

KAKENHI

GRANTS-IN-AID FOR SCIENTIFIC RESEARCH

Creating New Knowledge

—For Shaping and Transmitting World-leading Knowledge Assets—

— In 2018, the KAKENHI marks the 100th anniversary of its foundation —



文部科学省

MINISTRY OF EDUCATION,
CULTURE, SPORTS,
SCIENCE AND TECHNOLOGY-JAPAN



JSPS

JAPAN SOCIETY FOR THE PROMOTION OF SCIENCE
日本学術振興会

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*This booklet has been produced based on information as of September 2018, unless otherwise specified.

I. Overview of Grants-in-Aid for Scientific Research Program (KAKENHI)

1. What is KAKENHI?

Universities and research institutions across Japan conduct many different kinds of research. As one means of supporting the research, KAKENHI (a Series of Single-year Grants / Multi-year Fund; see note below) is the fund covering all fields from the humanities to the social sciences and natural sciences, and is aimed at creative, pioneering scientific research from basic to applied fields.

Research activities take many forms, including those in which the researchers carry out their work with curiosity, projects in which the area of concentration and goals are defined in advance, and those intended to lead to specific product development. The starting point for all these activities is scientific research based on the researcher's creative ideas. By broadly supporting this scientific research, which is the foundation of all research activities, the KAKENHI program plays a major role, in the fostering and development of scientific advances.

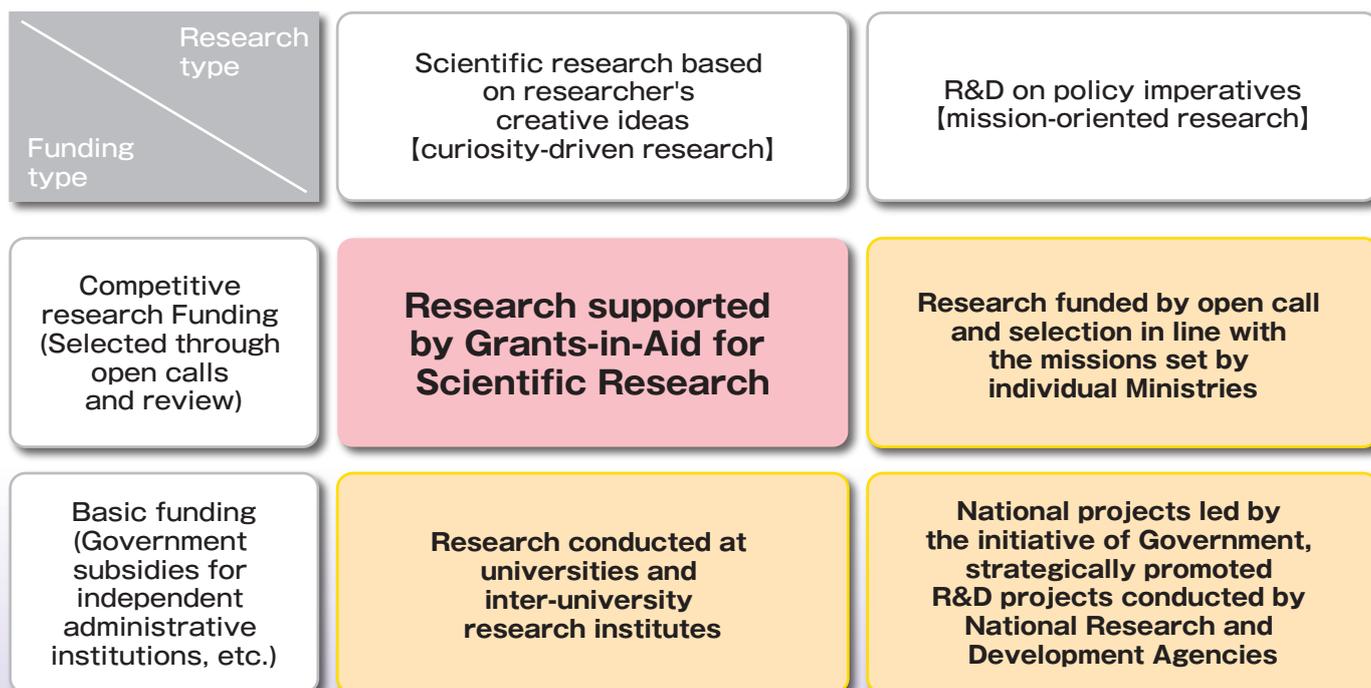
Grants-in-Aid are awarded based on the rigorous review of research plans contained in researcher's grant applications. This kind of program is called a competitive funding program.

KAKENHI is the largest competitive funding program in Japan, accounting for more than 50% of all competitive funding by the government. (The budget for fiscal 2018 is 228.6 billion yen.) In fiscal 2017, there were around 101,000 new applications in the main research categories*, of which approximately 25,000 proposals were adopted. When those projects that were adopted earlier and are continuing for multiple years are included, some 76,000 research projects are currently being supported.

The KAKENHI system was reformed in fiscal 2011 by adding a Multi-year Fund. Compared to the previous system of just Single-year Grants, the new fund allows the flexible use of grants across fiscal years. Steps are being taken to further enhance the function of this Multi-year Fund.

*Main research categories: The KAKENHI categories of "Specially Promoted Research", "Scientific Research on Innovative Areas (Research in a proposed research area)" (with some exceptions), "Scientific Research" (excluding Generative Research Fields), "Challenging Exploratory Research", "Challenging Research", "Early-Career Scientists", and "Research Activity Start-up".

The placement of "KAKENHI" in the policy on the promotion of science, technology and scientific research in Japan

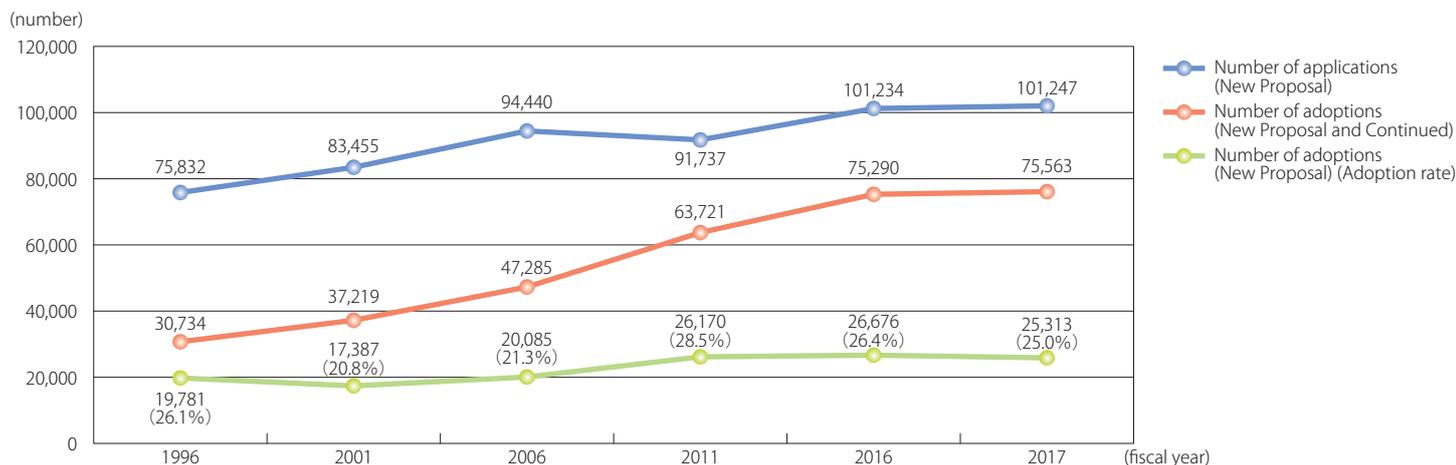


Note: Grants-in-Aid disbursements take two forms: the conventional Series of Single-year Grants and the new Multi-year Fund. These two grant systems make up the Grants-in-Aid for Scientific Research (KAKENHI) Program.

2. Requirements for Application and Adoption, and Budget, etc.

Trends in KAKENHI Applications, Adoptions, and Adoption Rate

The number of applications for KAKENHI is on the rise, but the number of projects adopted is steady. The rate of new adoptions, which had been relatively constant at a little over 20% for more than 10 years, rose overall to 28.5% following measures taken in fiscal 2011 to dramatically improve the adoption rate for small-scale research categories. Since then, however, the overall adoption rate has been in decline.



Notes:

*1 Data for main research categories only.

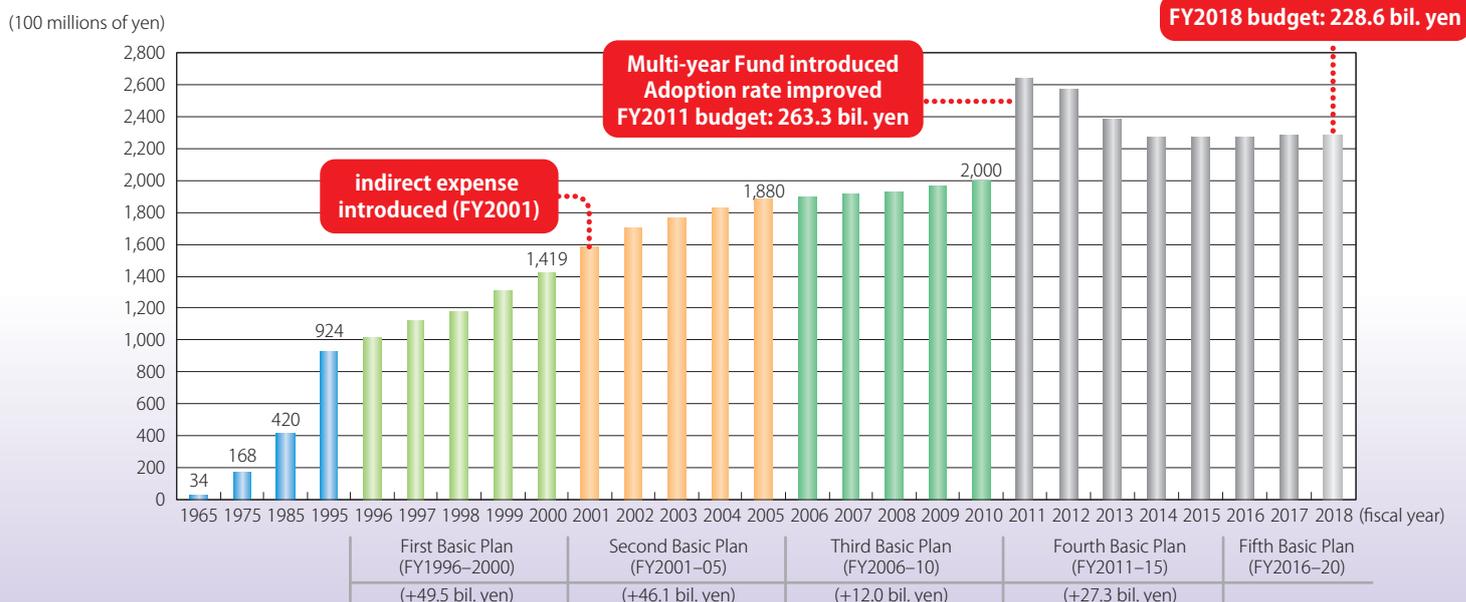
*2 For the Grant-in-Aid for Challenging Research category introduced in fiscal 2017, a strict approach has been taken to screening in line with the aims of the category, regardless of the government's adoption rate target of 30%. When this category is excluded, the adoption rate is 27.6%.

Budget Transition

The amount budgeted for KAKENHI grew considerably as competitive funding during the periods of the First and Second Science and Technology Basic Plans set by the government. Over the Third Basic Plan period, however, due to national budgetary constraints the growth was more gradual. In fiscal 2011, a major improvement in the adoption rate along with the introduction of Multi-year Fund resulted in an increase of the budget by 63.3 billion yen over the previous fiscal year, to 263.3 billion yen.

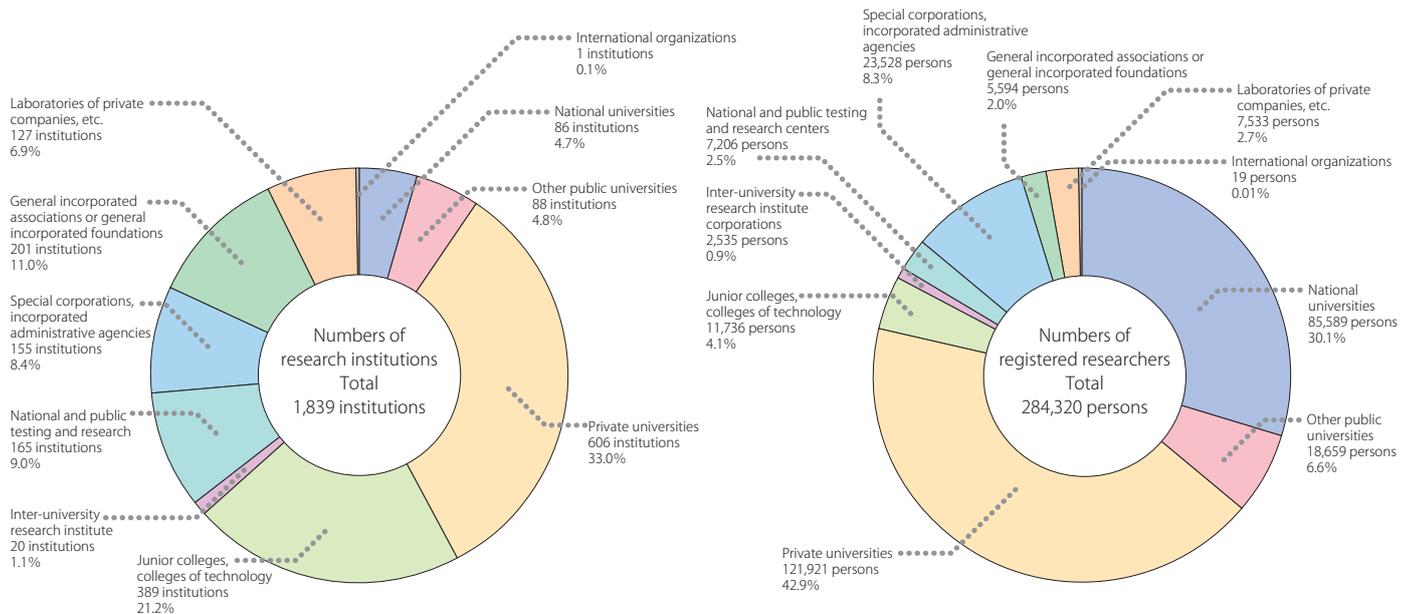
Due to the introduction of Multi-year Fund in fiscal 2011, the research funds scheduled to be dispersed in subsequent years are now included in the budget for each year.

The budget for fiscal 2018 is 228.6 billion yen (200 million yen more than the previous fiscal year).



Number of Researcher-Affiliated Research Institutions and Registered Researchers

In addition to researchers who belong to universities or other schools, those belonging to research institutions designated by the Minister of Education, Culture, Sports, Science and Technology (MEXT) may apply for KAKENHI. The MEXT Minister has also designated national and public testing and research centers, along with laboratories of public interest corporations and private companies, as research institutions, from which many researchers apply for KAKENHI. As of November 2017, approximately 284,000 researchers were eligible to apply for KAKENHI.



Notes:

- The figures above use classifications as of November 2017.
- A researcher who is registered by more than one research institution is included in the numbers of each.

3. Research Categories

Research categories are defined for KAKENHI based on the research stage, scale, and other factors, in order to facilitate application and review. Researchers applying for funding select a category based on the contents and scale of their own research plan.

Research categories and frameworks were reviewed as part of the transition to a new review system from the 2018 funding year (call for proposals: September 2017) and to further strengthen support for challenging research in line with recent scientific trends.

The research categories central to KAKENHI are classified as “Scientific Research”. These are the research categories to consolidate scaffolds for academic research which supports research aimed at deepening and developing academic disciplines based on accumulation in past (which form the research categories of “Scientific Research”) “Scientific Research” is divided into four types, S, A, B, or C, depending on the research period and total cost of the research.

