sign-on integration with the CV-creation function on JREC-IN Portal (a researcher career site; https://jrecin.jst.go.jp/seek/SeekTop) researchmap has become more convenient than ever.

The publishable data registered with researchmap will also be made publicly available by J-GLOBAL(only in Japanese) (http://jglobal.jst.go.jp/). The users of researchmap and J-GLOBAL are a broad range of Japanese and overseas universities and companies and offer high expectations for future joint research work and other approaches. Moreover, JST uses researchmap when it examines the research record information of researchers.

The strategic basic research programs (CREST and PRESTO) plan to use researchmap as a master database of research record information and in the future to use it in all sorts of situations, such as research record reports and so on.

The information registered at researchmap is put to use in national and other academic and science and technology policy formulation research, as well as being used for statistical objectives, so those implementing the program are requested to be sure to register with researchmap.

6.11 Efficient promotion of research and development through effective use of currently available research facilities and equipment

The Ministry of Education, Culture, Sports, Science and Technology is promoting the development of the grounds for sharing research institutes and facilities and integrating different research fields in accordance with the Act on the Promotion of Public Utilization of the Specific Advanced Large Research Facilities (Act No. 78, 1994); the Act on Enhancement of Research and Development Capacity and Efficient Promotion, etc., of Research and Development, etc., by Advancement of Research and Development System Reform (Act No. 63, 2008); and other laws. If the uses and purchases of research facilities and equipment are being considered upon the application, please consider actively using facilities and equipment owned by universities and national research and development agencies and made available to others and opportunities for cooperation among industries, academia, and the government from the perspective of effective promotion of consigned research in this program; effective use of already available facilities and equipment; and removing overlaps in purchasing facilities and equipment.

On the other hand, there is no restriction on the use for other research of research equipment

purchased post-selection with the contract research budget, as long as the use does not impact the contracted research (with the exception of use for a profit-making business).

<Reference: Examples of shared facilities and equipment>
○Facilities covered in the Act on the Promotion of Public Utilization of the Specific Advanced Large Research Facilities
・SPring-8, the large synchrotron radiation facility
http://user.spring8.or.jp/?lang=ja

・SACLA, an X-ray free-electron laser facility (Applications are accepted around May and November every year.)
http://sacla.xfel.jp/

・J-PARC, a large intensity proton accelerator (Applications are accepted around May and October every year.)
http://is.j-parc.jp/uo/index.html

・High Performance Computing Infrastructure (HPCI) including the K computer
http://www.hpci-office.jp/
*Please refer to the website of registered agencies for the promotion of facility uses for information on the application of projects to use these facilities.
(The website is being prepared.)

○Projects for promoting the sharing of advanced research facilities
http://kyoyonavi.mext.go.jp/

○Nano technology platform
http://www.nanonet.go.jp/

○Development of research base network toward the construction of a low-carbon society
http://www.nims.go.jp/lcnet/

○Tsukuba Innovation Arena for Nanotechnology (TIA-nano)
http://tia-nano.jp/

○Project for Platform for Drug Discovery, Informatics, and Structural Life Science (four bases)
http://pford.jp/

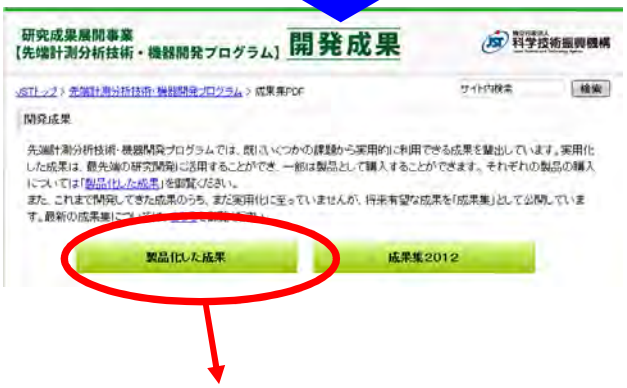
○National BioResource Project
http://www.nbrp.jp/

○Japanese Experiment Module (KIBO) / International Space Station (ISS)
http://iss.jaxa.jp/kiboexp/participation/

6.12 Regarding the Results of JST's Development of Systems and Technology for Advanced Measurement and Analysis Program

- JST implements a wide variety of research and development programs ranging from basic research to industry-academia collaborations and so on, and a great deal of these research results have been put into practical use already.
- Among these, the development of systems and technology for advanced measurement and analysis program, which seeks to build and develop a basic research and development platform, has resulted in the practical use of many research and development tools.
  Visit the Advanced Measurement website (http://www.jst.go.jp/sentan) for details.

Click here



Click here

Search here for practical applications of research and development tools.

Chapter 7 Limitations on the Overlap of Proposals within the Strategic Basic Research Programs

With regard to the Invitation for Application of Research Proposals for CREST and PRESTO in FY 2015, based on administration policies, restrictions on duplicate applications to other programs within the Strategic Basic Research Programs are preliminarily clarified as follows. With regard to other programs both within and outside JST that are not mentioned in this chapter, in the case that it is individually determined that the duplicate applications are unreasonable or excessively concentrated, certain measures will be taken. For details, please see "6.3 Measures against Unreasonable Duplication and Excessive Concentration."

(1) Only one application may be submitted across all CREST and PRESTO Research Areas in Research Proposal Applications. A researcher who submits a proposal for the Call for Research Proposals (First Term) may also submit a proposal for the Call for Research Proposals (Second Term). Proposal selections, however, will be limited to only one research area. If the proposal submitted to the Call for Research Proposals (First Term) by a researcher who submits a proposal for the Call for Research Proposals (Second Term) is selected, the researcher should select either one of them.

(2) If you are in any of the following positions, as a rule, do not apply. (Except that the ending time period of the concerned ongoing research is finished before March 31, 2016.)
a. Research Director of ERATO (Supervisor-Oriented Research) in the Basic Research Programs
b. Research Director of CREST (Team Research) in the Basic Research Programs
c. Researcher of PRESTO (Individual Research) in the Basic Research Programs
d. Research Director of ALCA in the Basic Research Programs

(3) For CREST, there are following restrictions on application as a Lead Joint Researcher or Research Participant;
a. Multiple applications from one researcher by switching from Research Director to Lead Joint Researcher, or vice versa are not allowed.
b. In case Research Director, Lead Joint Researcher or Research participant proposes one research project, he / she proposes another as a Research Director, Lead Joint Researcher and both proposals are short-listed, adjustment could be made such as cut down of research cost or selection of one research proposal by the applicant.
c. In case one currently participating as a Lead Joint Researcher or Research participant propose a research project and is short-listed, adjustment as mentioned above "b" may be made.

(4) Currently-active PRESTO researchers cannot participate as Lead Joint Researcher for CREST. (Except that ongoing PRESTO research is finished before March 31, 2016.)
In case those who are applying to CREST cannot include currently-active PRESTO researchers as Lead Joint Researchers (Except that ongoing PRESTO research is finished before March 31, 2016.).
A Lead Joint Researchers of currently-active CREST research projects or applying CREST research projects can apply PRESTO. However, if they are nominated for adoption of PRESTO, they should select either being PRESTO researcher or CREST Lead Joint Researcher. PRESTO researchers can participate in the CREST as a collaborator.

(5) Those who are applying to ALCA as a Research Director and also applying to CREST or PRESTO, they can be selected in only one program of three programs (CREST, PRESTO or ALCA).

(6) If the applicant's research proposal has been short-listed for FY2015 CREST or PRESTO programs and as a result, the applicant will participate in multiple research projects in JST's competitive research funds, adjustments among research projects may be enforced. For example, the research expenses for the applicant's project(s) may be reduced the applicant may be invited to select only one among the projects. (Except if the concerned ongoing research is finished before March 31, 2016). In the case of proposals for CREST, such adjustments may be subjected to not only Research Director but also the participants.

Chapter 8 Submission via the Cross-ministerial R&D Management System (e-Rad)

8.1 Points to Note with Regard to Submission via the Cross-ministerial R&D Management System (e-Rad)

Calls for research proposal applications are made via the e-Rad (http://www.e-rad.go.jp/)[*1] system. The process for submitting research proposal applications via e-Rad is described below.

Please pay attention to the following points in particular.

○ **Researcher registration is required in advance.**
For details, please refer to 8.4.1.

○ **Please allow several days or more after the application deadline for inputting information into e-Rad.**
Input of information into e-Rad takes a minimum of around 60 minutes. Furthermore, on the day of the application deadline, there is a risk that the e-Rad system may be crowded and inputting may take a long time. Please allow ample time before the application deadline to commence inputting information into e-Rad.

○ **It is possible to "temporarily save" input information.**
It is possible to discontinue input of and temporarily save application information part way through. For details, please refer to the "Saving and Reassessing your Application Information" section under "8.4.4 Entering the Required Information into the e-Rad System" and/or "Usage Manual for Researchers" or "Frequently Asked Questions" sections on the e-Rad portal site (http://faq.e-rad.go.jp/).

○ **"Retraction" is possible, even after the research proposal has been submitted.**
Up to and including the day prior to the application deadline, it is possible for researchers to retract and re-edit their research proposals. For details, please refer to the "Amending Submitted Application Information: 'Retraction' " section under "8.4.4 Entering the Required Information into the e-Rad System" and/or "Usage Manual for Researchers" section on the e-Rad portal site.
Do not "retract" research proposals on the day of the application deadline. On the day of the application deadline, there is a risk that the e-Rad system may be crowded and re-editing the proposal after retraction may take a very long time.

[*1] The e-Rad system is a cross-ministerial system that enables online completion of all processes (Application receipt → Evaluation → Selection → Management of selected research topics → Reporting of results, etc.) related to the management – referring primarily the competitive funding systems overseen by individual ministries - of research and development. "e-Rad" is derived from the words "electronic" and "research and development" (for science and technology).

8.2 Flow of Application Process Using e-Rad

(1) Enter information on the research institution and researcher

Applicants who do not have a login ID or password must request the administrative section of their research institution to register the institution in the e-Rad system. It should be noted that the registration process can take more than two weeks. →For more details, please refer to 8.4.1.

↓

(2) Obtain application requirements and research proposal forms

Check the list of current calls for research proposal applications on the e-Rad portal site, and download the application requirements and research proposal forms. → For more details, please refer to 8.4.2.

↓

(3) Prepare a research proposal (maximum file size of 3 MB） → For more details, please refer to 8.4.3.

↓

(4) Enter the application information into the e-Rad system

Enter the required information into the e-Rad system. Input takes around 60 minutes. → For more details, please refer to 8.4.4.

↓

(5) Submit the research proposal

Submit your research proposal by uploading it. → For more details, please refer to 8.4.5.

8.3 System Availability and Where to Direct Questions

8.3.1 How to use the e-Rad system

An instruction manual explaining how to use the e-Rad system can be downloaded from the e-Rad portal site.

- Please submit research proposals after accepting the terms of the e-Rad user agreement.
- Please check (https://www.e-rad.go.jp/terms/requirement/index.html) before using the e-Rad system.

8.3.2 Where to direct questions on how to use the e-Rad system

Questions regarding JST's systems and programs should be directed to JST. Questions on how to use the system should be directed to the e-Rad helpdesk.

Please read carefully the explanation of the application process contained in this chapter, and the contents of the e-Rad portal site, before submitting a question.

Questions regarding matters like systems and programs, preparation of documentation for submission, and submission procedures	JST Department of Innovation Research (Person in charge of calls for proposals)	Please submit questions by e-mail (Questions will be accepted by more direct means in urgent situations.) E-mail : rp-info@jst.go.jp (For matters related to proposal submission) Tel : 03-3512-3530 (For matters related to proposal submission) Hours: 10:00 -17:00 ●Except on Saturdays, Sundays, and holidays
Got questions regarding use of the e-Rad system	e-Rad helpdesk	Tel: 0120-066-877 Hours: 9:00-18:00 ●Except on Saturdays, Sundays, holidays, and the year-end and new year period [In the case that the toll-free service is unavailable] 03-3455-8920 (direct line)

- Website for this program: (http://www.senryaku.jst.go.jp/teian.html)
- e-Rad portal website (http://www.e-rad.go.jp/)

8.3.3 e-Rad system availability

Monday to Sunday 0:00-24:00

- Maintenance and inspection schedules are announced ahead of time on the portal site.

8.4 Detailed Submission Instructions and Precautions

8.4.1 Entering information on research institutions and researchers

Applicants must first register their researcher information and obtain an e-Rad login ID and password. For CREST applications, registrants include the Research Director and all Joint Researchers. For PRESTO applications, the registrant includes only the Research Director (If registration via a system or program of another ministry or other government organization has already been completed, doing so once again is not required.)

The following registration procedures are required. **Please allow two weeks or more for completing procedures**. For details, please refer to the "Preparations for Using the System" or "Frequently Asked Questions" sections on the e-Rad portal site.

1) For researchers affiliated with a domestic research institution

, Operator: administrator at the research institution

Registration details: research institution and information on the researcher

2) For researchers affiliated with a foreign research institution, and researchers affiliated with no research institution

Operator: applicant

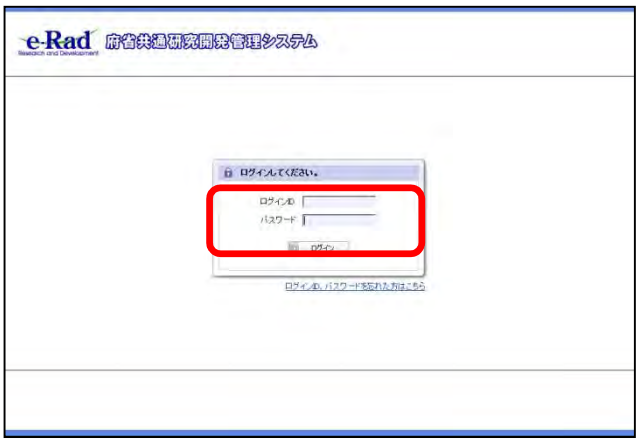
Registration detail: information on the researcher

8.4.2 Obtain application requirements and research proposal forms

(1) Click "e-Rad login" on the portal site.

(2) Log in using the applicant's login ID and password.

- Once this is done, information on the researcher who has logged in will be automatically displayed in areas showing information on the Research Director.



For first-time logins, it is necessary to enter initial settings. In addition, when logging in from a PC other than the one normally used for login, the login process will go to an additional authentication screen. On such occasions, the user may be asked to respond to a preset question.

(3) Search for calls for proposals

Click on 1) “Application / Selection Information Management” on the left-side menu. Next, click on 2) “List of Current Calls for Proposals.”

(4) Click on “Details” for the call for proposals for which an application will be submitted.
Make sure everything is correct in terms of the call-for-proposals selection, CREST or PRESTO category, and research area.

Simple searches can be performed by clicking “Search Conditions”.
(Please search based on terms such as system name, research area, and Research Supervisor.)

(5) Download the research proposal forms and application requirements

Confirm that the call for proposals, CREST / PRESTO category, and research area are correct.

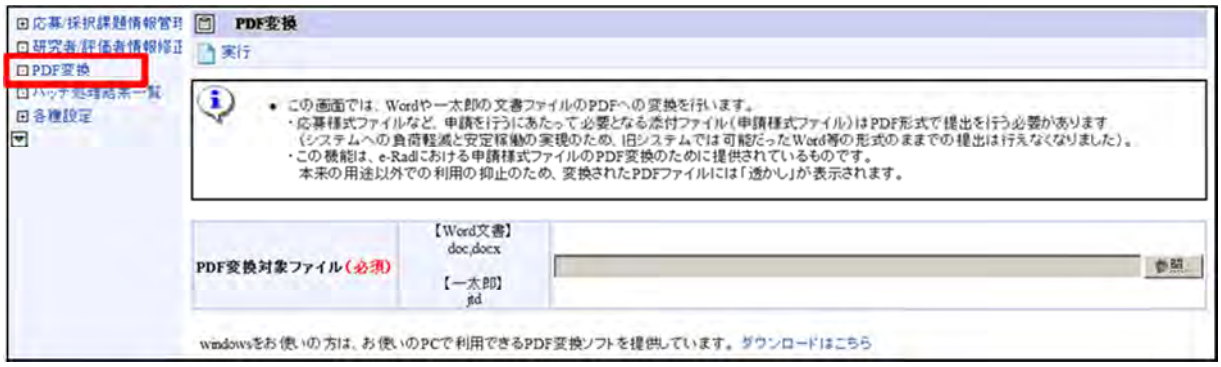
For the research proposal forms, click "Application Form File" and download the file.