The research categories of “Early-Career Scientists” provide opportunities for independent research by early-career researchers to support growth as researchers and to facilitate step-up to research categories of “Scientific Research”. “Early-Career Scientists” aims in principle at researchers who acquired their Ph.D. less than 8 years*. Funding under “Early-Career Scientists” can be received no more than twice; to continue research with KAKENHI support, the researcher must apply for another category such as “Scientific Research”.

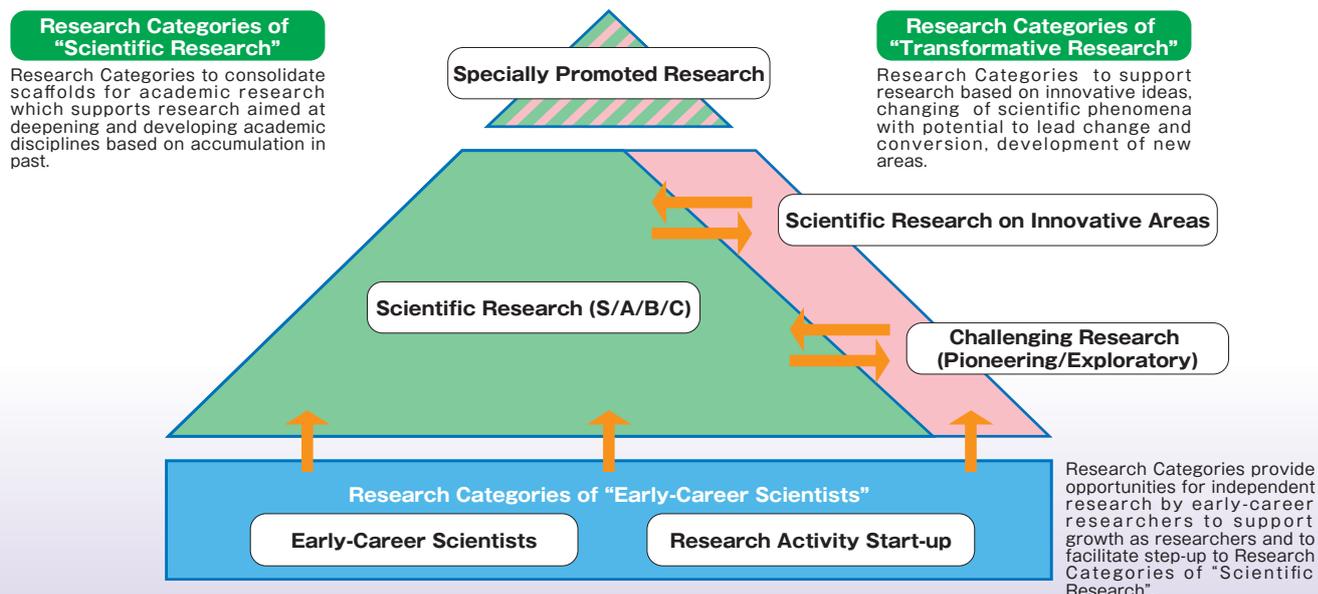
*Includes researchers with the prospect of acquiring a Ph.D. and those who acquired a Ph.D. less than 8 years ago, excluding periods of maternity leave and childcare leave taken after acquiring the Ph.D. As a temporary transitional measure, researchers 39 years old or younger who have not acquired a Ph.D. will also be deemed eligible for the time being.

The research categories of “Transformative Research” comprise categories that support research based on innovative ideas, changing of scientific phenomena with potential to lead change and conversion, development of new areas. “Scientific Research on Innovative Areas” was established in fiscal 2008, with the aim of forming new areas and significantly advancing existing ones through such initiatives as joint research and efforts to develop human resources. “Challenging Research (Pioneering/Exploratory)”, first offered in the 2017 funding year (call for proposals: September 2016) aims at radically transforming the existing research framework and/or changing the research direction and has a potential of rapid development.

“Specially Promoted Research” supports outstanding and distinctive research that open up a new scientific field. Research selected for this category must possess features required for both the research categories of “Scientific Research” and the research categories of “Transformative Research”.

A Multi-year Fund system is introduced for research projects with relatively small research costs such as “Scientific Research (C)”, “Young Scientists (B)”, “Early-Career Scientists”, “Challenging Exploratory Research”, and “Challenging Research (Exploratory)”.

Image of research categories in FY 2018



Notes:

*This figure shows the stratum of research categories, with those receiving the upper limit of funding at the top. Its purpose is to give an image of the scope and number of research projects. It is no meant to indicate the role of each research category or the significance of the project implemented under them.

*Image contains main research categories.

List of Research Categories

For most KAKENHI research categories, funds are provided to support research activities themselves. In addition, there are such categories as the Grant-in-Aid for Publication of Scientific Research Results, which provides support for presenting research results at conferences, enhancing the international dissemination of information, publishing scientific journals and books, and creating databases, as well as categories of grants provided through the JSPS Fund for the Promotion of Joint International Research.

As of April, 2018

Research categories	Purposes and description of each research category
Grants-in-Aid for Scientific Research	
Grant-in-Aid for Specially Promoted Research	Outstanding and distinctive research conducted by one or a relatively small number of researchers expected to achieve remarkably excellent research results that open up a new scientific field. (The research period is 3 to 5 years (in a truly necessary case, period up to 7 years is acceptable). The budget ranges from 200 million to 500 million yen per project (only in a truly necessary case, budget exceeding 500 million yen is asked for).)
Grant-in-Aid for Scientific Research on Innovative Areas	(Research in a proposed research area) This category is intended to foster novel research areas proposed by diverse groups of researchers that are expected to lead to development and heightening of Japan's research level in the respective fields, to be conducted by collective research efforts through collaboration, scholarly training, shared use of equipment, etc. (The period is 5 years. The budget range is generally set between 10 million to 300 million yen per fiscal year per proposed area.)
Grant-in-Aid for Scientific Research	(S): Creative/pioneering research conducted by one or a relatively small number of researchers. (The period is 5 years. The budget ranges from 50 to 200 million yen per project.) (A), (B), (C): Creative/pioneering research conducted by one researcher or jointly by multiple researchers. (The period is 3 to 5 years.) (A) 3 to 5 years 20 million to 50 million yen (B) 3 to 5 years 5 million to 20 million yen (C) 3 to 5 years 5 million yen or less *Classification of (A)/(B)/(C) is according to the budget range.
Grant-in-Aid for Challenging Exploratory Research *1	[No new proposals have been called since FY2016.] Early-stage research conducted by one or multiple researchers which, based on a unique idea, sets a high and challenging goal. (The period is 1 to 3 years. The budget is up to 5 million yen per project.)
Grant-in-Aid for Challenging Research	(Pioneering) (Exploratory) Research conducted by a single or multiple researchers that aims at radically transforming the existing research framework and/or changing the research direction and has a potential of rapid development. The scope of the (Exploratory) category encompasses research proposals that are highly exploratory and/or are in their budding stages. The research period and total budget range are as follows; (Pioneering) 3 to 6 years 5 million to 20 million yen (Exploratory) 2 to 3 years 5 million yen or less
Grant-in-Aid for Young Scientists *1	[No new proposals have been called since FY2017.] (A), (B): Research conducted individually by a researcher of age 39 or younger. The research period and total budget range are as follows; (A) 2 to 4 years 5 million to 30 million yen (B) 2 to 4 years 5 million yen or less *Classification of (A)/(B) is according to the budget range.
Grant-in-Aid for Early-Career Scientists	Research conducted by an individual researcher (*) who is less than 8 years after Ph.D. acquisition. As an interim measure, a non-Ph.D. researcher who is 39 years old or younger can also apply. (*) Individuals who are in the prospect of acquiring Ph.D. are also eligible. When counting the years after Ph.D. acquisition, the period of maternity leave and childcare leave can be excluded. (The period is 2 to 4 years. The budget is up to 5 million yen per project.)
Grant-in-Aid for Research Activity Start-up	Research conducted by a single researcher who has been freshly appointed to a research position, or who has returned from his/her maternity, childcare or other kinds of leave. (The period is up to 2 years. The budget is up to 1.5 million per fiscal year.)
Grant-in-Aid for Encouragement of Scientists	Research conducted by an individual who is ineligible for application for other KAKENHI categories (e.g. Individuals who belong to educational or research institutions, private companies, etc. and engage in the researches to contribute to the promotion of the science). (The period is 1 year. The budget range is between 100 thousand and 1 million yen per project.)
Grant-in-Aid for Special Purposes	Funding of research projects of pressing urgency and importance. (e.g. investigation of natural disaster)
Grant-in-Aid for Publication of Scientific Research Results	
Publication of Research Results	Subsidy for publication and/or international dissemination of research achievements of high academic values executed by academic associations and other organizations.
Enhancement of International Dissemination of Information	Subsidy for efforts by academic societies and other scholarly organizations to strengthen international dissemination of academic information for the purpose of international academic exchange.
Scientific Literature	Subsidy for academic publication of research results (books) authored by an individual or a group of researchers.
Databases	Subsidy for creation and operation of a database open to public use, by an individual or a group of researchers.
Grant-in-Aid for JSPS Fellows	Funding for research conducted by JSPS Fellows (including Foreign JSPS Fellows). (The period is up to 3 years.)
Fund for the Promotion of Joint International Research	
Fostering Joint International Research *2	(A) Support of joint international research project conducted by a KAKENHI grantee in collaboration with researcher(s) at foreign university or research institution. Over a period of 6 to 12 months. The grant seeks to markedly advance research plans for the root research project and to foster independent researchers who can be internationally competitive. (The budget is up to 12 million yen.) (B) Support of joint international research project conducted by multiple domestic researchers and researcher(s) who belongs to overseas research institution. In addition to the development of scientific research, the grant seeks to build out infrastructure of joint international research or further strengthen joint international research and to foster researchers who can be internationally competitive. (The period is 3 to 6 years. The budget is up to 20 million yen.)
International Activities Supporting Group	Support of international activities within Scientific Research on Innovative Areas. (Set period of the Area, up to 15 million yen per year) *After FY2018 call for proposal, "International Activities Supporting Group" will be incorporated into "Grant-in-Aid for Scientific Research on Innovative Areas "Administrative Group".
Home-Returning Researcher Development Research	Support of research to be conducted by a Japanese researcher with current affiliation abroad who is to be newly appointed at university or research institution in Japan. (The period is up to 3 years. The budget is up to 50 million yen.)
Generative Research Field	This category set for "Scientific Research (B/C)" is open to research proposals for which screening within the conventional framework of research fields may be difficult and/or to applicants who prefer their proposals to be screened from a broader perspective relevant to the Generative Research Field. (The research period that can be applied for differs depending on the year of application.) *After the call for proposals in FY2018, setting of a new field is suspended. (FY2018 Call for proposal is only for the 6 fields established in FY2016 and FY2017.)

*1 No new invitation for applications is conducted for Grants-in-Aid for "Challenging Exploratory Research" and "Young Scientists (A/B)".

*2 From the FY2018 call for proposals, "Fund for the Promotion of Joint International Research (Fostering International Joint Research)" has change to "Fund for the Promotion of Joint International Research (Fostering International Joint Research (A))", following the establishment of "Fostering International Joint Research (B)".

4. Project Members

The research supported by KAKENHI is carried out based on the creative thinking of each researcher. Many of the research projects are therefore centered on individuals and are conducted by one or a few researchers. Funding is also provided for area-centered projects, carried out by groups of researchers for developing a new research area, in order to raise the level of and strengthen science in Japan.

Scientific Research

Grants for these categories are intended for research plans that will significantly advance creative, pioneering research and are carried out by one or a few researchers, as a general project members funded by KAKENHI.

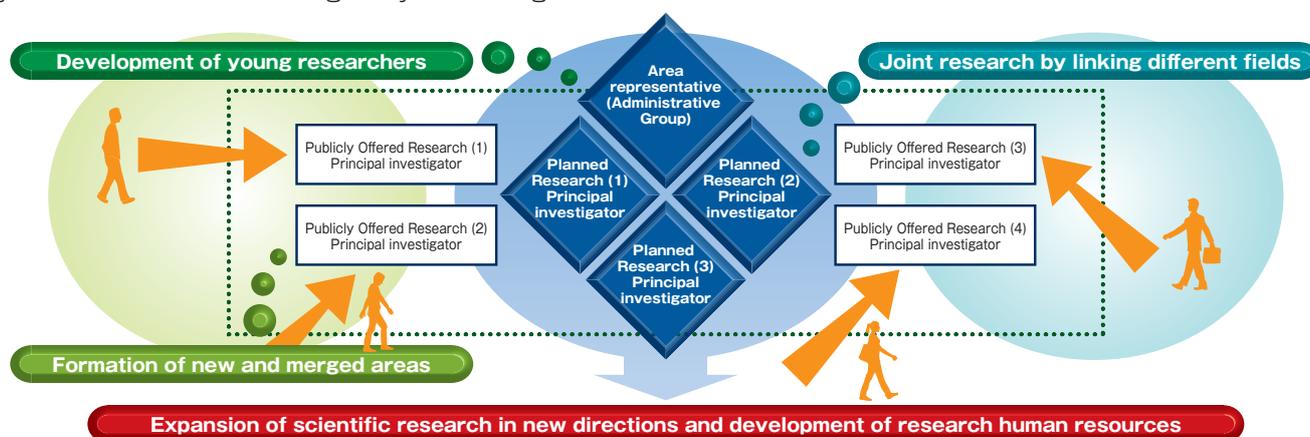
Early-Career Scientists

These categories are aimed at providing young researchers with opportunities to conduct independent research, helping them to establish a good start in their careers as researchers. In order to ensure the independence of young researchers, the grants are for research plans that will be carried out by a single researcher and contain outstanding ideas with a promise of future development.

Scientific Research on Innovative Areas (Research in a Proposed Research Area)

This category is intended, in particular, for research plans carried out in collaboration by a diversity of researchers, which do not fit within existing disciplines, or in the case of existing disciplines, where the development of that research area will bring about major ripple effects on other fields. By having young researchers participate in the area and conduct joint research, these grants also play a role in developing research human resources. (Established in fiscal 2008.)

Scientific Research on Innovative Areas consists of "Planned Research", which is organized in advance at the time the research area is set and forms the core of the project to carry it out according to plan, and "Publicly Offered Research", whereby a call for proposals is made after the research area is set, for the purpose of further advancing research in that area. With "Publicly Offered Research", researchers in fields that up to now had no points of contact are able to participate in a research area, enabling approaches to problem-solving by brand new methods and greatly advancing the research area.



5. Platforms for Advanced Technologies and Research Resources

As KAKENHI support for research projects, in fiscal 2016 the Platforms for Advanced Technologies and Research Resources program was launched. This builds on the Support Activities in Three Areas of Bioscience program implemented through fiscal 2015. In close collaboration across related institutes, with inter-university research institutes and Joint Usage/Research Centers as core institutes, the new program is aimed at creating resource and technology platforms for supporting science research. It consists of an Advanced Technology Support Platform Program providing shared use of equipment and technical assistance to researchers in a wide range of research fields and areas, and a Research Platform Resource Support Program offering assistance in the form of collection, storage, and provision of resources (materials, data, test specimens, samples, etc.) and archiving technology. Each platform provides research support services enabling researchers to carry out their KAKENHI projects efficiently and effectively. Invitations to apply for support and selection of proposals are made by each platform. See the website below for the support functions and for links to platform websites (in Japanese only).

http://www.mext.go.jp/a_menu/shinkou/hojyo/1367903.htm

II . Trend on KAKENHI Reform

Radical Reform of KAKENHI System

It is questioned whether Japan can continue producing the kind of excellent scientific results that will allow it to maintain its international presence in future years. Given this situation, the Council for Science and Technology, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) has issued a recommendation for radically reforming the Grants-in-Aid for Scientific Research (KAKENHI) program, positioning academic research as the source of national strength. ("Promotion of Academic Research in Japan and Reform of KAKENHI(Interim Report)" in August 27, 2014, Science Subcommittee of Council for Science and Technology)

The Fifth Science and Technology Basic Plan (fiscal 2016-20) drawn up by the Japanese government likewise incorporates proposals along the lines of the KAKENHI Reform policies, calling for qualitative reforms aimed at maximizing results creation, and from the quantitative perspective of setting a goal to increase the adaption rate to 30%.