- **<u>Be very careful to use the correct forms for the research area for which the application will be submitted.</u>**

Application requirements (application requirements for the call for proposals) can be accessed from the same page. (Click on “Application Requirement File” to download the requirements.)

8.4.3 Preparing a Research Proposal

- Make sure that application requirements are understood before preparing a research proposal.
- Research proposals (doc format) must be converted to the PDF format before uploading to the e-Rad system. PDF conversion can be performed using the menu that appears after login. It is also possible to download the conversion software from the same menu and install it on the researcher's computer.



■NOTE:

- Please confirm the recommended operating environment in advance to log in the e-Rad system. The recommended operating environment is IE, Firefox, or Safari.
- Research proposals converted to the PDF format should be no larger than 3MB. Files exceeding 10MB cannot be uploaded to the e-Rad system.
- Delete the conversion history.
- When creating PDF files, do not set a password for the research proposal.
- Make sure that page numbers have been attached to the file converted to PDF format.
- Confirm the creating PDF files. Following misconversion could be happen.

  * In the process of conversion, characters, such as those used in certain languages and special characters, may not be rendered correctly. It is necessary, therefore, to check all PDF files within the system. For more information on characters available for use, please refer to the "Usage Manual for Researchers" (downloadable from the e-Rad portal site).

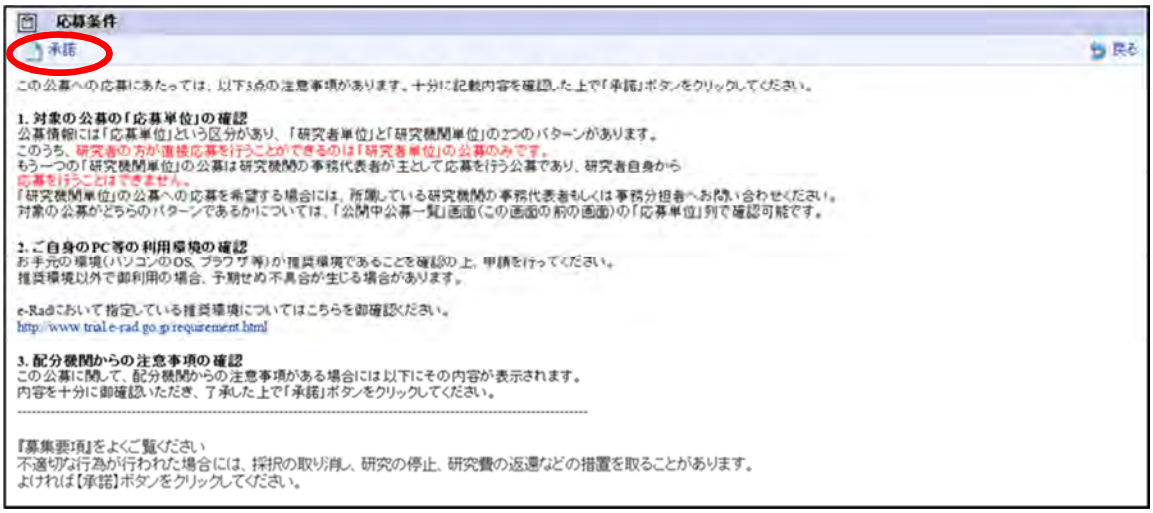
8.4.4 Entering the Required Information into the e-Rad System

(1) Search for calls for proposals

After preparing a research proposal, log in once again, search for calls for proposals (Procedure is the same as in (2)) and click “Enter Application Information.”

(2) Application conditions

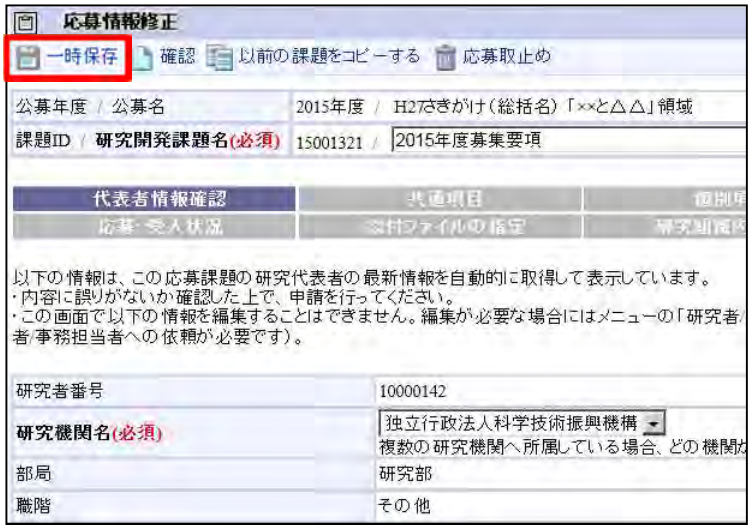
After reading the cautionary note, click "Agree” on the upper left portion of the screen.



Saving and Reassessing your Application Information

1. Saving Information Temporarily

In the case that you wish to temporarily store application information during input, please click on the “Temporarily Save” button at the top-left of the screen.



2. Reassessing your Application Information

First click on “1) Application/Selection Information Management” in the right-side menu, then click on “2) Application Information Management”, which will be displayed.

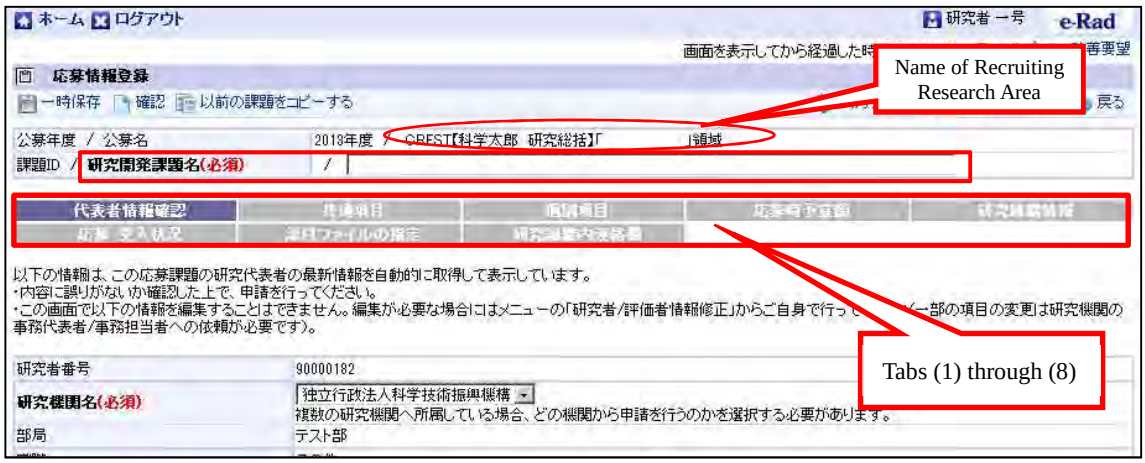
Input the recruitment year (2015) and research area name into the 【Search Criteria】 box and click the “Search” button.

If you click on the “Edit” button, the Application Information Registration (Amendment) page will appear.

(3) Enter application information

Enter the various types of information required to apply.

This screen is organized with tabs. Clicking the eight tabs shown below will display a related data entry screen.



Application information data entry screen (Accessed by clicking the “Research Director Information Confirmation” tab)

- In the space labeled “R&D Subject,” enter the "Research Project Name” from Research Proposal (Form 1).

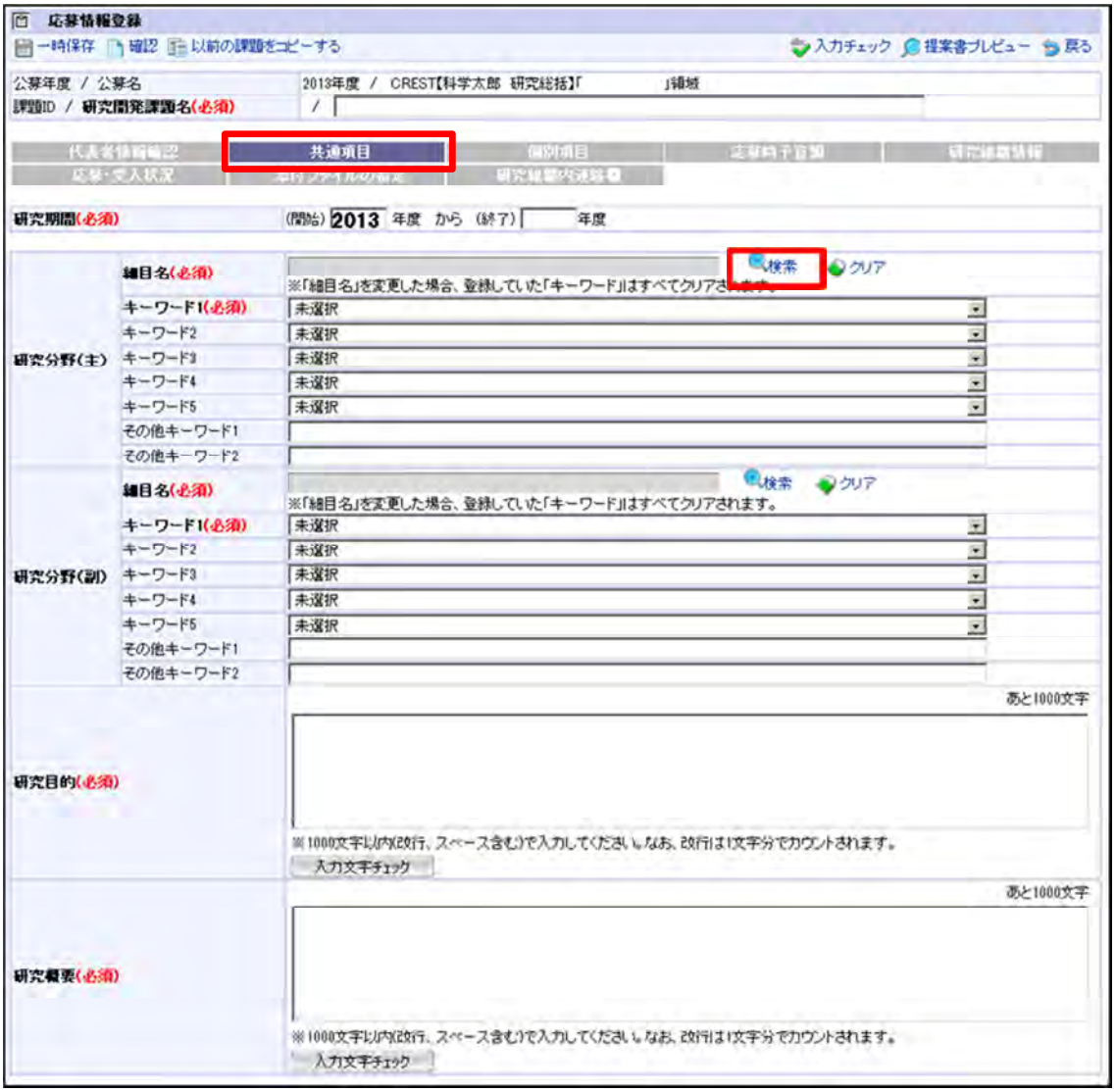
➢ Confirm that the call for proposals, CREST / PRESTO category, and research area are correct.

1） “Research Director Information Confirmation” tab

- Check whether the information on the Research Director is correct. Information registered on the e-Rad system is automatically entered.
- Researchers who are affiliated with multiple research institutions must select the institution from which the proposal will be made. This selection is made via this tab.

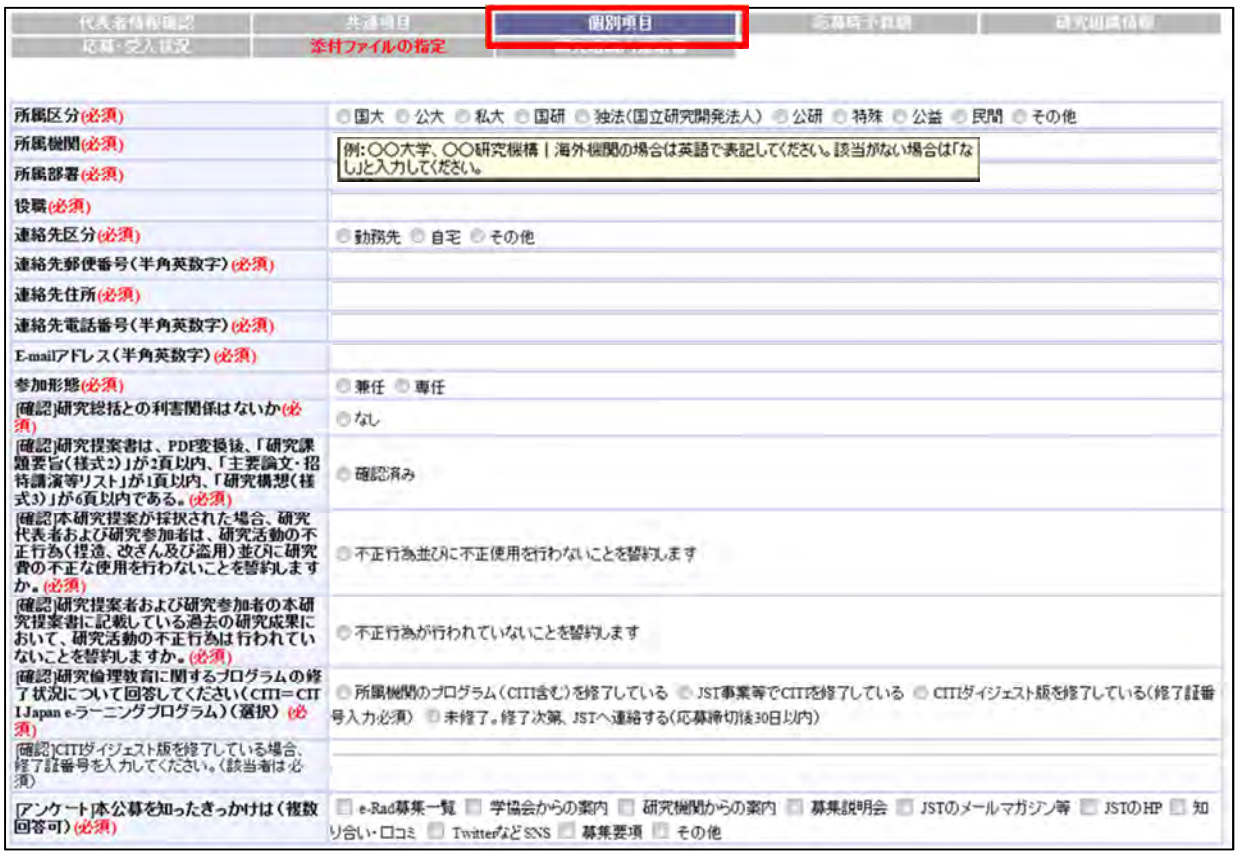
It is possible to amend researcher information from the e-Rad “Revise Researcher / Evaluator Information” menu. For details, please refer to the “Usage Manual for Researchers.”

2) “Common Items” tab



Research Period (Start): 2015 (Fiscal year)
Research Period (End) (3 1/2 year projects): 2018 (Fiscal year)
Research Period (End) (5 1/2 year projects): 2020 (Fiscal year)
Research Field (Main, Secondary) / Specific Name: Click “Search” and use the new screen to perform a detailed search for the research field / specific name that apply to the proposed research. Select the appropriate items.
Research Field (Main, Secondary) / Keywords: After selecting a specific name, select keywords from the list.
Research Objectives: Enter "Refer to the research proposal."
Research Overview: Enter "Refer to the research proposal."

3) “Individual Items” tab



Enter information for affiliation category, institutional affiliation, department affiliation, job title, contact category, postal code, address, telephone number, e-mail address, form of participation (PRESTO only), and the survey question as indicated on the screen. (Placing the cursor over each item will cause a related explanation to appear. Please refer to these as necessary.)