1. KAKENHI Reform

Against this backdrop, reform of the KAKENHI program is being carried forward according to Implementation Policy of KAKENHI Reform. This initiative has three pillars: 1) Revision of the review system; 2) Revision of research categories and frameworks; and 3) Implementation of flexible and effective grant-usage system. As a vanguard reform, a new review system has been introduced since the 2018 funding year (call for proposals: September 2017).

Trajectory of Grant-in-Aid System Reform —Reform Application Review System and Research Categories—

Funding year	FY 2016 (Call for proposals : Sep 2015)	FY 2017 (Call for proposals : Sep 2016)	FY 2018 (Call for proposals : Sep 2017)	FY 2019 (Scheduled for call for proposals : Sep 2018)
Specially Promoted Research	Revision of research categories (Emphasize challenging research, restriction on repeated grant acquisition)		Transition to new system	
Scientific Research on Innovative Areas	Revision of research categories toward Grant-in-Aid system reform from FY 2019			
Scientific Research (S)	"FY2018 Reform of the KAKENHI Review System"		Broad Section + Comprehensive Review	
Scientific Research (A)	Design new review system		Medium-sized Section + Comprehensive Review	
Challenging Exploratory Research	Enhancement revisions	Transform to "Challenging Research" (Precedent implementation of Medium-sized Section and Comprehensive Review)		Comprehensive Review
Scientific Research (B)			Basic Section + Two-Stage Document Review	
Scientific Research (C)				
Young Scientist(A)	Revision of research categories (Appropriate way of support based on carrier build-up, etc.)		Integrate to "Scientific Research"	"KAKENHI Young Support Plan" (Improve the recruiting ratio for key items)
Young Scientists(B)	Trial of support for independence			"Early-Career Scientists" ("change name") (Quantity control, Implementation of independence, etc.)

* The Review Section for the large-scale research categories ("Grant-in-Aid for Specially Promoted Research", "Grant-in-Aid for Scientific Research on Innovation Areas") which have been reviewed on "category unit" of Humanities and Social Sciences, Science and Engineering, Biological Sciences, etc. is basically implemented as it is.

- "5th Science and Technology Basic Plan" adopted by Cabinet decision January 22, 2016
<http://www8.cao.go.jp/cstp/english/basic/5thbasicplan.pdf>
- "Promotion of academic research in Japan and reform of Grants-in-Aid for Scientific Research (KAKENHI) (report of deliberations on the 7th Research Fund Commission) (interim report)," Subdivision on Science, Council for Science and Technology, August 27, 2014
http://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu4/toushin/1351968.htm (in Japanese only)
- KAKENHI reform website: http://www.mext.go.jp/a_menu/shinkou/hojyo/1362786.htm (in Japanese only)
- About FY2018 Reform of the KAKENHI Review System:
http://www.mext.go.jp/a_menu/shinkou/hojyo/1367693.htm (in Japanese only)

2. FY2018 Reform of the KAKENHI Review System

Under the Grants-in-Aid for Scientific Research (KAKENHI), the review system for Scientific Research and other categories received high marks from researchers for its ability to quickly and fairly review a huge volume of applications. Over recent years, however, there has been a steady increase in the number of grant applications coupled with a gradual shift in the trajectory of research proposals. This changing environment spawned requests to improve both the application review system and its research categories. Concomitantly, there was also a need to reform the review method so that it responds to changing scientific trends and in ways that better identify and fund highly viable research projects within a competitive environment.

Against this backdrop and toward the Grants-in-Aid for Scientific Research for fiscal 2018 (from the September 2017 call for proposals), we have revised KAKENHI Review Section and Review Method in the following ways:

- The “List of Categories, Areas, Disciplines and Research Fields” applied in and before fiscal 2017 was abolished and a new “Review Section Table” consisting of “Basic Section”, “Medium-sized Section” and “Broad Section” has been adopted for the review.
- We have introduced the Comprehensive Review in which both document review and panel review are conducted by the same reviewers and also introduced the Two-Stage Document Review in which the document reviews are conducted in each stage by the same reviewers instead of the method in which both the document review and the panel review are conducted by different reviewers applied in and before fiscal 2017. (The review method depends on the research category).

As a connective to ongoing system reform, the KAKENHI program will be periodically re-evaluated and initiatives advanced in response to changes in scientific trends and research environments.

Summary - FY2018 Reform of the KAKENHI Review System

Diverse scientific research based upon free ideas advanced by KAKENHI open-recruitment and review

Former Review System (in and before FY2017 Grant)

Recruit/review applications in more than 400 research fields

*Most of applications are for Scientific Research (C): 321 fields subdivided into 432 Review Sections.

Scientific Research (S)
Scientific Research (A) (B) (C)
Young Scientists (A) (B)

• Fields in most research categories reviewed in same method.
• Two-tier review: document and panel review conducted by different reviewers

*The “Challenging Research” which “Challenging Exploratory Research” was evolved/reformed and newly introduced at FY2018 Grants is classified as “Medium-sized Section” and is prior to implementation by “Comprehensive Review”.

Abolish “List of Categories, Areas, Disciplines, and Research Fields”

New Review System

New Review Section and Review Method From FY2018 Grants (from the September 2017 call for proposals)

<p>Broad Section (11 sections recruited/reviewed)</p> <p>Medium-sized Section compiled into one Review Section.</p> <table border="1"> <tr><td>Scientific Research (S)</td></tr> </table>	Scientific Research (S)	<p>Comprehensive Review —More diversified—</p> <p>Same group of researchers comprising various fields conduct document and panel reviews from wide perspective.</p> <p>*With Scientific Research (S), review comments are used.</p> <p>By reviewing grant proposals from multifaceted perspective, projects with high potential selected.</p> <p>Comments on how to improve research plans are fed back to applicants.</p>	
Scientific Research (S)			
<p>Medium-sized Section (65 sections recruited/reviewed)</p> <p>Basic Section compiled into one Review Section.</p> <table border="1"> <tr><td>Scientific Research (A)</td></tr> <tr><td>Challenging Research</td></tr> </table>	Scientific Research (A)	Challenging Research	
Scientific Research (A)			
Challenging Research			
<p>Basic Section (306 sections recruited/reviewed)</p> <p>Review Sections for various already cultivated science.</p> <table border="1"> <tr><td>Scientific Research (B) (C)</td></tr> <tr><td>Early-Career Scientists</td></tr> </table>	Scientific Research (B) (C)	Early-Career Scientists	<p>Two-Stage Document Review —More efficient—</p> <p>In selecting grant awardees, same group of researchers carries out two document reviews.</p> <p>Each reviewer in the group given a chance to reconsider his/her results by referring to other reviewers’ evaluations in second round.</p> <p>More efficient as it eliminates need for the group members to meet to do panel review</p>
Scientific Research (B) (C)			
Early-Career Scientists			

The Review Section for the large-scale research category (“Grant-in-Aid for Specially promoted Research”, “Grant-in-Aid for Scientific Research on Innovation Areas”) which have been reviewed on “category unit” of Humanities and Social Sciences, Science and Engineering, Biological Sciences. etc. is basically implemented as it is. As for the review method, we plan to gradually improve it after the review progress of the event.

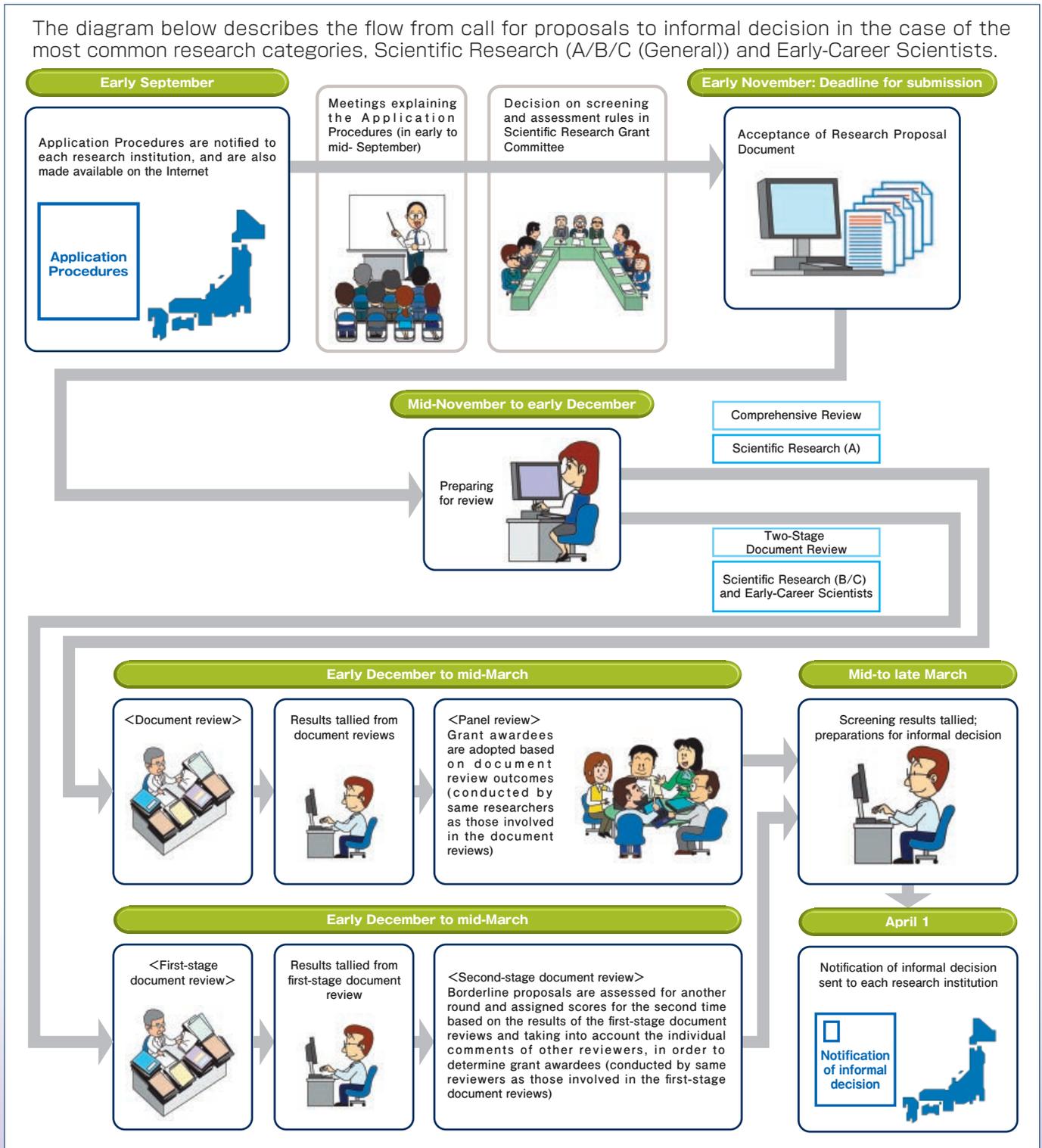
III. Application, Review, Use of Funds, and Assessment

1. Flow from Call for Proposals to Provisional Grant Decision

The schedule is set up in order to enable research projects to commence from the beginning of the fiscal year. For most research categories, accordingly, the call for proposals takes place in September of the previous year, Research Proposal Documents are accepted in November, and adoption is decided based upon a review process, after which a notice of provisional decision to grant the funding is sent promptly to each research institution.

New review methods are being employed from the 2018 funding year (call for proposals: September 2017).

The diagram below describes the flow from call for proposals to informal decision in the case of the most common research categories, Scientific Research (A/B/C (General)) and Early-Career Scientists.



2. Requirements for Application

Not only researchers at universities, but those belonging to research institutions of private corporations or other organizations designated by the MEXT Minister may apply for KAKENHI grants.

Non-Japanese or part-time researchers who belong to any of these research institutions, and who meet the qualifications for application, may also apply. Please check with your research institution for specifics.

Each research institution is notified of the Application Procedures. Application documents including Research Proposal Document are available on the KAKENHI websites of MEXT and the JSPS.

English-language versions of the Application Procedures and Research Proposal Document form are available, and application may be made in English.

Online application may be made using the electronic application system. The application procedures are designed for smooth and quick handling

Main contents of the Research Proposal Document (extracted from “Scientific Research (A) (General)”)

1. Research Objectives, Research Method, etc.

This research proposal will be reviewed in the “Medium-sized” Section of the applicant’s choice. In filling this application form, refer to the Application Procedures for Grants-in-Aid for Scientific Research -KAKENHI-. In this column, research objectives, research method, etc. should be described within 5 pages. A succinct summary of the research proposal should be given at the beginning. The main text should give descriptions, in concrete and clear terms, of (1) scientific background for the proposed research, and the “key scientific question” comprising the core of the research plan, (2) the purpose, scientific significance, and originality of the research project, and (3) what will be elucidated, and to what extent and how will it be pursued during the research period. If the proposed research project involves Co-Investigator(s) (Co-I(s)), a concrete description of the role-sharing between the Principal Investigator (PI) and the Co-I(s) should be given.

2. Research Development Leading to Conception of the Present Research Proposal, etc.

In this column, descriptions should be given within 1 page, of (1) applicant’s research history leading to the conception of this research proposal and its preparation status, and (2) domestic and overseas trends related to the proposed research and the positioning of this research in the relevant field.

3. Applicant’s Ability to Conduct the Research and the Research Environment

In this column, descriptions of (1) applicant’s hitherto research activities, and (2) research environments including research facilities and equipment, research materials, etc. relevant to the conduct of the proposed research should be given within 2 pages to show the feasibility of the research plan by the applicant (PI) (and Co-I(s), if any). If the applicant has taken leave of absence from research activity for some period (e.g. due to maternity and/or child-care), he/she may choose to write about it in “(1) applicant’s hitherto research activities”.

4. Issues Relevant to Human Right Protection and Legal Compliance

In case the proposed research involves such issues that require obtaining consent and/or cooperation of the third party, consideration in handling of personal information, or actions related bioethics and/or biosafety (including the laws and regulations and the guidelines in the country/region(s) where the joint international research is to be conducted), the planned measures and actions for these issues should be stated within 1 page. This applies to research activities that would require approval by an internal or external ethical jury, such as research involving questionnaire surveys, interviews and/or behavior surveys (including personal histories and images) including personal information, handling of donated specimens, human genome analysis, recombinant DNA, and experimentation with animals. If the proposed research does not fall under such categories, enter “N/A (not applicable)”.

5. Items to be Entered When New Application is Made in the Fiscal Year Previous to the Final Year of the Research Period of an On-Going KAKENHI Project

In this column, the applicant should give within 1 page: (1) the relevant information on the on-going project (for which FY2019 is the final year of the research period) including the original plan at the time of application/adoption and the research accomplishment such as new knowledge acquired, and (2) the reason why he/she is submitting this new proposal for FY2019 on top of the on-going project (in terms of the development of the on-going research, necessity of new research budget, etc.). If not applicable, leave this page blank. (Do not eliminate the page.)

Research Expenditure and Their Necessity

投資費品費の明細						消耗品費の明細	
年度	品名・仕様	設置機関	数量	単価	金額	事項	金額

For the convenience of applicants, these columns can be completed using the electronic application system from the 2018 funding year (call for proposals: September 2017).

The Status of Application and Acquisition of Research Grants

(1) 応募中の研究費					
研究費種別	研究費種別 (研究代表者氏名)	応募	平成27年度 の研究費 (期間全体の額)	エフ ォ ー ト (%)	研究費の精選および他の研究費に加えて 本応募研究課題に応募する理由 (研究費の研究代表者の場合は、研究期間全体の受入額)

Review Criteria under consideration:

We also plan to revise the criteria used in reviewing applications: please refer to the Japan Society of Promotion of Science’s KAKENHI website for details. <https://www.jsps.go.jp/j-grantsinaid/index.html>

Review Sections Tailored to Research Categories

The Review Section Table is made up of an “Overview”, “Table for Basic Sections”, and “Table for Medium-sized and Broad Sections”. The overview allows applicants to grasp the overall picture of the review sections. The Basic Sections have been established to take into account the diversity of scientific research and address the varied themes cultivated to date. They comprise research categories which attracted large numbers of applications per research field in the review system that operated up to the 2017 funding year, such as “Scientific Research (B/C)” and “Early-Career Scientists”. The Basic Sections are not rigidly defined, but rather expressed as “-related” so they can flexibly encompass new advancements and diverse expansions in scientific research.