- For CREST applications, enter information on the Research Director.

(PRESTO only)

Form of Participation: Select one.

(Joint Appointment): For researchers affiliated with a university or national research and development research institution, or national and public testing and research institution, or private company

(Exclusive Appointment): For postdoctoral fellows and researchers who will resign or take leave from the research institution with which they are currently affiliated

- For details, please refer to “3.3.3 Joint appointment and Exclusive appointment.”

Points to Note when Inputting Information Using the “Individual Items” Tab

- For items marked 【CHECK】, be sure to check the content carefully before clicking the “Check” button.
- With regard to programs related to Research Integrity Education, please refer to “6.1 Enrolling in and Completing the Educational Program for Research Integrity”.
- In the case that you have completed the condensed CITI Japan e-learning program, please be sure to input the Completion Certificate Number.

4) Budget at Application Time” tab

Direct Cost (CREST): Enter the yen-denominated team total cost figures for each fiscal year from “Itemized Research Cost Plan (team)” on Research Proposal (Form 6). (Unit = 1,000 yen/each fiscal year)

- (CREST only) If the figure for the initial fiscal year (2015) under this tab does not equal the total for the Research Director and all Lead Joint Researchers under the “Research Organization Information” tab (5) below), an error will result.

Direct Cost (PRESTO): Enter the yen-denominated cost figures for each fiscal year from “Desired Research Budget” on Research Proposal (Form 1). (Unit = 1,000 yen/each fiscal year)

- Direct cost breakdowns are not required.

Overhead Cost (Indirect Cost): Enter “0” (1,000s of yen) for each fiscal year.

- Please input “0 yen” due to system functioning.
  In actuality, in addition to research costs (direct costs), as a general rule research institutions are paid contract research costs up to a maximum of 30% of direct research costs based on contract research agreements.

★The fiscal years for the research period entered under the “Common Items” tab (2) above) will be displayed. The “fiscal year” box appears in accordance with the research period input using the “(2) Common Items” tab. To view the column for the final fiscal year, use the horizontal scroll bar to move the column into view.

5) “Research Organization Information” tab

Direct Cost (CREST): Enter the “Initial Fiscal Year (2015) Research Cost for the Research Director's Group” from the “Research Budgets for Individual Research Group” on Research Proposal (Form 6). Round to the nearest 1,000 yen.

Direct Cost (PRESTO): Enter the desired budget figure for the initial fiscal year (2015). Round to the nearest 1,000 yen.

- Direct cost breakdowns are not required.

Overhead Cost (Indirect Cost): Enter “0” (1,000s of yen).

Research Institution: In the case that you are affiliated with multiple research institutions, please select the institution at which you conduct research.

Field of Specialization: Enter in concise terms.

Role: Enter “Research Director” or “Lead Joint Researcher.”

Effort: Enter the anticipated total effort for FY2015 if the proposal is selected. (For CREST, this should be the same figure as appears on Research Proposal (Form 4 (5 Lead Joint Researchers)). For PRESTO, this should be the same figure as appears on Research Proposal (Form 5).

- (CREST only)

- When there are Lead Joint Researchers, click “Add” in the lower portion of the screen to enter data for them. Enter researcher information in the same manner information was entered for the Research Director.
- If the figure for the initial fiscal year (2015) under the “Budget at Application Time” tab (4) above) and the total for the Research Director and all Lead Joint Researchers under this tab are not equal, an error will result.
- In the case that the Lead Joint Researcher does no register his/her information on e-Rad in sufficient time to meet the Application Deadline, provisionally combine the Lead Joint Researcher’s information with that of the Research Director. After application has been completed, please promptly send the researcher information for the Lead Joint Researcher that could not be input to the following contact address: rp-info@jst.go.jp.

6) “Application and Acceptance Status” tab

No entries are required for this tab.

- For “Support from Other Organizations, etc.,” enter the information from Research Proposal (Form 10) for a CREST application, or the information from Research Proposal (Form 5) for a PRESTO application.

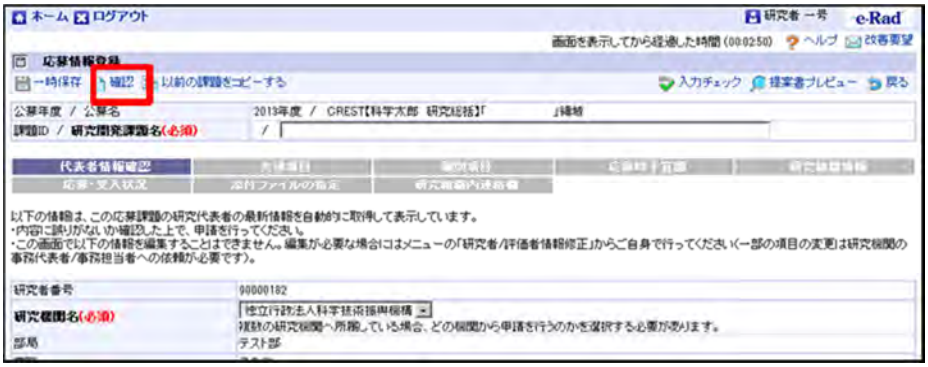
7) “File Attachment” tab

Click “Choose” to select and upload the PDF created in (3) Preparing a Research Proposal.

8) “Internal Research Organization Contact Information” tab

This information will not be used in CREST / PRESTO examinations.

8.4.5 Research Proposal Submission



Click on the “Confirm” button at the top-left of the screen.

In the case that there are sections where the input information does not correlate with e-Rad’s input rule, an error message will appear at the top of the screen, the tab for the section where the problem occurred will appear in red, and the cell for the incorrectly input information will appear in yellow. Please make corrections as instructed in the message.

Confirm that all entered information is being correctly displayed and click on “Submit” in the upper left portion of the screen to submit the proposal. Substantial time is required to complete the submission process in some cases.

If the submission is successful, a message reading “Application Information Receipt Finalized” will be displayed. At that point, the Research proposal has been submitted to JST. It should be noted that CREST / PRESTO do not require that the research institutions with which researches are affiliated provide approval via the e-Rad system.

Amending Submitted Application Information: “Retraction”

Researchers may retract or amend their proposals up to and **including the day prior to the application deadline.**

- **Do not “retract” research proposals on the day of the application deadline**.

1) First click on “1) Application/Selection Information Management” in the left-side menu, then click on “2) List of Processed Items”, which will be displayed.

2) Click on the “Retract” button.

3) When the Retraction screen appears, click on the “Retraction” button.

After retraction is completed, the proposal will be “temporarily saved”. For recommencing input of information from a “temporarily saved” status, please refer to “Saving and Reassessing your Application Information” above.

■ Confirmation of application information status

After clicking “Application / Selection Information Management” on the left-side menu (1) below), click “Application Information Management” (2) below).

If the proposal has been submitted correctly, status will appear as “Processing” (there may be a time lag for applications submitted via e-Rad).

Research Applications whose status does not appear as “Processing” by the Application Deadline are invalid. If a “Processing” message does not appear by the Application Deadline despite compliance with submission rules, please send an e-mail to the following contact address: rp-info@jst.go.jp.

Figure　Application information management (Processing)

Receipt by JST

When a research proposal has been received by JST after the Application Deadline, the application status is shown as “Application Complete” or “Received.” It should be noted that in some cases the change in application status may not be reflected until several days after submission.

Q & A

Q&A information can also be found on the following website for research proposal solicitations. For content that draws frequent inquiries, we intend to update information as necessary.
http://www.senryaku.jst.go.jp/teian/top/faq.html

For information on topics like operation of the Cross-ministerial R&D Management System (e-Rad), registering research institutions and researchers, and using the e-Rad system, please refer to the following website.
http://www.e-rad.go.jp/

○ Enrolling in the educational program for research integrity

Content of the educational program for research integrity

Q What content must be included in the educational program for research integrity that is conducted by affiliated institutions?

A Educational programs for research integrity are the responsibility of each research institution. JST does not specify the specific teaching material to be used in those programs.

(Reference)
According to the “Guidelines for Responding to Misconduct in Research Activities” (August 26, 2014, adopted by the Minister of Education, Culture, Sports, Sciences and Technology), which will be implemented from April 2015, research institutions are required to implement a structure for preventing misconduct, such as the installation of a Research Integrity Education Manager, and to conduct education at the institutional level. Further, the allocating institution is also required to confirm researcher enrollment in the institution’s research integrity education program.
Note however that the details in the above guidelines focus on misconduct in academic papers and does not cover bioethics and conflicts of interest, which are different topics. If you have any questions, please contact the JST Office of Research Integrity.

Japan Science and Technology Agency
Department of General Affairs, Office of Research Integrity,
E-mail：ken_kan@jst.go.jp

Program completion certification

Q Is it necessary to submit documentation certifying completion of an educational program for research integrity?

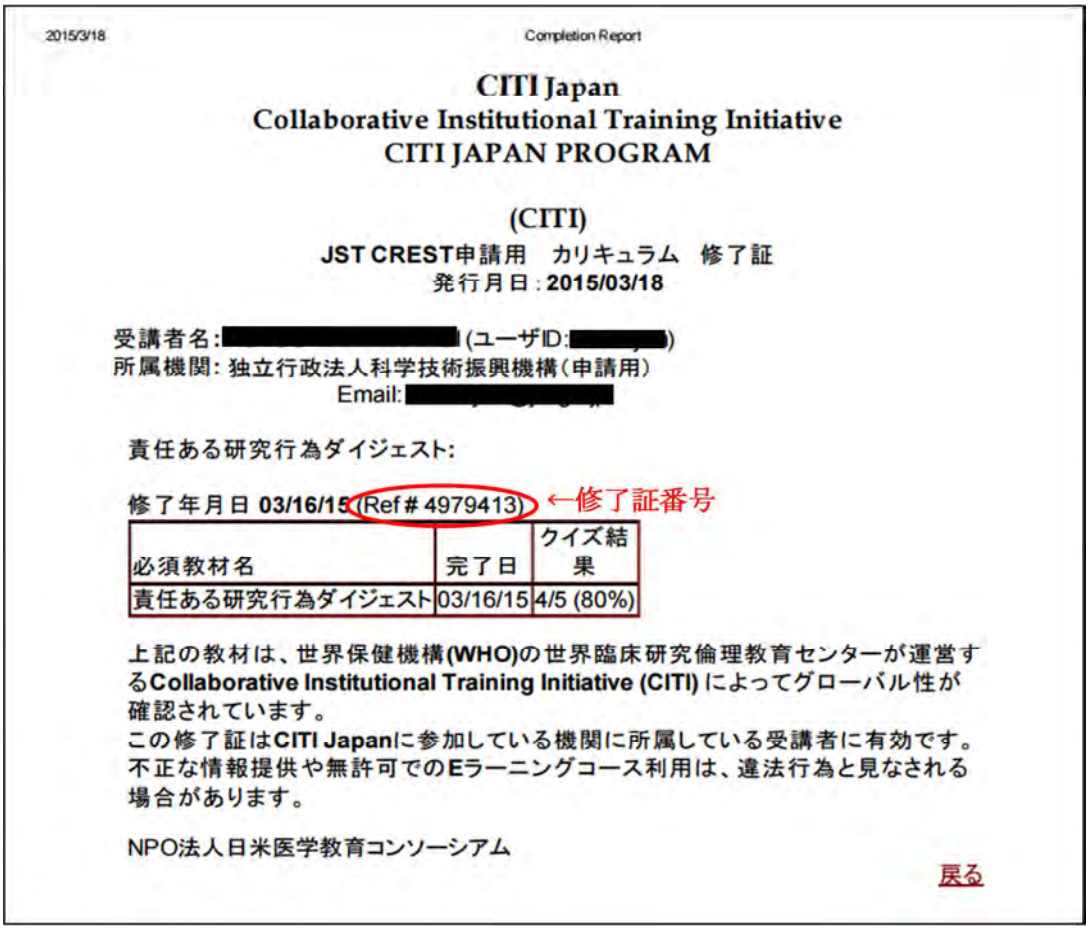
A No, submission is not necessary.

Declaring completion with the certificate completion number.

Q I have completed the condensed CITI Japan e-learning program, but where/how do I view the certificate completion number?

A To view the completion certificate, click the link for the completion certificate in the Completion Report column on the Main Menu. The Ref # printed to the right of the completion date is the certificate completion number.

Main Menu for the condensed CITI Japan e-learning program digest


2015/3/18 Completion Report

CITI Japan
Collaborative Institutional Training Initiative
CITI JAPAN PROGRAM

(CITI)
JST CREST申請用　カリキュラム　修了証
発行月日 : 2015/03/18

受講者名: [redacted] (ユーザID: [redacted])
所属機関: 独立行政法人科学技術振興機構（申請用）
Email: [redacted]

責任ある研究行為ダイジェスト:

修了年月日 03/16/15 (Ref # 4979413) ←修了証番号

必須教材名	完了日	クイズ結果
責任ある研究行為ダイジェスト	03/16/15	4/5 (80%)

上記の教材は、世界保健機構(WHO)の世界臨床研究倫理教育センターが運営するCollaborative Institutional Training Initiative (CITI) によってグローバル性が確認されています。
この修了証はCITI Japanに参加している機関に所属している受講者に有効です。
不正な情報提供や無許可でのEラーニングコース利用は、違法行為と見なされる場合があります。

NPO法人日米医学教育コンソーシアム

戻る

↑ Sample of certificate of completion-

Availability of an English-version condensed CITI Japan e-learning program

Q Since I have not taken the program offered by my institution, I am planning to enroll in the condensed CITI Japan e-learning program. What options are there if my native language is not Japanese, which makes taking the course in Japanese difficult?

A An English translation of the condensed CITI Japan e-learning program has been published and posted on the Invitation for Proposal website.

○ Matters related to both CREST and PRESTO

Responding to the Fiscal year 2015 Call for Proposals

Q When submitting a research proposal, is the approval of the institution with which I am affiliated required?

A It is not required. However, if your proposal is selected, a research agreement will have to be signed by both JST and the research institutions with which you are affiliated, so please notify your research institution ahead of time, as necessary.

Use of color in research proposals

Q Is it possible to use color for text or figures in research proposals? Do evaluators include color quality as a factor in their assessment of research proposals?

A Evaluators do include color quality as a factor in their assessment of research proposals. However, proposals may be printed out from PDF files, so we ask that you take care to use figures and tables that are easy to read even at low resolutions.

Overhead Cost (Indirect Cost)

Q Is support for covering overhead cost (indirect cost) paid to all research institutions that sign a research agreement?

A In principle, an amount equal to 30% of research cost (direct cost) is paid to all research institutions that sign a research agreement. This amount is for covering overhead cost (indirect cost).

Q What types of expenditures count as overhead cost (indirect cost)?

A Overhead cost (indirect cost) includes expenditures for improving the research environment of researchers participating in a research project selected under the CREST or PRESTO programs, and moneys used by research institutions to cover expenditures required for enhancing their overall functions. Prime examples of overhead cost (indirect cost) provided in the “Common Policy on Accounting for Indirect Cost covered with Competitive Funding” (Ministerial and Agency Agreement on Competitive Funding of April 20, 2001/Revised May 29, 2014).

1) Management and administrative expenditures
− Provision, maintenance, and use of facilities and equipment
− Administrative expenses
Furnishings, supplies, equipment rental, outside services, personnel expenses, telecommunications and transportation, honorariums, domestic and international travel, meetings, printing, etc.
Other

2) Research expenditures
− Expenditures for goods, etc. used in common

Furnishings, supplies, equipment rental, outside services, telecommunications and transportation, honorariums, domestic and international travel, meetings, printing, newspapers and magazines, utilities
− Expenditures necessary for advancing the research activities related to application of the funded research
Personnel expenses for researchers, research support staff, etc.; furnishings, supplies, equipment rental, outside services, telecommunications and transportation, honorariums, domestic and international travel, meetings, printing, newspapers and magazines, utilities
− Patent-related expenditures
− Expenditures for the provision, maintenance, and operation of research buildings
− Expenditures for the provision, maintenance, and operation of facilities for managing laboratory animals
− Expenditures for the provision, maintenance, and operation of facilities for interaction among researchers
− Expenditures for the provision, maintenance, and operation of facilities
− Expenditures for the provision, maintenance, and operation of networks
− Expenditures for the provision, maintenance, and operation of large-scale computing equipment (including supercomputers)
− Expenditures for the provision, maintenance, and operation of facilities for housing large-scale computing equipment
− Expenditures for the provision, maintenance, and operation of libraries
− Expenditures for the provision, maintenance, and operation of fields (agricultural, etc.)
Other

3) Other expenditures
− Expenditures related to activities for the further development of research results
− Expenditures related to public relations activities
Other

In addition to those examples provided above, other items that are necessary for improving the research and development environment of a researcher who has obtained competitive funding or that are necessary for improving the overall functions of research institutions may also be counted as overhead cost (indirect cost) if the head of the research institution determines that the incursion of such expenditures is necessary. These expenditures, however, do not include those that should be accounted for as direct cost.