Several Basic Sections are brought together under each Medium-sized Section for use in the “Scientific Research (A)” and “Challenging Research (Pioneering/Exploratory)” research categories. These enable selection of outstanding research proposals in a competitive environment employing a broader scope in line with the aims and character of the research category in question. The content of each Medium-sized Section is not limited by the content of the Basic Sections it contains: applicants need not feel bound by the Basic Sections listed when choosing a Medium-sized Section.

Broad Sections bring together multiple Medium-sized Sections to enable selection of outstanding research proposals in a competitive environment under the “Scientific Research (S)” category.

Applicants should select a review section under which to apply after checking the contents shown in the “Table for Basic Sections” and “Table for Medium-sized and Broad Sections”.

The Broad Section applies to “Scientific Research (S)”. Applicants for this category select one of the Broad Sections listed, from A through K

The Medium-sized Section applies to “Scientific Research (A)” and “Challenging Research”. Applicants for these categories select one of the Medium-sized Sections listed.

The Basic Section is the fundamental unit, and used in the “Scientific Research (B/C)” and “Early-Career Scientists”. Applicants for these categories select one of the Basic Sections listed.

Each item of Basic Section offers some examples related research contents. They help applicants understand the concrete contents.

■The Review Section Table(Overview Excerpt)

Broad Section A	
Medium-sized Section 1:Philosophy, art, and related fields	
Basic Section	
01010	Philosophy and ethics-related
01020	Chinese philosophy, Indian philosophy and Buddhist philosophy-related
01030	Religious studies-related
01040	History of thought-related

■The Review Section Table(Table for Basic Section Excerpt)

Basic Section	Examples of related research content	Medium-sized Sections and Broad Section corresponding Basic Sections	
		Medium-sized Section	Broad Section
01010	[Philosophy and ethics-related]	1	A
	Philosophy in general, Ethics in general, Western philosophy, Western ethics, Japanese philosophy, Japanese ethics, Applied ethics, etc.		
01020	[Chinese philosophy, Indian philosophy and Buddhist philosophy-related]	1	A
	Chinese philosophy/thought, Indian philosophy/thought, Buddhist philosophy, Bibliography, Philology, etc.		

■The Review Section Table(Table for Medium-sized and Broad Sections Excerpt)

Broad Section A	
Medium-sized Section 1:Philosophy, art, and related fields	
Basic Section	Examples of related research content
01010	[Philosophy and ethics-related] Philosophy in general, Ethics in general, Western philosophy, Western ethics, Japanese philosophy, Japanese ethics, Applied ethics, etc.
01020	[Chinese philosophy, Indian philosophy and Buddhist philosophy-related] Chinese philosophy/thought, Indian philosophy/thought, Buddhist philosophy, Bibliography, Philology, etc.

*In addition, some items of Basic Sections belong to multiple Middle-sized Sections, so applicants can select a Middle-sized Section that seems to be most suitable for their own research proposal.
(Some items of Medium-sized Sections also belong to several Broad Sections)

3. Review Framework

Review for grant applications is performed as peer review drawing on more than 7,000 reviewers.

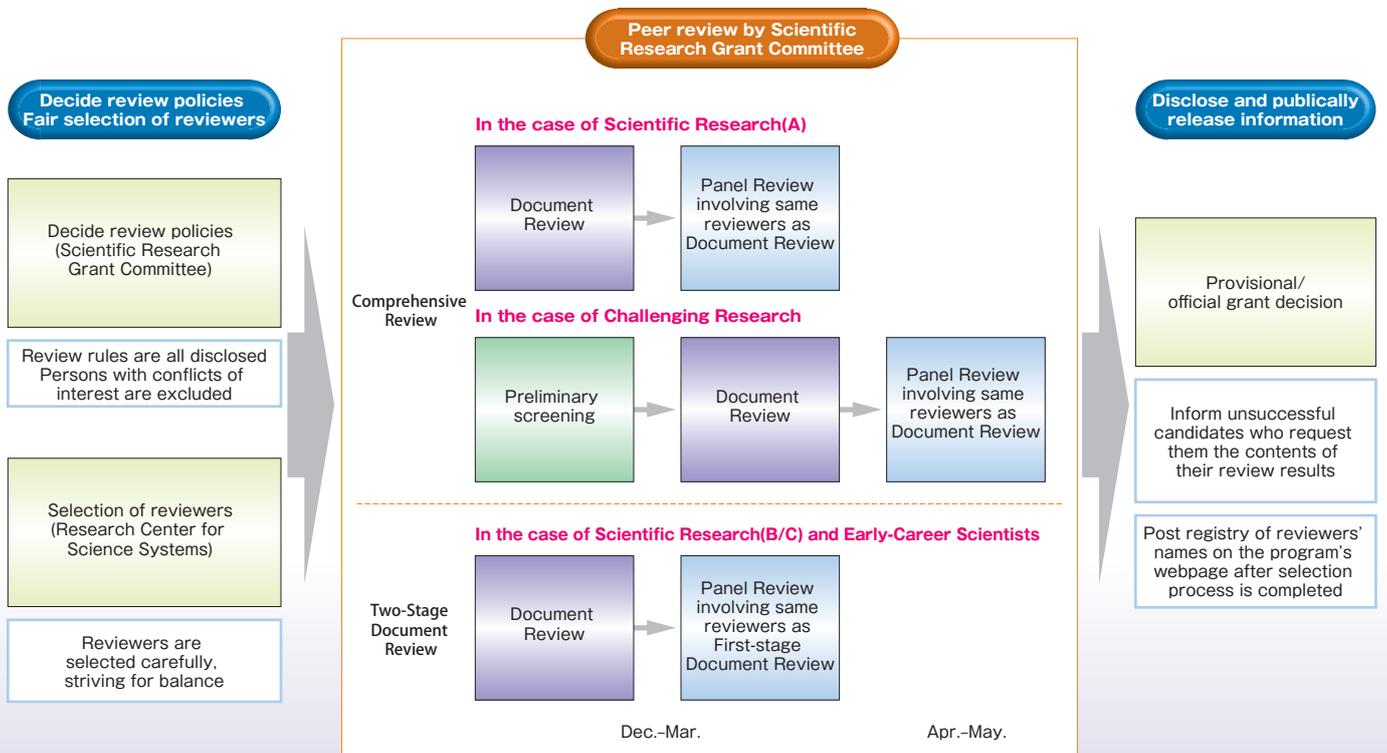
The review policies and criteria are all disclosed on the KAKENHI websites of MEXT and the JSPS.

Today, nearly all review for KAKENHI is performed by the JSPS, which has set up a Scientific Research Grant Committee for review and assessment of grant applications. The Research Center for Science Systems in the JSPS, moreover, is responsible for such tasks as selecting reviewers and considering improvements to the KAKENHI program.

From the 2018 funding year (call for proposals: September 2017), KAKENHI applications are reviewed using one of two review methods: the “Comprehensive Review”, in which adoption is determined pursuant to a document review followed by a multi-faceted review by a panel comprising the same reviewers as conducted the document review; and the “Two-Stage Document Review”, in which the same reviewers conduct document reviews in two stages.

Efforts are made to ensure transparency of the process, by disclosing the review results and by publishing a list of reviewers when their term of appointment ends.

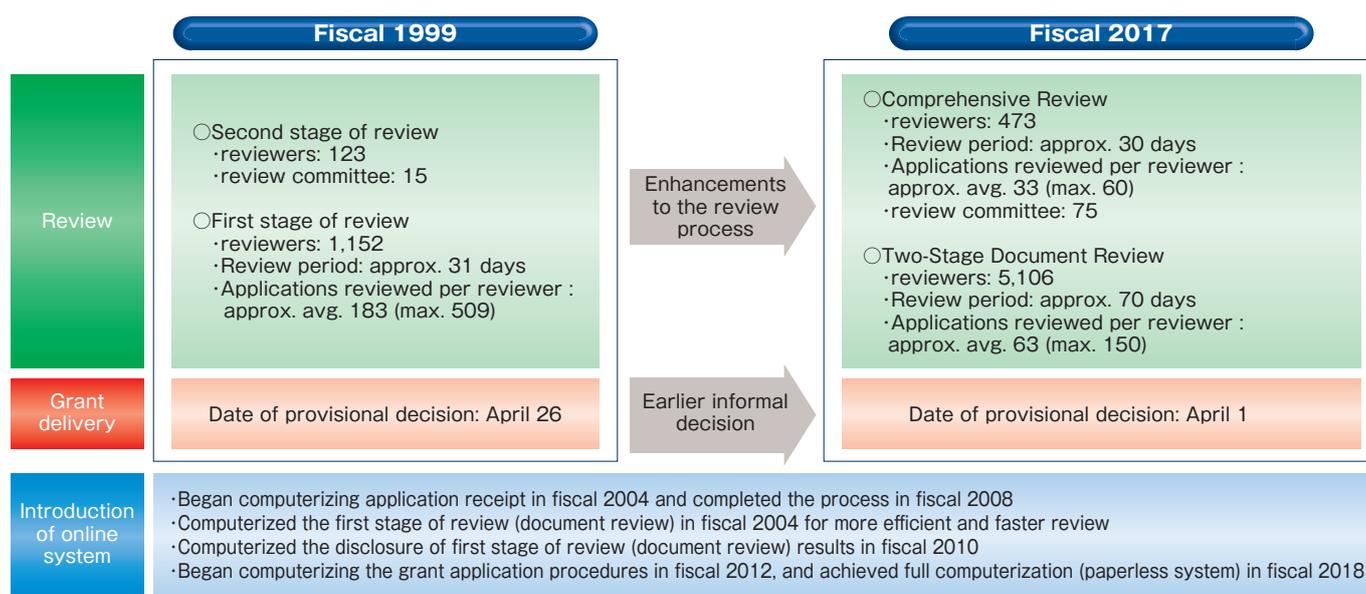
KAKENHI Review Methods A Fair, Impartial and Transparent Review Process



*As for the review method of the large-scale research category ("Grant-in-Aid for Specially promoted Research", "Grant-in-Aid for Scientific Research on Innovation Areas"), we plan to gradually improve it after the review progress of the event.

Comparison of Review and Grant Delivery for Fiscal 1999 and Fiscal 2017 New Adoptions

The program was handed over to the JSPS starting in fiscal 1999. By taking measures to strengthen its functions as a research funding organization, significant improvements were made, such as enhancing the review framework and speeding up the provisional grant decision.



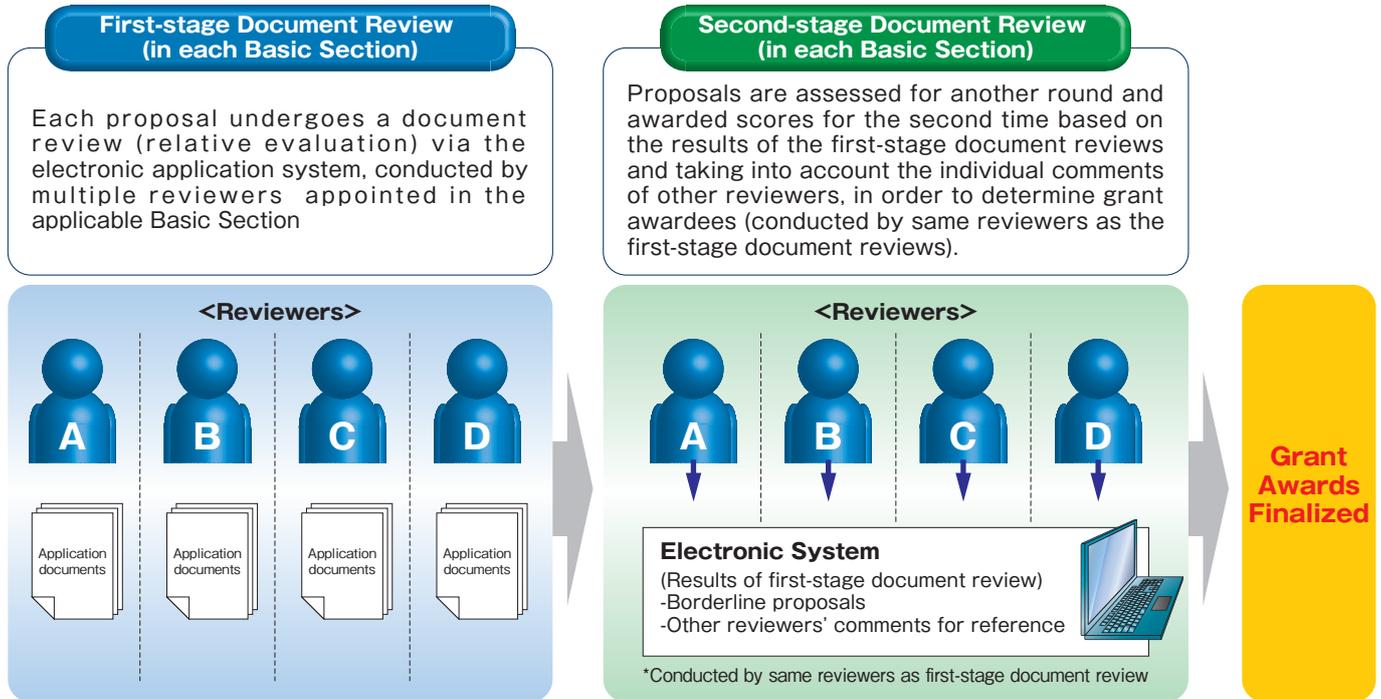
Note: Of the categories reviewed by the JSPS, data is shown for “Scientific Research (A/B/C (General))” and “Early-Career Scientists”.

4. Specific Review Procedures

From the 2018 funding year (call for proposals: September 2017), the review methods shown in the figures below are employed.

[Two-Stage Document Review]—“Scientific Research (B/C)” and “Early-Career Scientists”—

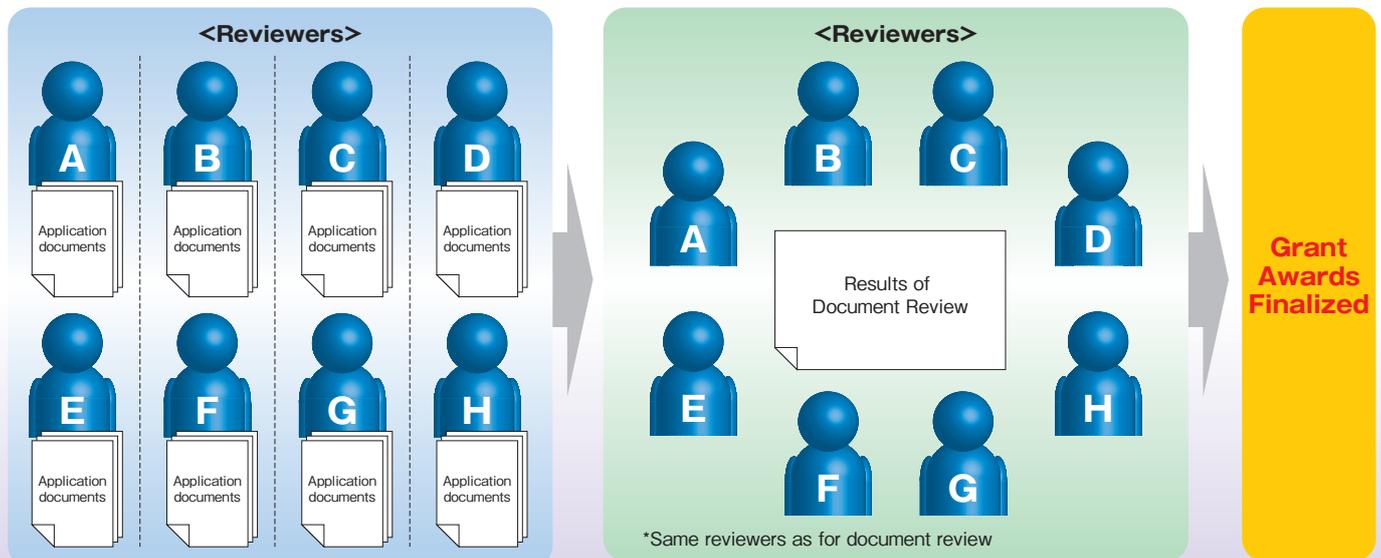
Each “Scientific Research (B)” proposal is reviewed by six reviewers; each “Scientific Research (C)” and “Early-Career Scientists” proposal is reviewed by four reviewers.



[Comprehensive Review]—“Scientific Research (A)” and “Challenging Research”—

Between six and eight reviewers are appointed for each proposal in the “Scientific Research (A)” and “Challenging Research”, and each proposal is subject to both a document review and a more thorough and multi-faceted panel review. In the event that a large number of applications is received, the review may include processes such as preliminary screening (“Challenging Research” only) or random assignment* of research proposals.

*In order to alleviate the burden on reviewers in sections with large numbers of applications, multiple review groups are established and proposals assigned to them randomly.



*For “Scientific Research (S)”, in addition to the Comprehensive Review, we have introduced a system of review comments produced by researchers in closely-related specializations, taking into account the specialized nature of applications.

5. Research Center for Science Systems

The Research Center for Science Systems in the JSPS plays a wide range of roles aimed at establishing a fair and highly transparent review and assessment system.

Outline

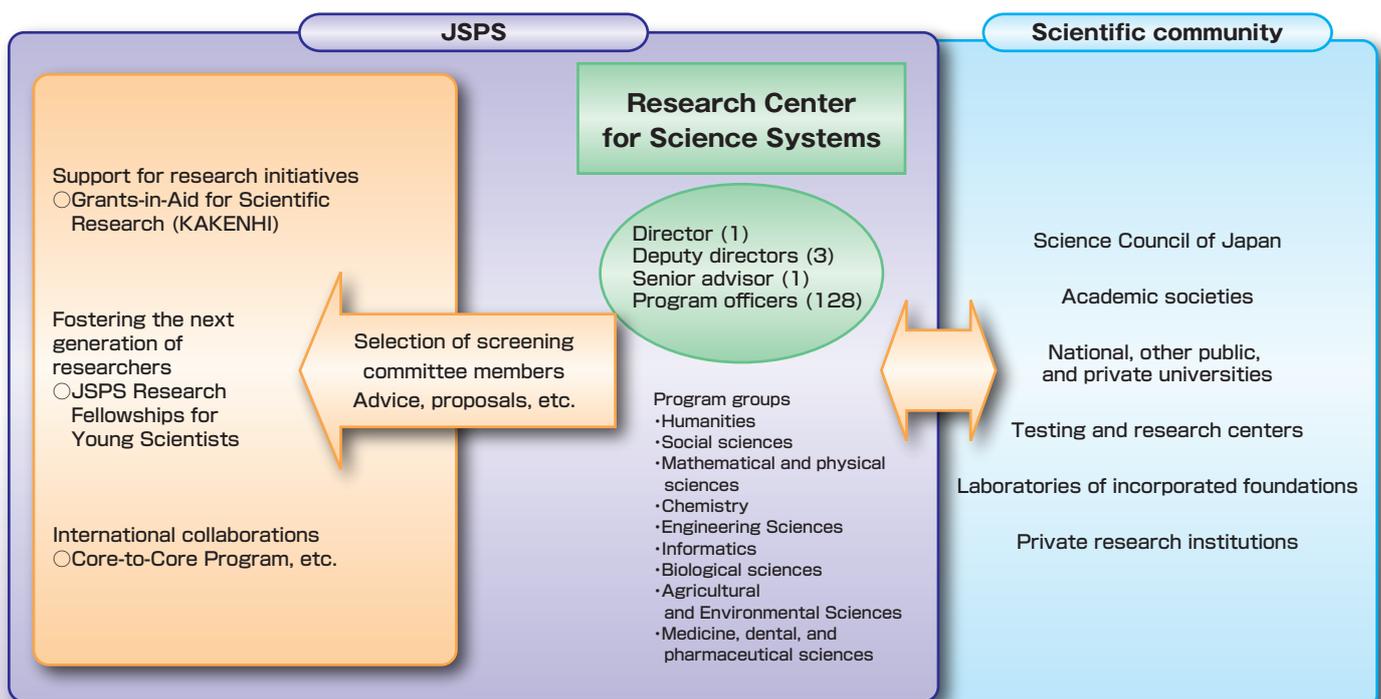
The Council for Science, Technology and Innovation, in its “System Reform in Competitive Research Funding” paper, offered suggestions for deriving maximum benefit from competitive funding. The Council called for establishment of a rigorous and highly transparent review system, along with the assignment of experienced researchers as program directors (PD) and program officers (PO) with across-the-board responsibility from theme selection to evaluation and follow-up. Based on this and other advice, the Research Center for Science Systems was created in the JSPS in July 2003.

In the Research Center for Science Systems, the Director, Deputy Directors, and Senior Advisor serve as program directors, while 128 researchers are assigned as program officers. Program officers are appointed for three-year terms, and part-time appointments are given to top-level researchers currently active at the forefront of their fields. The senior program officers’ meeting and nine research groups’ meetings are held regularly. In addition, working groups are set up as needed for taking on important issues dynamically.

Program officers in the Research Center for Science Systems are affiliated with universities and other research institutions as well as with the respective academic societies relevant to their field of research. Taking into account the current state, views, and wishes of the scientific community, they are involved in improving and enhancing KAKENHI and other JSPS programs from the standpoint of researchers.



Senior program officer’s meetings



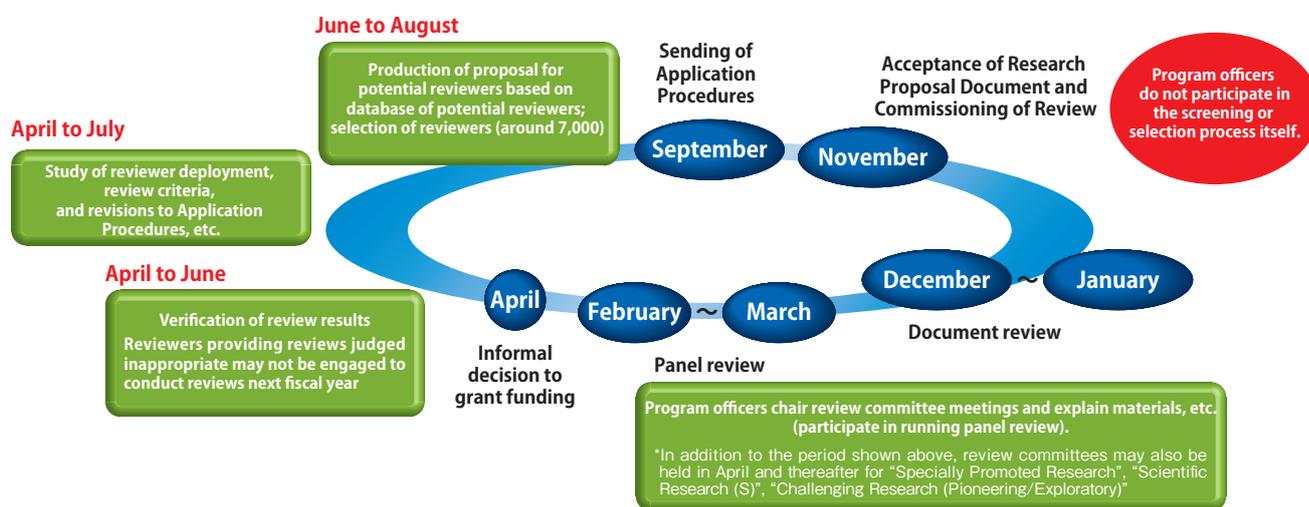
Main Roles of the Research Center for Science Systems in the KAKENHI Program

Drawing on a database of potential reviewers, a list of recommended specialists to review applications for JSPS programs is prepared each year. (Including alternates, approximately 13,000 candidates are selected.)

The Center's program officers do not participate in the review or selection processes, but sit in on various review committee meetings, observe the conducting of panel reviews and explain review methods, ensuring a fair and rigorous review process.

Based on suggestions from reviewers, all means for improving reviewer deployment and review criteria for the next fiscal year are also studied.

From the standpoint of fairness of the review process, we conduct verification and analysis of matters such as provision of favors and suitability in regard to both the document review and panel review. If this verification process finds any review committee members to be engaged in provision of favors or to be materially unsuitable, this finding is taken into account appropriately when selecting reviewers for the next fiscal year and beyond.



6. Senior Scientific Research Specialists

MEXT assigns 24 senior scientific research specialists (in the humanities and social sciences, science and engineering, biological sciences, etc.), all currently active in research in their respective fields in universities or other institutions, to help administer the KAKENHI program.

○ See the following MEXT website for details:
http://www.mext.go.jp/a_menu/shinkou/hojyo/1284449.htm (in Japanese only)

Appointed as part-time national public servants, these specialists serve as program officers, providing guidance and advice on the management of each field of the Scientific Research on Innovative Areas category for which MEXT issues call for proposals and conducts review and assessment.

They are also involved as experts in a wide range of duties including KAKENHI review and assessment, improvement of the program as a whole, and publicity.



MEXT senior scientific research specialists (at MEXT office)

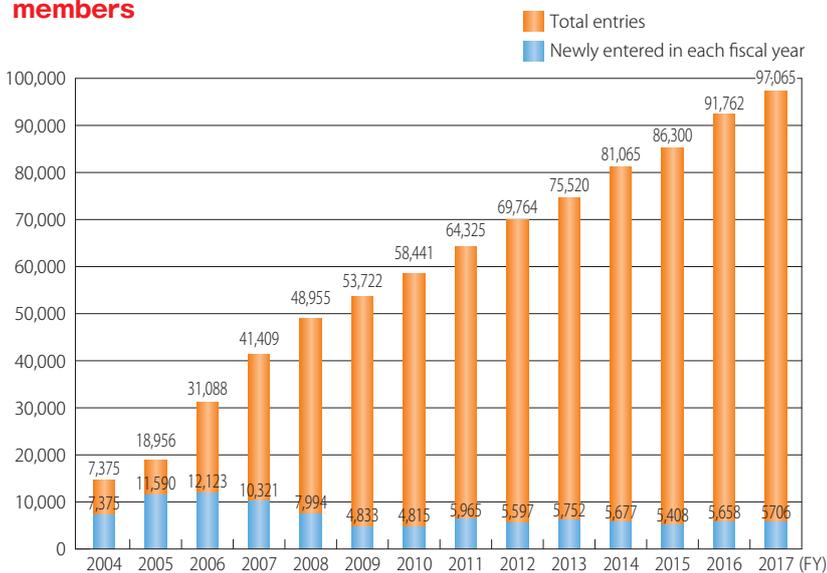
7. Selection of Reviewers (in the case of “Scientific Research”, etc.)

Efforts are made to ensure that reviewers are selected fairly and appropriately, to choose outstanding, high-quality research projects, and to raise the reliability of the KAKENHI review process. The JSPS, taking into account a variety of viewpoints, conducts a fair and open selection of reviewers. Program officers at the Research Center for Science Systems create a list of reviewer candidates from those in the database of potential review committee members. The reviewers are then selected by the JSPS. (Until fiscal 2004, the selection was based on recommendations by the Science Council of Japan.)

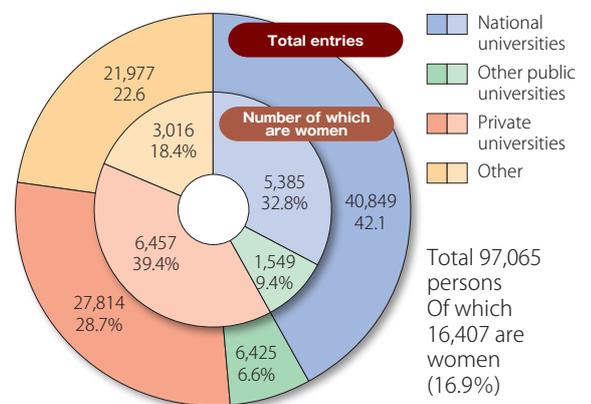
The selection of reviewers is made with reference to the database of potential reviewers. This database, which continues to grow each year, lists candidates for whom information was provided by KAKENHI Principal Investigators and by academic societies. (Number of candidates as of fiscal 2017: approx. 97,000.) To keep the database entries up to date, the researchers themselves are able to check and update their registered information when necessary.

In the Research Center for Science Systems, several program officers in each field are responsible for preparing lists of potential reviewers, based on their discipline, published papers to date, awards received, and other factors. In putting together the list of candidates, the emphasis is on finding persons who are fully conversant in the field, fair, and sufficiently capable, while also enabling review to take into account a broad range of viewpoints. Moreover, program officers endeavor to make use of women researchers and those from public and private universities, independent administrative agencies, private enterprises and the like, ensuring that reviews are free from any bias in light of applicants’ attributes.

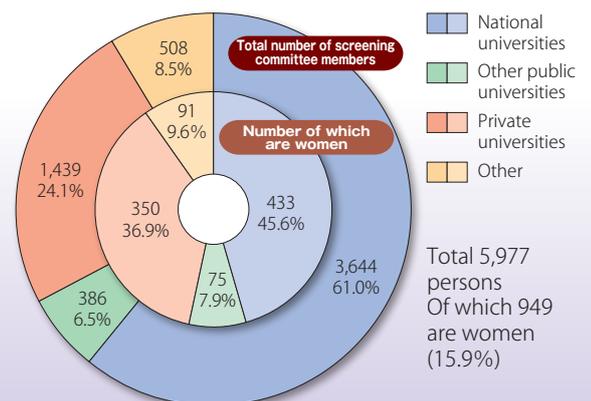
Trend in entries in database of potential review committee members



Status of database entries (fiscal 2017)



Number of review committee members (for fiscal 2017 applications)

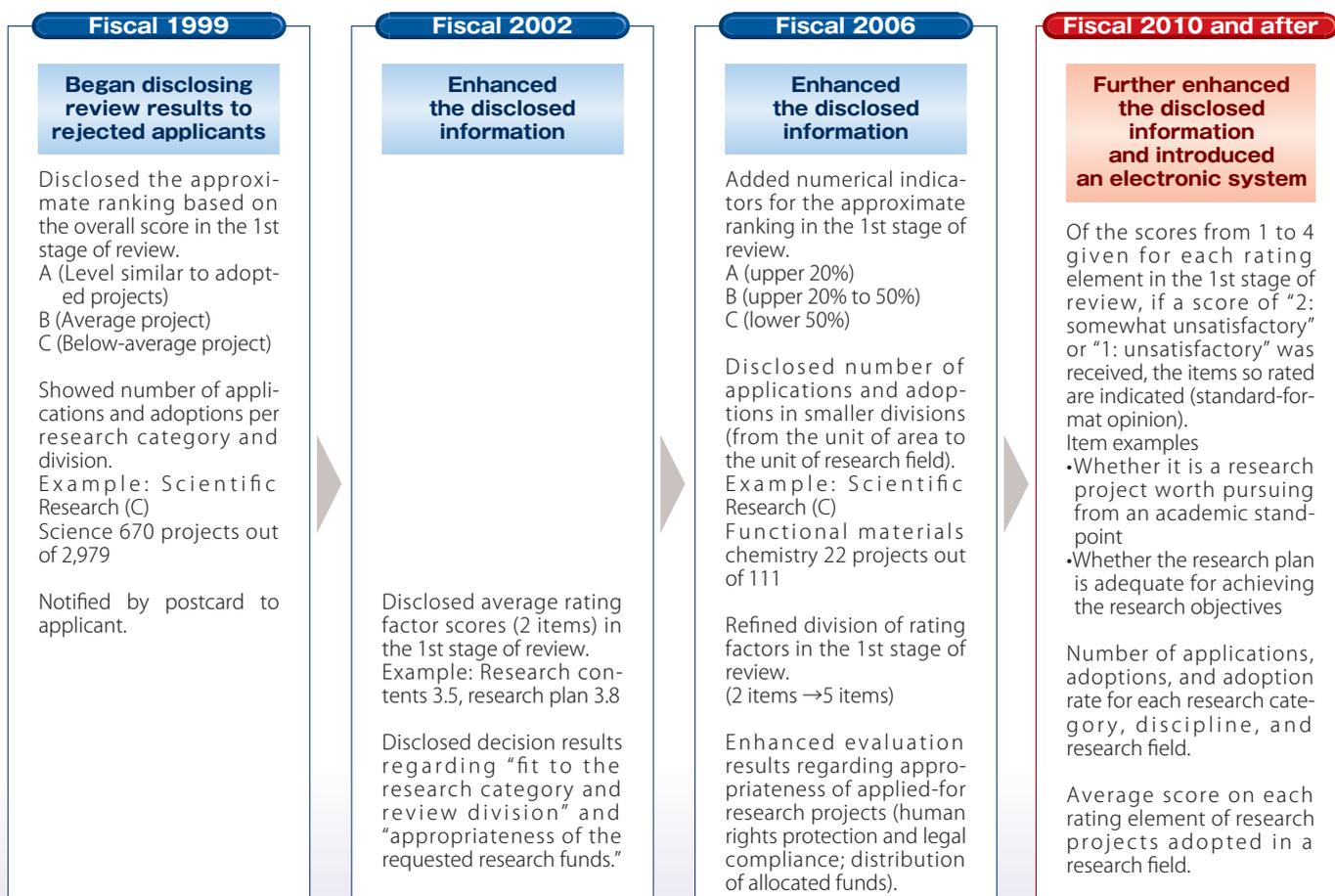


8. Disclosure of Review Results

Review results are disclosed to the applicants themselves to make the review process more transparent. Researchers whose proposals were not adopted can make use of the review results in devising their future research plans.