Research institutions that receive funds to cover overhead cost (indirect cost) must appropriately manage their overhead cost (indirect cost) and properly retain, for a period of five years following the conclusion of the contract research agreement, receipts and other documentation (*) evidencing the proper use of funds for covering overhead cost (indirect cost). Furthermore, the head of a research institution that has received funds to cover overhead cost (indirect cost) must report, on the designated form, each fiscal year's overhead cost (indirect cost) expenditures by June 30 of the following fiscal year.

(*) As documentary evidence, documentation that incorporates overhead cost (indirect cost) covered by other competitive funds may also be used (It is not necessary to employ segment accounting to reflect multiple research agreements.)

For more details, refer to the directions separately established by JST for executing contract research agreements.

Research Facilities

Q What criteria will be used to determine whether the performance of research would be impractical if not done at a foreign institution?

A Examples of standards that it is anticipated will be used for determining whether research must be performed overseas include the following.
1. Required facilities did not exist in Japan and have been installed only at a foreign institution.
2. Field studies that can be performed only overseas are required.
3. Research materials can be obtained only at a foreign research institution or foreign location, and cannot be brought to Japan.

Personnel Transfers following Proposal Selection

Q If a Research Director (CREST) or researcher (PRESTO) experiences a change of position (promotion, transfer to a different research institution, etc.) while conducting research, will the Research Director (CREST) or researcher (PRESTO) be permitted to continue research activities?

A As long as it is possible to continue research activities unhindered following the change of position, research activities may be continued. Having another person take over as Research Director(CREST) or researcher (PRESTO) as a result of a change of position, however, is not permitted.

Q If a research institution affiliation changes because of the personnel transfer, or other reason, as research is being conducted, is it possible to move research equipment, etc. purchased with research funds to the new research institution?

A Equipment, etc. purchased with funds accounted for as research costs (direct cost) must, in principle, be moved, via transfer of ownership, etc. to the new research institution in accordance with a research agreement.

Other

Q Who is the Program Officer (PO) for the program? What roles does the PO perform?

A For the CREST and PRESTO programs, the Research Supervisor is the Program Officer (PO) designated for competitive funding systems. For information on the roles played by the Research Supervisor, refer to “2.1.1 CREST Overview” and “3.1.1 PRESTO Overview”.

Q Please provide information on the research topics selected and applications submitted for the previous fiscal year.

A Refer to the JST website (http://www.jst.go.jp/pr/info/info1051/index.html).

Q What is the researcher number referred to in Form 1?

A For researchers with a Scientific Research Grant Recipient Number, "researcher number" this refers to that number. For researchers who do not have a Scientific Research Grant Recipient Number, "researcher number" refers to the 8-digit researcher number assigned when researcher information was registered on the e-Rad (Cross-ministerial R&D Management System〔http://www.e-rad.go.jp/〕) system. Research proposals must be submitted via the e-Rad system, so regardless of whether the researcher has a Scientific Research Grant Recipient Number, the researcher's information must be registered on the e-Rad system before the e-Rad system can be used. Researchers who do not have an e-Rad login ID should contact either the responsible party at the research institution with which they are affiliated, or the e-Rad helpdesk. Please note that the registration process can require several days and it is advisable to set aside over two weeks for completing it.

Q At present, I am affiliated with an overseas research institution and do not have a researcher number. What should I do?

A Personally apply for a researcher registration by mailing (postal mail) a completed Researcher Number Issuance Request Form, identification documentation, and other materials directly to the e-Rad system administrator. For more details, go to the e-Rad portal site, click on “For Researchers,” “Preparations for Using the System,” and “Researchers Not Affiliated with a Research Institution” and read the information provided.

Q If the date of the interview conducted as part of the selection process is inconvenient, is it possible to have

someone else be interviewed in my place. Alternatively, is it possible to set a different interview date?

A It is not possible to have someone else interviewed in your place. In addition, since, interview dates were set by coordinating the schedules of numerous evaluators, setting a different interview date is also not possible. Please check the interview period information shown in "1.3 Solicitation and Selection Schedule (First Term)". Interview schedules for individual research areas will be posted on the call-for-proposals website (http://www.senryaku.jst.go.jp/teian.html), so refer to it, as well.

○ Matters regarding CREST

Entering Research Costs in Proposals

Q Is it necessary to include in the research proposal: 1) The bases for recording research costs and 2) Yearly budgets?

A It is not necessary to include the bases for recording research costs, but do include an itemized research budget and the research budget for the entire research group in Research Proposal (Form 6). In addition, those selected for participation in the interview phase of the selection process will be asked to prepare supplementary materials covering matters like details of research expenditures.

Research Organization and Budget Allocation

Q Please give examples of joint research group organizational approaches and joint research group budget allocations that are unacceptable.

A Unacceptable organizational approaches include (but are not limited to) ones in which: 1) The Research Directors does not play the central role in the research organization for pursuing the proposed research initiative; 2) A substantial portion of the research is subcontracted to an external party or parties; 3) The role and position of the Joint Research Group relative to the research initiative is unclear; and 3) The budget is allocated equally to the Joint Research Group without considering its role and position.

Q In the interview, is it possible to change the research project organization and total budget, which were included in the research proposal?

A Selections are based on the contents of research proposals, so please be very careful to create a research proposal that you will not want to change later. It should be noted, though, that at the time selections are to be made, changes can be requested in accordance with instructions from the Research Supervisor.

Applicant Requirements

Q Is it possible for non-full-time researchers (guest researchers, etc.) to submit research proposals? Also, is it possible for researchers scheduled to retire during the research period to submit proposals?

A Both are possible if you can establish your own research project organization at a domestic (located in Japan) research institution during the research period and it is possible for JST to enter into a contract research agreement with the research institution.

Research Team Organization

Q In submitting a CREST research proposal, is it possible to include in the research project organization – as a Lead Joint Researcher – a researcher who is currently performing PRESTO research?

A It is not possible for a researcher currently performing PRESTO research to participate as a CREST Lead Joint Researcher (excluding projects ending in FY2015).

Q Is it possible for multiple organizations to form one group? Is it necessary for groups to always be divided according to organization?

A If it is necessary for multiple institutions to undertake the same research topic, it is possible for multiple institutions to form one group. However, there may be cases in which groups will be required to divide into separate institutions when it is necessary to implement budgets for each institution separately when concluding agreements for contracted research after a research proposal has been approved. For details, please inquire after your proposal has been approved.

Research Cost

Q In entering the "Total Research Budget" (CREST Form 1) and "Budget Plan" (CREST Form 6) in the research proposal, should the amount include overhead cost (indirect cost) to be paid to the research institution if a contract research agreement is signed?

A Do not include overhead cost (indirect cost). Enter only direct cost information.

Q After a research proposal is selected, how should the allocation of research expenditures within the team be decided?

A Once a research proposal is selected, allocations of research expenditures within the team are determined based on the research plan prepared for every fiscal year. For more information on research plans, please refer to "2.3.1 Preparing a Research Plan" .

Q Please explain the policy objective underlying RAs (Research Assistants).

A Based on the following policy objectives, CREST recommends that RAs be paid salaries approximating living costs.