Summaries of the review result findings are disclosed for each theme or each area for which proposals were invited, in the case of the categories of “Specially Promoted Research”, “Scientific Research on Innovative Areas (Research in a proposed research area [new research areas]), “Scientific Research (S)”, “Scientific Research (A)”, “Scientific Research (B/C)(Generative Research Fields)”, “Challenging Research (Pioneering/Exploratory)” and “Publication of Scientific Research Results (Publication of Research Results, Enhancement of International Dissemination of Information (A), Open-Access Publication Support, Scientific Literature, and Databases)”.

In the two-stage document review for Grants-in-Aid for Scientific Research, etc., the approximate ranking in the Basic Section, scores (averages) awarded by reviewers for each rating element, and “standard-format opinions” are disclosed to applicants who request them. The figure below shows an example of disclosure of first-stage document review results.



9. Toward Easy-to-Use Grants-in-Aid

Based on requests from researchers and research organizations, various enhancements are being made to the KAKENHI Program to facilitate the use of Grants-in-Aid.

- In the case of new research projects, funds can be used once the informal notification of adoption has been made. For continued projects, the amount to be granted during the research period is notified in the initial year, and in subsequent years can be used without interruption during the full research period.
- Extending the deadline for Report on the Results submission to the end of May enables research to be carried out to the end of the fiscal year.
- The allocation of funds to each expense item (goods, travel expense, personnel cost/honoraria, etc.) can be changed freely for up to 50% of total direct expense (up to three million yen if 50% of the total direct expense is no more than three million yen).
- If, in the pursuit of the research, it becomes evident that, due to initially unforeseeable factors, the expected research cannot be completed within the fiscal year, procedures can be taken to extend the research period and have funding carried over to the following fiscal year. (Funding carried over in fiscal 2017: 2,254 projects)
- Research can be suspended temporarily for maternity and childcare leave and resumed when the leave is completed.
- Other funds with no restrictions on use can be combined with KAKENHI funds for use in research. (It is not possible to thus combine different research funds each provided for separate purposes, such as commissioned work costs or other KAKENHI funds.)
- To enable research funds use to be paced to the research progress, in fiscal 2011 Multi-year Fund was introduced for some KAKENHI research categories, and the categories eligible for Multi-year Fund are revised on an ongoing basis.
- From fiscal 2012 it became possible to combine funds from multiple KAKENHI grants for purchasing equipment that is used jointly (joint-use equipment). For purchases of joint-use equipment, combined use of KAKENHI funds and other funds is possible, provided that combined use is also permitted under competitive research grant programs other than KAKENHI and that it does not impede the research undertaken using KAKENHI funds.
- In fiscal 2013, an Adjustment Fund system was introduced allowing research funds to be used in advance or, if certain conditions are met, carried over to the next fiscal year, in categories not yet eligible for Multi-year Fund.
- We are incrementally transitioning to methods using an electronic application system for computerized (paperless) production and submission for other processes necessary for the use of KAKENHI funds, and pro-actively working on initiatives to alleviate the administrative burden on researchers and research organizations.

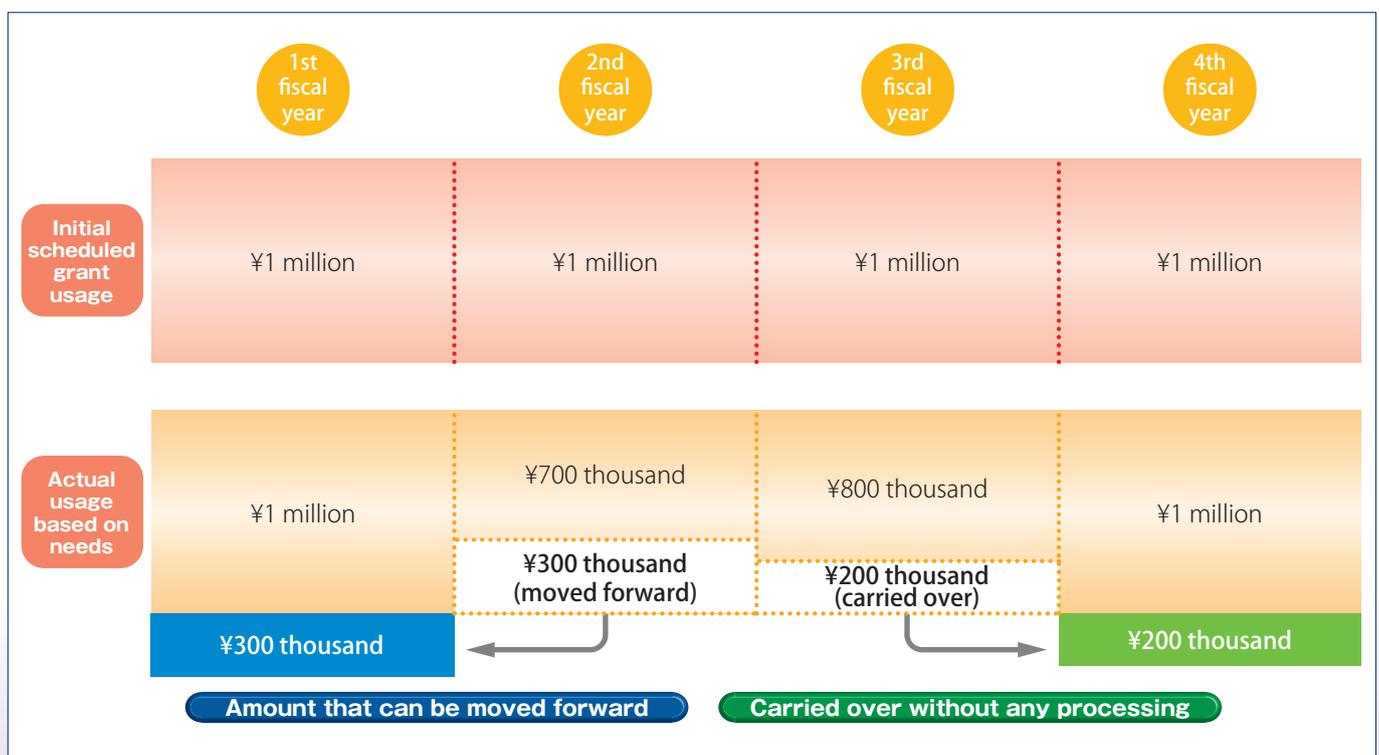
Until recently, national grant programs disbursed research funds on a yearly basis only, making it necessary to conduct research each fiscal year within the scope of the funds issued for that year, and to go through a troublesome procedure of accounting for the funds at the end of each fiscal year. Besides the administrative difficulties, there was a tendency for research to stall at the end of the fiscal year. The following changes were therefore made to the KAKENHI program to enhance usability.

(1) Introduction of Multi-year Fund (fiscal 2011-)

Before fiscal 2011, Grants-in-Aid were issued on a single fiscal year basis, requiring researchers to divide their research plans into one-year segments when applying for a grant. Now, this Multi-year Fund gives them the flexible use of their grants over the entire duration of multi-year projects.

- ◆By requesting funding scheduled for the next fiscal year(s) to be carried forward, researchers can make optimal use of their grants in pace with progress of their work.
- ◆The use of grant funds may be carried over into the next fiscal year without having to do advanced processing. Without having to think about the end of fiscal years, researchers can advance their work by carrying unused funds over into the next fiscal year(s).
- ◆Researchers can advance their work without having to do end-of-year accounting. As this system eliminates the fiscal-year framework, orders placed for goods or services in one year may be delivered in the next.

Image of (1) Multi-year Fund grant usage

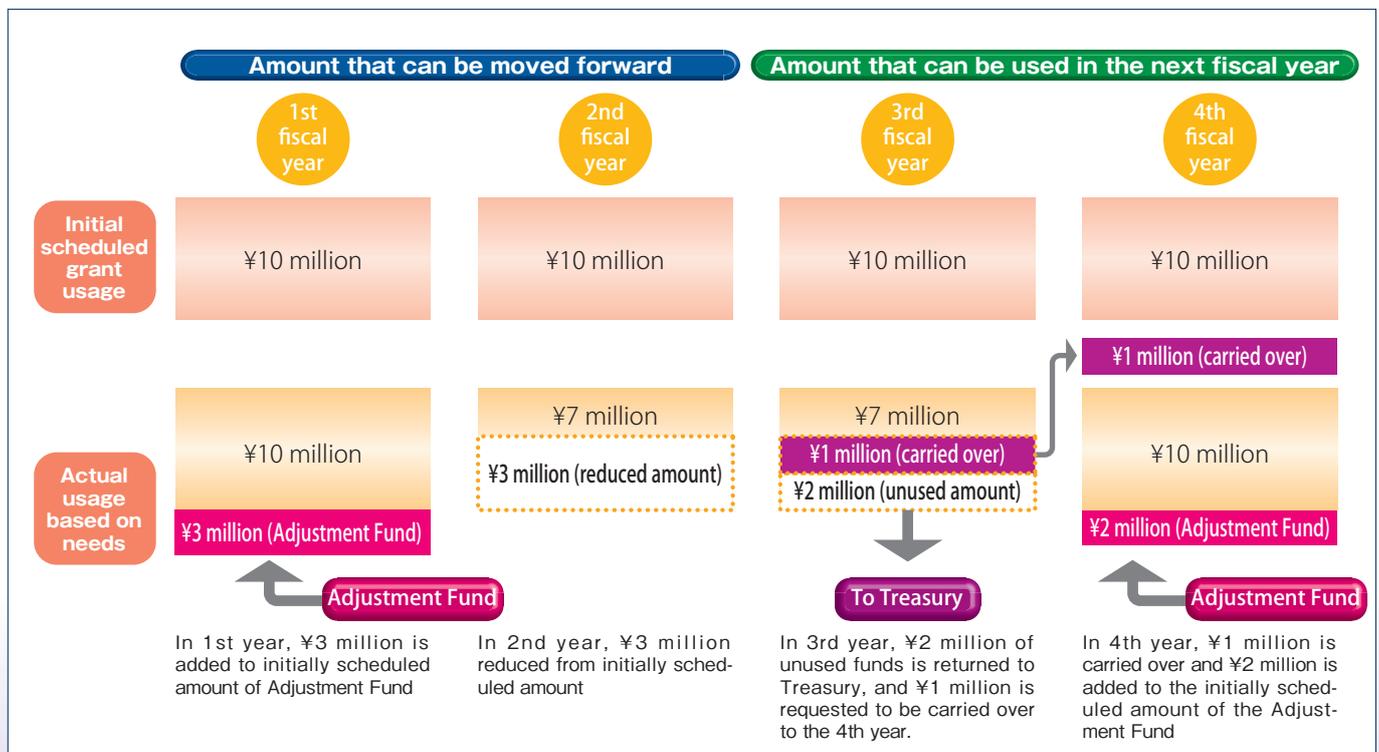


(2) Establishment of Adjustment Fund (fiscal 2013-)

An Adjustment Fund system has been in operation since fiscal 2013. Its purpose is to enable funds in projects that do not fall under the program's Multi-year Fund to be brought forward and under certain conditions carried over to the next fiscal year.

- ◆When researchers wish to use grant funds allocated for out years, they may use this Adjustment Fund to move forward funds for use in the current fiscal year.
- ◆Grant funds may be carried over into the next fiscal year under certain conditions. With this system, unused funds in one fiscal year are returned temporarily to the Treasury and then redeemed from the next year's Adjustment Fund in an amount of up to 100%.

Image of (2) Adjustment Fund grant usage



10. Assessment Following Adoption

*This information pertains to assessment structures in fiscal 2018.

Research funded by KAKENHI undergoes regular assessment by the scientific community, such as when the research results are published as academic papers. A research funding organization, however, also has a crucial role in properly assessing the results of KAKENHI-funded research. For researchers, as well, third-party assessment is useful as a basis for reviewing research conducted up to now or for leading to development into new research.

For these reasons, the KAKENHI program, based on the “General Guidelines for Evaluating Government Funded R&D”, carries out assessment in keeping with the scope and progress stage of research, and makes public all the assessment results on the KAKENHI website and elsewhere.

	Assessment Method	Details of Assessment
Grant-in-Aid for Specially Promoted Research	【Projects adopted up to fiscal 2017】 • Document • Interviews • On-site surveys	【Projects adopted up to fiscal 2017】 • Self-evaluation by researchers themselves as to the progress of their research (each fiscal year) • Research project progress assessment (fiscal year prior to final fiscal year of the research period)
	【Projects adopted in fiscal 2018 and thereafter】 • Document • Interviews (On-site surveys)	【Projects adopted in fiscal 2018 and thereafter】 • Self-evaluation by researchers themselves as to the progress of their research (each fiscal year) • Interim assessment (middle year of the research period) • Ex-post assessment (next fiscal year after end of the research period)
Grant-in-Aid for Scientific Research on Innovative Areas	• Document • Interviews	• Self-assessment by researchers themselves as to the progress of their research (each fiscal year) • Interim assessment (third year of a five-year research period) • Ex-post assessment (next fiscal year after end of the research period)
Grant-in-Aid for Scientific Research (S)	• Document (Interviews or On-site surveys)	【Projects adopted up to fiscal 2017】 • Self-evaluation by researchers themselves as to the progress of their research (each fiscal year) • Research project progress assessment (fiscal year prior to final fiscal year of the research period) 【Projects adopted in fiscal 2018 and thereafter】 • Self-evaluation by researchers themselves as to the progress of their research (each fiscal year) • Interim assessment (middle year of the research period) • Ex-post assessment (next fiscal year after end of the research period)
Grant-in-Aid for Scientific Research (A/B/C)	• Document	• Self-assessment by researchers themselves as to the progress of their research (each fiscal year)
Grant-in-Aid for Challenging Exploratory Research		
Grant-in-Aid for Challenging Research (Pioneering/Exploratory)		
Grant-in-Aid for Young Scientists (A/B)		
Grant-in-Aid for Research Activity Start-up		

Note: Results of self-assessment are also posted, including a summary of the research accomplishments, the progress to date, and how the research will be advanced in the future. In addition, research announcements (journal papers, academic society presentations, books, and applications for and acquisition of industrial property rights on research results) are made public. Another way the research results are subject to assessment by the scientific community is by making them widely known via the “Database of Grants-in-Aid for Scientific Research (KAKEN)”.

Researchers who undergo these kinds of evaluation go on to reflect the assessment in subsequent research project applications (proposals for Grants-in-Aid for Scientific Research), as they draw up their Research Proposal Document based on the summary of the assessment results and assessment results themselves, and are assessed once again in the review process.

IV. Initiatives for Ensuring Appropriate Use of KAKENHI Funds and Fair Research Activities

- To prevent any improper grant spending and research misconduct, related to the Grants-in-Aid for Scientific Research-KAKENHI, every effort has been made to increase awareness of the rules, including distribution of handbooks and holding of explanatory meetings. At the same time, each research institution, rather than the individual researcher, is asked to perform the management of KAKENHI grants and various procedures, under an effective management structure in accordance with the “Guidelines on Management and Audit of Public Research Funds” at Research Institution. This policy reduced the burden on researchers while helping to prevent inadvertent rule violations.
- Starting in fiscal 2014, a mechanism was newly introduced in the electronic application system, which requires that before a formal application for grant delivery can be filed, the applicant must not only pledge to use the KAKENHI grant fairly and efficiently and not to commit any research misconduct, but must also complete a checklist of the minimum items necessary regarding the conduct of KAKENHI-funded research.

Revision of Guidelines on the Management and Audit of Public Research Funds at Research Institution and Establishment of Guidelines for Responding to Misconduct in Research

To address the ongoing problem of misconduct in research, the “Guidelines on Management and Audit of Public Research Funds” at Research Institution were revised in February 2014 based on studies, especially, in the MEXT “Task Force on Misconduct in Research and Inappropriate Use of Research Funds” that was established in August 2013. In addition, Toward “Guidelines for Responding to Misconduct in Research” (August 2006) led to the establishment of “Guidelines for Responding to Misconduct in Research” in August 2014, taking into account the Task Force studies and on the February 2014 summary of findings of the Cooperative Council on the Revision and Reform of the Application of the “Guidelines for Responding to Misconduct in Research”. Research institutions are asked to set up the necessary structures and mechanisms for preventing misconduct, in line with these guidelines.

Outline of New Initiatives

- Initiatives for preventing misconduct in advance
 - Making incidents public (Improper Grant Spending); publishing lists of incidents (research misconduct)
 - Mandating compliance education for researchers and administrative personnel and making sure the education is received (extracting a pledge) (improper grant spending); improving research ethics by conducting research ethics education coursework (research misconduct)
 - Mandating the preservation of research data for a set period and its disclosure (research misconduct)
- Making clear the management responsibilities in the organization
 - Drawing up internal regulations and making them public (improper grant spending, as well as research misconduct)
 - Assigning a compliance officer (improper grant spending); assigning a research ethics education officer (research misconduct)
 - Promptly obtaining a full understanding of the facts of incidents (improper grant spending); ensuring prompt investigations of Specific Research Misconduct (research misconduct)
- Supervision and support by the national government
 - Cutting indirect expense in case of organizational problems in a research institution or delays in reporting results of investigations (measure taken by research funding organizations)(improper grant spending, as well as research misconduct)

*About the educational materials on research ethics

Prior to filing formal application for grant delivery, it is mandatory for Principal Investigators and Co-Investigators who participate in research activities conducted with KAKENHI grants to read and complete training materials on research ethics (“For the Sound Development of Science—The Attitude of a Conscientious Scientist—”[“For the Sound Development of Science” Editorial Committee on JSPS], e-Learning Course on Research Ethics [eL CoRE], APRIN e-learning program [eAPRIN], etc.) or undergo research ethics training provided by their research institution pursuant to the “Guidelines for Responding to Misconduct in Research” (Adopted by the MEXT on August 26, 2014).

Measures Taken against Researchers Who Commit Misconduct

Researchers who commit misconduct in KAKENHI-funded projects may be required to return the research funds, as well as being barred from receiving KAKENHI grants for a set time period. Moreover, the nature of such researchers' misconduct will be made public.

Also researchers who commit misconduct in a project supported by a competitive funding program other than KAKENHI (including those administered by other governmental organs) and are barred from receiving grants under that program for a set time period will also be barred from receiving KAKENHI grants for the same period.

○Period of KAKENHI suspension “Improper Grant Spending and Fraudulent Grant Acquisition of KAKENHI”

Subject of Measures	Extent of the improper grant spending and Period of KAKENHI suspension		
Researchers who committed improper grant spending of KAKENHI and researchers who conspired in such fraudulent act	Misappropriation of KAKENHI for personal gain	10 years	
	Other than misappropriation of KAKENHI for personal gain	(1) Cases of major seriousness and maliciousness	5 years
		(2) Cases other than (1) and (3)	2 to 4 years
(3) Cases of minor seriousness and maliciousness		1 year	
Researchers who acquired KAKENHI by deception or other fraudulent means and researchers who conspired in such acts	5 years		
Researchers who were not directly involved in the improper grant spending of KAKENHI, but failed to exercise due care	The upper limit is 2 years and the lower limit is 1 year depending on the degree of the breach of duty by the researchers who have the duty of care as a good manager.		

*Sharp reprimand shall be issued to researchers in case that the influence on society and the maliciousness of their conducts are judged to be insignificant and the amount of money involved is small.

“Research Misconduct”

Subject of Measures		Negative Impacts on Science and on Public at Large Degree of Maliciousness and Period of KAKENHI Suspension
Subject of Research Misconduct	(a) Particularly malicious individual(s) who, for example, had intention of research misconduct from the very beginning of the research	10 years
	(b) Author(s) of paper(s), etc. related to the research in which research misconduct(s) have been identified (other than(a) above)	(determined in accordance with the impact on the progress of the science in the field in question and the social impact, and on the level of maliciousness involved in the acts)
	Responsible author(s) of the paper(s) in question (corresponding author, lead author or other authors bearing equivalent responsibilities)	
	Author(s) of the paper(s) in question other than the responsible author(s) described above	2 to 3 years
(c) Individual(s) involved who are not the authors of the research paper(s) for which research misconduct(s) are identified.	2 to 3 years	
Responsible author(s) of paper(s), (corresponding author, lead author or other authors bearing equivalent responsibilities) for which research misconduct(s) are identified, but not involved in the alleged research misconduct		1 to 3 years

V. Public Release and Analysis of Research Results

The results of research supported with Grants-in-Aid are to be proactively made available to the public. This is critical as providing opportunities for citizens to learn about research results promotes their application within society, while deepening the public's understanding of the Grants-in-Aid program. A summary of Grant-in-Aid projects and their results are available over the Internet.

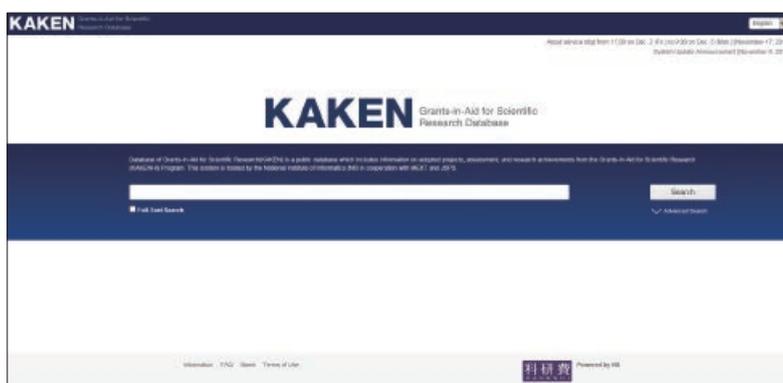
KAKENHI research achievements are given public access via the Database of Grants-in-Aid for Scientific Research (KAKEN) of the National Institute of Informatics.

<https://kaken.nii.ac.jp/en/>

The research using the KAKENHI should be carried out based on researcher's own self-awareness and responsibility. Therefore the publication on the implementation of the research or research achievements, etc. should not come from the government request and the views and responsibilities on the research achievements should be attributed to the researchers themselves.

About the Database of Grants-in-Aid for Scientific Research (KAKEN)

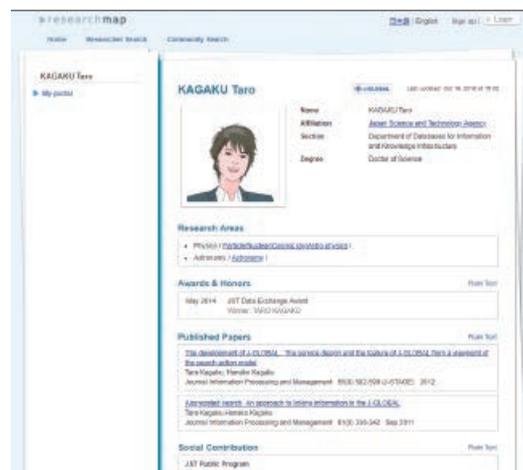
- This database posts information on projects adopted for Grants-in-Aid (from 1965 to date) and summaries of the Report on the Research Results (from 1985 to date).
- Information in the database can be searched by research category, researcher name, discipline, and a variety of other items. The latest research results can therefore be accessed by wide-ranging keyword searches.



Registration of the Researcher Information in researchmap

The "researchmap (<https://researchmap.jp/>)" is the Japan's largest researcher information database as a general guide to Japanese researchers. The information on the research achievements registered in the researchmap is ready to be openly available over the Internet and the database itself is linked to the e-Rad, other many university faculty databases and so on, and also the Japanese Government as a whole is going to further utilize the researchmap.

Furthermore, since the posted information in the researchmap and/or the database of the Grants-in-Aid for Scientific Research (KAKEN) is to be handled as a reference according to the necessity in the review of the KAKENHI, the registration of the researcher information into the researchmap is encouraged.



Acknowledgements and Financial Support for Publishing Research Results

Researchers are asked to acknowledge the Grants-in-Aid program when reporting their research results in papers, conferences, and other fora.

The program also allows researchers to use direct expense to cover the cost for publicizing their research results widely to the public.

Promotion of "Open Access" to the research papers supported by KAKENHI grants

Japan Society for the Promotion of Science (JSPS) endorses general policy of promotion of open access of publications of research results funded by public grants including KAKENHI.

Note that open access is not mandatory if there are justifiable reasons for deferral such as copyright-related issues, or insufficient repository infrastructure at the research institution.

The open access implementation policy of JSPS is given on the following webpage:

https://www.jsps.go.jp/data/Open_access.pdf

The National Institute of Science and Technology Policy conducted data analysis bringing together the resources of the Database of Grants-in-Aid for Scientific Research (KAKEN) and the Web of Science (WoS) online databases of scholarly papers.

- Article information in the natural sciences archived in the WoS for publication years 1996 to 2013 was analyzed. Article information in KAKEN for which there was no matching information in WoS was excluded from the study.

- Articles archived in WoS for which there is matching article information in KAKEN are referred to here as “WoS-KAKEN articles,” while WoS articles with no matching information in KAKEN are here called “WoS-only articles.”

- “Top 10% adjusted articles” is a number obtained by extracting those articles in the top 10% of cited articles each year in each field and adjusting so that the real number is 1/10 of the number of articles each year in each field. This indicates the number of high-profile articles.

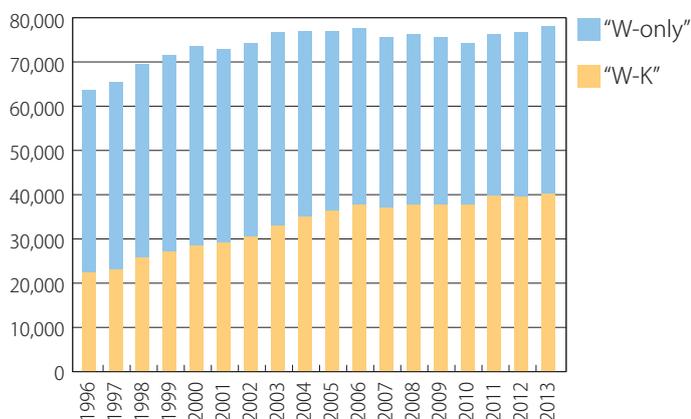
Status of “WoS-KAKEN Articles” among Japanese Articles

Results of the data analysis show that in terms of both quality and quantity, KAKENHI plays a major role in funding of Japanese scholarly articles.

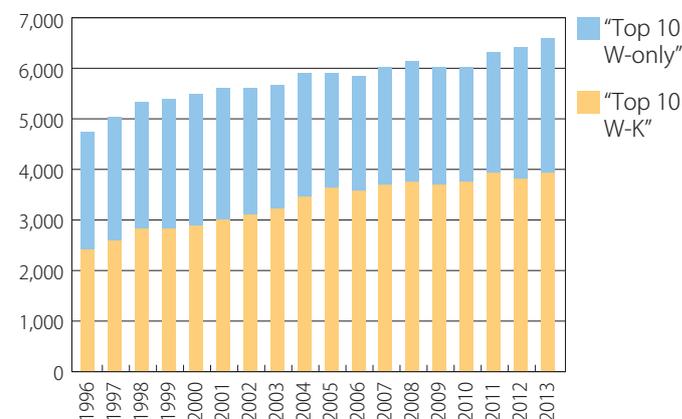
- Among Japanese articles, “WoS-KAKEN articles” have increased some 1.7 times in recent years compared to the latter 1990s, while “WoS-only articles” have been declining.

- Looking at Japanese Top 10% adjusted articles, “WoS-KAKEN articles” have increased around 1.5 times in recent years compared to the latter 1990s, while “WoS-only articles” have remained largely steady.

Breakdown of the number of Japanese WoS articles



Breakdown of the number of Japanese Top 10% adjusted articles



Integral count	Number of Japanese WoS articles		
	Total	W-K	W-only
A. 1996-1998	66,026	23,800	42,226
B. 2001-2003	74,631	30,940	43,691
C. 2006-2008	76,385	37,393	38,992
D. 2011-2013	77,256	40,157	37,099
A→D Difference	11,230	16,357	-5,127
A→D Growth rate	1.17倍	1.69倍	0.88倍

Integral count	Number of Japanese Top 10% adjusted articles		
	Total	W-K	W-only
A. 1996-1998	5,051	2,630	2,420
B. 2001-2003	5,644	3,141	2,503
C. 2006-2008	6,010	3,695	2,315
D. 2011-2013	6,444	3,893	2,551
A→D Difference	1,393	1,263	131
A→D Growth rate	1.28倍	1.48倍	1.05倍

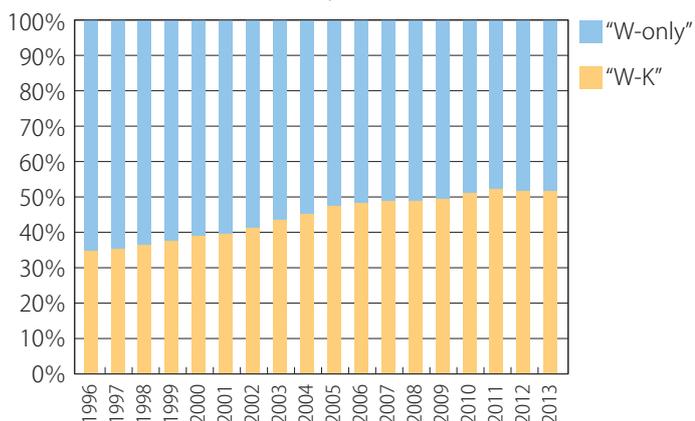
Source: Compiled by the National Institute of Science and Technology Policy based on Thomson Reuters (now Clarivate Analytics) Web of Science XLM (SCIE, end 2015)

1. “W-K” are “WoS-KAKEN articles” and “W-only” are “WoS-only articles”.
2. “Top 10 W-K” are “WoS-KAKEN articles” in the Top 10% adjusted articles, and “Top 10 W-only” are “WoS-only articles” in the Top 10% adjusted articles.
3. “Japanese articles” are those in which one or more Japanese research institution is listed in the affiliations of the author(s) in the Web of Science database of scholarly papers in the natural sciences.
4. The figures shown in the tables are three-year moving averages.