(1) 4th Science and Technology Basic Plan (August 19, 2011 Cabinet Decision)
The government will increase grant-type economic support, such as fellowships, Teaching Assistants (TA) and Research Assistants (RA), so that quality students may feel secure about proceeding to a graduate school. With this effort, the government will strive to achieve the goal set by the 3rd Basic Plan, i.e., "enabling 20 percent of doctorate course students to receive an amount equivalent to their living expenses." (Excerpted from P32, 33)
http://www8.cao.go.jp/cstp/kihonkeikaku/4honbun.pdf

(2) On the Expansion of Competitive Funding and Promotion of System Performs (June 14, 2007, Council for Science and Technology Policy) To secure outstanding researchers, support will be provided to graduate students in the form of enhanced fellowships for students in the latter stages of doctoral programs and enhanced compensation for RAs (Research Assistants) and others, via competitive funding. These and other measures are intended to help achieve the 3rd Science and Technology Basic Plan objective of providing support to approximately 20% of doctoral students in the latter stages of their programs.
http://www8.cao.go.jp/cstp/siryo/haihu68/siryo2-2.pdf

(3) Important issues in the 2008 Science and Technology Basic Policy (January 30 2008 Council for Science and Technology Policy)
Expand investment in the next generation of researcher human resources through measures like enhancement of competitive funding for young researchers and expansion of support for students in doctoral programs. (Excerpted from p5)
http://www8.cao.go.jp/cstp/siryo/haihu73/siryo1.pdf

Use of Research Budgets

Q Is it possible to subcontract program preparation and other such work to external companies, etc.?

A If it is required as a matter of advancing research work, it is possible. However, there is a premise that such subcontracting of work to outside parties is based on subcontracting agreements that exclude research and development work. In principle, the subcontracting of research and development work is not permitted.

Research agreement

Q Is the research agreement entered into by the research institutions with which Lead Joint Researchers are affiliated a subcontract[*1] via the research institution with which the Research Director is affiliated?

A In this program, research agreements are not subcontracts. JST contracts separately with each of the research institutions with which the Research Director and Lead Joint Researchers are affiliated.

Research Evaluations

Q How is research evaluated and how will evaluations be used?

A In principle, CREST research projects undergo an:
1) Interim evaluation around three years after they begin, and a
2) Final evaluation at the end of the research period.
For more information, please refer to “2.3.6 Project Evaluations”. In addition, research areas are evaluated (“2.3.7 Research Area Evaluations” and follow-up evaluations take place after a certain amount of time has passed following the completion of the research period. All evaluation results are posted on the website.

Multiple Applications

Q Is it possible to make a CREST research proposal as a Research Director and participate in another research proposal as a Lead Joint Researcher?

A This is possible, but if both proposals come to be considered seriously for selection, research funding may be lowered or the researcher in question may be asked to participate in only one of the research projects, depending on factors like the details and scale of the research to be performed. It should be noted that having researchers swap roles as Research Director and Lead Joint Researcher and submitting multiple research proposals is not permitted. For more details, please refer to "Chapter 7 Limitations on the Overlap of Proposals within the Strategic Basic Research Programs”.

○ Matters regarding PRESTO

Requirements for applicants

Q What is the status with regard to research proposal submissions by female researchers?

A Female researchers comprise 10-20% of those applicants and selectees. In the hope of encouraging research proposal submissions from a broad spectrum of researchers, JST does not consider factors such as gender or research history in making its selections. A special webpage has been created on PRESTO female researchers and it includes application and selection data.
http://www.jst.go.jp/kisoken/presto/nadeshiko/

JST strives to use role models to promote the attractiveness of the scientific and engineering professions, for both men and women, to children, young adults, and people with some connection to science and technology. It is our hope that many of these people will then be encouraged to pursue careers in science and engineering. That is why we conduct our activities in a manner open to both men and women.

(http://www.jst.go.jp/gender/)

Q Does the PRESTO program have an age limit?

A There is no particular age limit for submitting PRESTO research proposals. However, research is performed mainly by researchers in their 30s and it is hoped that PRESTO can help to boost the careers of such researchers.

Q Is it possible for non-full-time researchers (guest researchers, etc.) to submit research proposals?

A The PRESTO program has no restrictions in terms of the institutional affiliations or positions of applicants. Whether an applicant is a full-time employee of a research institution or not, or paid or not, is not considered in the selection process.

Q Is it possible to submit a PRESTO research proposal and participate as a Lead Joint Researcher in a CREST research project?

A It is possible to submit a PRESTO research proposal. However, if the subject researcher is already participating as a Lead Joint Researcher in a CREST research project and his/her PRESTO research proposal comes under serious consideration for selection, or if both the subject researcher's PRESTO research proposal and a CREST research proposal for which the researcher would be a Lead Joint Researcher come under serious consideration for selection, adjustments – such as choosing either participation in the CREST research project or pursuing the PRESTO research project – would become necessary (excluding projects ending in FY2015). It is advisable, therefore, to consult well with the person who is or would be the CREST Research Director before submitting a PRESTO research proposal.

Q Can a Special Researcher at the Japan Society for the Promotion of Science apply to the PRESTO program?

A There are no restrictions on the applicant's position at the time of application. Researchers who are currently performing work under the system of an institution other than JST, or who will apply to do so, should ask that institution whether it is appropriate to perform work concurrently under its system and the PRESTO program.

Q The discussion in "3.2.4 Research Proposal Submission Requirements" says that, "For proposals to perform research work at an overseas research institution, it must be possible for the subject research institution to enter into a research agreement with JST."
What are the terms and conditions of the agreement that must be signed?

A Download a draft of JST's designated research agreement (http://www.jst.go.jp/kisoken/presto/en/2015presto/intex.html) and then have a person in charge of contracts at the research institution with which you are affiliated examine it to determine whether there are any points that may pose problems. Particular attention should be paid to the three points below.

1. Payments to a foreign research institution to cover overhead cost (indirect cost) shall not exceed 30% of direct cost (research cost).
2. The overseas research institution is required to transfer, free of charge, intellectual property rights to JST.
3. It must be possible to submit to JST English-language cost statements showing the details of research expenditures (equivalent to the account books used by Japanese institutions).

Research Period

Q Are there any calls for proposals for five-year research projects?

A For the current fiscal year, there are no calls for proposals for five-year research projects. As for the next and later fiscal years, please refer to the call for proposal descriptions for each fiscal year.

Research Cost

Q Is it necessary to include in the research proposal: 1) The bases for recording research costs and 2) Yearly budgets?

A It is not necessary. However, those selected for participation in the interview phase of the selection process will be asked to prepare supplementary materials covering matters like details of research expenditures.

Joint and Exclusive Appointments

Q What are the conditions for a researcher to receive a joint appointment?

A A joint appointment can be received if the researcher's research institution approves the researcher's request for a joint appointment. Regarding matters like time spent on joint appointments, please follow the research institution's provisions.

Use of Research Budgets

Q Is it possible to subcontract program preparation and other such work to external companies, etc.?

A If it is required as a matter of advancing research work, it is possible. However, there is a premise that such subcontracting of work to outside parties is based on subcontracting agreements that exclude research and development work. Subcontracting any work involving research and development is in principle not permitted.

Employment of Researchers with Doctoral Degrees

Q Under the PRESTO program, is it possible to employ a researcher who has a doctoral degree (a postdoc)?

A Under the PRESTO program, it is not possible to create a research team including postdocs. However, postdocs can be employed as research assistants to support the efforts of an individual researcher pursuing PRESTO research.

Other

Q Is it possible to suspend and later resume PRESTO research in response to life events (childbirth, child care, and nursing care)?

A If a PRESTO researcher experiences of a life event during the research period, it is possible, upon consultation with the Research Supervisor, to suspend research work for periods of time designated for individual life events and later resume work.

Q Should personnel cost for PRESTO researcher with Exclusive Appointment expend from research expenditure? How much is the approximate cost?

A JST expend it separately from the research cost. It would be around 6 to 7 million yen per year.

Q What does it mean “when necessary a portion of research expenditures may be executed by JST”?

A In case there is expenditure such as inappropriate cost to contract like travel fee of PRESTO researcher with Exclusive Appointment who is an employee of JST, research cost which is difficult to expend at a research institution for the reason of the research institution or the researcher and so on, JST execute the research expenditure directly.

CREST/PRESTO

Please make sure to visit our Invitation for Research Proposals page for the latest updates and frequently asked questions:

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Contact for Inquiries

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