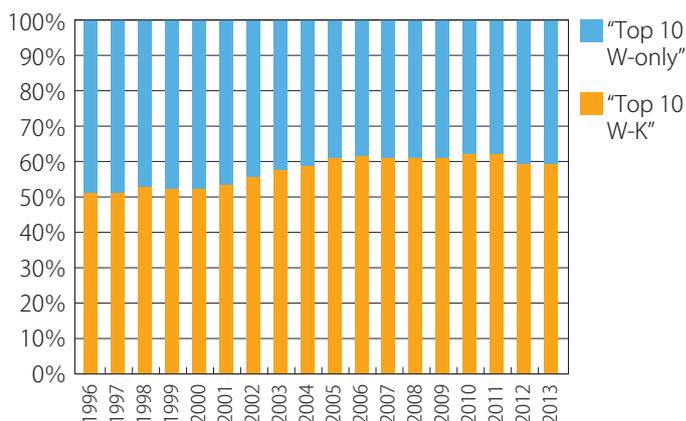
Source: Produced by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), based on: MEXT & National Institute of Science and Technology Policy, Structural Analysis of Scholarly Paper Production in Japan based on Linkage of Web of Science Databases of Scholarly Papers and the Database of Grants-in-Aid for Scientific Research (KAKEN) [Additional Materials] (in Japanese).

- The percentage of “WoS-KAKEN articles” in Japanese scholarly articles has risen from around 36% in the latter 1990s to around 52% in recent years.
- The percentage of “WoS-KAKEN articles” in Japanese Top 10% adjusted articles has risen from around 52% in the latter 1990s to around 60% in recent years.

Breakdown of the number of Japanese WoS articles



Breakdown of the number of Japanese Top 10% adjusted articles



Source: Compiled by the National Institute of Science and Technology Policy based on Thomson Reuters (now Clarivate Analytics) Web of Science XLM (SCIE, end 2015)

1. “W-K” are “WoS-KAKEN articles” and “W-only” are “WoS-only articles”.
2. “Top 10 W-K” are “WoS-KAKEN articles” in the Top 10% adjusted articles, and “Top 10 W-only” are “WoS-only articles” in the Top 10% adjusted articles.
3. “Japanese articles” are those in which one or more Japanese research institution is listed in the affiliations of the author(s) in the Web of Science database of scholarly papers in the natural sciences.

Source: Produced by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), based on: MEXT & National Institute of Science and Technology Policy, Structural Analysis of Scholarly Paper Production in Japan based on Linkage of Web of Science Databases of Scholarly Papers and the Database of Grants-in-Aid for Scientific Research (KAKEN) [Additional Materials] (in Japanese).

- The percentage of Japanese adjusted top 10% articles among “WoS-KAKEN articles” is around 10%, which is higher than among “WoS-only articles” (7%).

Integral count	Percentage of “Top 10 W-K” in “W-K”		
	W-K	Top 10 W-K	Percentage
2011-2013	40,157	3,893	9.7%

Integral count	Percentage of “Top 10 W-only” in “W-only”		
	W-only	Top 10 W-only	Percentage
2011-2013	37,099	2,551	6.9%

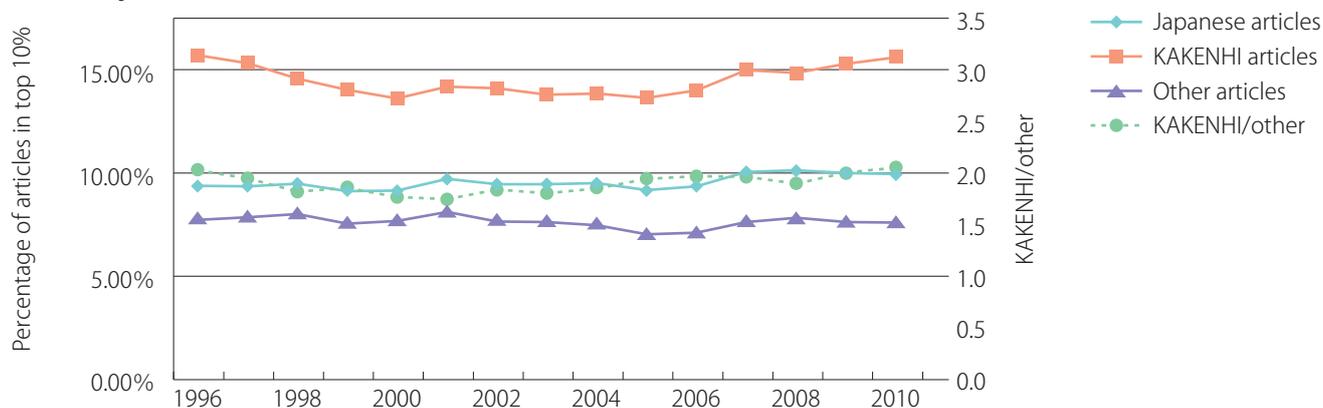
Source: Compiled by the National Institute of Science and Technology Policy based on Thomson Reuters (now Clarivate Analytics) Web of Science XLM (SCIE, end 2015)

1. “W-K” are “WoS-KAKEN articles” and “W-only” are “WoS-only articles”.
2. “Top 10 W-K” are “WoS-KAKEN articles” in the Top 10% adjusted articles, and “Top 10 W-only” are “WoS-only articles” in the Top 10% adjusted articles.
3. “Japanese articles” are those in which one or more Japanese research institution is listed in the affiliations of the author(s) in the Web of Science database of scholarly papers in the natural sciences.
4. The figures shown in the tables are three-year moving averages.

Source: Ministry of Education, Culture, Sports, Science and Technology & National Institute of Science and Technology Policy, Structural Analysis of Scholarly Paper Production in Japan based on “Linkage of Web of Science Databases of Scholarly Papers and the Database of Grants-in-Aid for Scientific Research (KAKEN) [Additional Materials] (in Japanese)”.

The remaining analysis results were reported by the Subdivision on Grants-in-Aid for Research in the Subdivision on Science, the Council for Science and Technology, and can be found on the MEXT website.
http://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu4/030/shiryo/1331868.htm (in Japanese only)

The JSPS Center for Science Information Analysis conducts analyses using data on articles archived in the Database of Grants-in-Aid for Scientific Research (KAKEN) and those in Scopus,*¹ the citation database provided by Elsevier.



- The above graph shows the percentages of articles from KAKENHI-funded research and articles not from KAKENHI-funded research in the top 10% of citations.

The percentage of articles from KAKENHI-funded research is
 -1.5 to 1.6 times that of Japanese articles as a whole, and
 -1.8 to 2 times that of non-KAKENHI-funded articles,
 showing the superior position of KAKENHI-funded projects.

- The UK Medical Research Council (MRC) also conducted an analysis using WoS data, comparing articles resulting from MRC-supported research and research papers in the UK medical field as a whole. The MRC reported that the superiority of MRC-funded research papers was 1.55 that of UK articles as a whole.

Notes:

- 1.Scopus, provided by Elsevier, is the world's largest database of abstracts and citations. It covers articles from more than 21,000 journals issued by more than 5,000 publishers around the world, in science, technology, medicine, social sciences, and arts and humanities.
- 2.While there are differences in article counts due to matching precision between KAKEN and Scopus articles, the effect on the percentage of top 10% citations should be slight.

See the website of the JSPS Center for Science Information Analysis for details.

https://www.jspcs.go.jp/j-csia/survey_and_analysis.html

VI. Information Dissemination and Public Relations Activities

Please view the following webpages and publications for various information on the Grants-in-Aid program.

KAKENHI Websites

1. MEXT provides information like the following, mainly on the research categories for which MEXT performs review and assessment, on its KAKENHI website (http://www.mext.go.jp/a_menu/shinkou/hojyo/main5_a5.htm [in Japanese only]):
 - Application Procedures, Research Proposal Document form
 - Regulations on assessment in funding of scientific research
 - MEXT rules on the use of funds (for research institutions and for researchers)
 - KAKENHI Handbooks (for research institutions and for researchers)
 - List of reviewers
 - Links for “Scientific Research on Innovative Areas (Research in a proposed research area)”
 - Overview of review for “Scientific Research on Innovative Areas (Research in a proposed research area)” and validation results
 - KAKENHI funding results
 - Reports by the Subdivision on Grants-in-Aid for Research and the Research Grant Review Section in the Subdivision on Science, the Council for Science and Technology
2. The JSPS provides information like the following, mainly concerned with the research categories for which the JSPS performs review and assessment, on its KAKENHI website (<https://www.jps.go.jp/english/e-grants/index.html>):
 - Application Procedures, Research Proposal Document form
 - Rules Concerning the Review and Assessment for Grants-in-Aid for Scientific Research
 - JSPS rules on the use of funds (for research institution and for researchers)
 - KAKENHI Handbooks (for research institutions and for researchers)
 - List of reviewers
 - Summary of KAKENHI review
 - Information on electronic application
 - Information on HIRAMEKI☆TOKIMEKI SCIENCE
 - “KAKENHI Essay Series” (essays by researchers on their views and expectations of the program)

Publications and Public Relations Magazines

MEXT and the JSPS prepare the following publications, which can be downloaded from their websites.

1. “KAKENHI News” (issued four times per year; in Japanese)

Topics relating to the latest research achievements and to the KAKENHI program are introduced. In the case of topics relating to the latest research achievements, researchers provide readily understandable explanations of the results of the research they have undertaken with KAKENHI grants.
2. “KAKENHI Handbook” (for researchers)

This Handbook, prepared primarily for researchers, provides an easy-to-understand description of the basic contents of the KAKENHI program.
3. “Frontline Scientific Research Projects Advanced in JAPAN”

Includes the titles of newly adopted projects under such categories as “Specially Promoted Research”, “Scientific Research on Innovative Areas (Research in a proposed research area)”, and “Scientific Research (S)”, along with the names of their principal investigators and summaries of their research content.



HIRAMEKI☆TOKIMEKI SCIENCE (Welcome to a University Research Lab—Science That Inspires and Inspirts)

This initiative involves communicating the original and ground-breaking results achieved by individual researchers in KAKENHI-funded research in universities and research institutions throughout Japan to elementary, middle, and high school students. The communications are presented in an easy-to-understand way that highlights the appeal and interest of scientific endeavor. The aim is to promote science by offering opportunities for students to experience the cultural value and social significance of science first hand, as well as strengthening their understanding of the meanings of science and its application in their everyday lives.

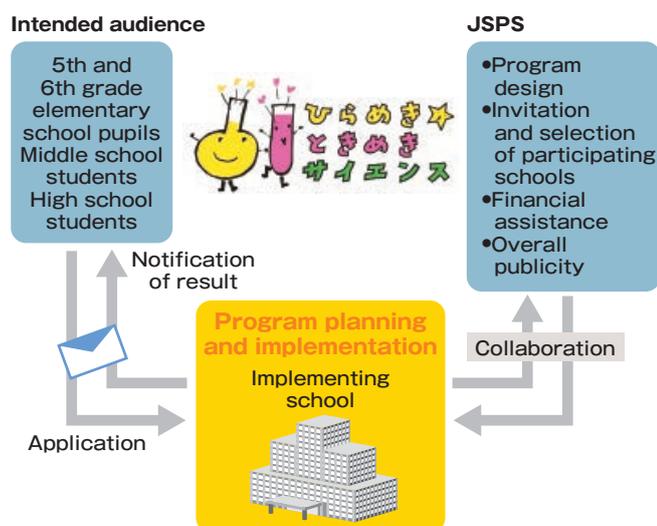
In fiscal 2017, a total of 341 programs were held at 170 institutions with the participation of 6,865 students, who will be the next generation of leaders. Since it was launched in fiscal 2005, the program has been held at 1,485 institutions with the participation of some 62,000 students.

278 experiential programs are also planned for fiscal 2018, involving visits to research laboratories at a total of 152 universities and other institutions across Japan between mid-July and the end of January, mainly in the school summer vacation period. Students participating in these programs will be able to experience real laboratory and field work and come into direct contact with the results of cutting-edge research.

Participation and visits by teachers from schools with students wishing to participate HIRAMEKI☆TOKIMEKI SCIENCE and other nearby schools are welcomed.

Teachers that wish to participate in a program and institutions that wish to hold one, please visit the “HIRAMEKI☆TOKIMEKI SCIENCE” page on the JSPS website at: <http://www.jsp.go.jp/hirameki/index.html> (Japanese only)

Organization behind HIRAMEKI☆TOKIMEKI SCIENCE



Number of projects to date

区分	National Universities		Public Universities		Private Universities		Inter-University Research Institutes		Others		Total	
	Institutions	Projects	Institutions	Projects	Institutions	Projects	Institutions	Projects	Institutions	Projects	Institutions	Projects
2008	41	78	9	14	42	70	—	—	—	—	92	162
2009	45	90	14	18	63	99	1	1	—	—	123	208
2010	42	94	14	15	61	93	3	3	—	—	120	205
2011	44	102	10	12	54	86	1	2	1	1	110	203
2012	44	92	6	7	60	95	4	4	6	7	120	205
2013	45	107	9	10	70	113	2	2	10	11	136	243
2014	50	129	12	16	70	106	2	2	11	14	145	267
2015	53	144	12	17	70	116	1	1	17	19	153	297
2016	50	156	15	20	73	127	1	1	22	26	161	330
2017	51	172	12	15	83	123	2	3	22	28	170	341

**“Others” includes junior colleges and National Technical Colleges.

Examples of programs offered in fiscal 2017



August 2017
Kanazawa University
Learning about economics through experiments



July 2017
Doshisha University
Measuring the ultrasound of bats —the physics of sound in living creatures—

VII. Research that Fosters Innovation

Much of the research funded by Grants-in-Aid is basic, enduring research with long-term vistas, rather than research with short-term objectives. It has yielded many milestone results, rendering significant benefits for people and society.

Grant support is provided for a wide spectrum of research endeavors, including some that attract little interest while at a seedling stage. There are many examples of such research evolving through an application stage to play significant roles in people's lives today. These are some examples.

Introducing Research Achievements Resulting from KAKENHI Funding



Molecular Mechanisms and Physiological Significance of Autophagy

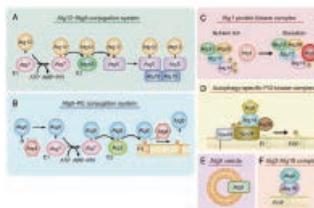
Yoshinori Ohsumi, Honorary Professor,
Tokyo Institute of Technology

Autophagy is an important mechanism of protein breakdown within cells. It was discovered in the 1960s, but for many years the genes and specific factors involved in autophagy remained unknown, with no advancements in understanding the phenomenon at the molecular level. This research project began with the hypothesis that yeast vacuoles could be organelles analogous to lysosomes in mammals.

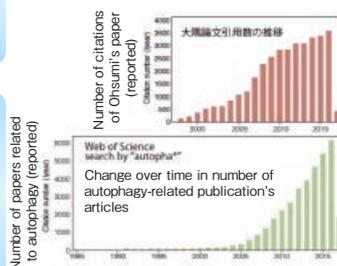
Research Outcome

- A process in which yeast cells starved of nutrition degenerate their own cytoplasmic components was discovered under optical microscope, and found to be the same membrane dynamics as the already known mechanism of autophagy.
- The research also succeeded in identifying many genes essential for this process.

- Analysis of the Atg proteins that code these genes shed light on the molecular devices that support the membrane dynamics, as well as revealing that they are conserved in a broad range of organisms from yeast through to mammals and plants.
- This occasioned the emergence of autophagy research as a major international research trend, which continues to uncover connections with a variety of physiological functions and health and disease.



The 18 Atg proteins essential for starvation-induced autophagy consist of six functional units.



KAKENHI financial support

Molecular Mechanism of Membrane Dynamics during Autophagy (from fiscal 2003, Specially Promoted Research), etc.

Funding by KAKENHI began in the 1980s.

Further developments from research achievements

There is a vast and numerous range of unexplained problems in the field of autophagy research, including:

- (1) Molecular mechanisms of membrane dynamics;
- (2) Quantitative analysis of the process and products of degeneration;
- (3) Conditions of induction and diverse forms of autophagy.

By using yeasts that allow strict control of conditions and biochemical analysis, it should be possible to add significance and methodological insights to quantitative analysis in research on autophagy in higher-order fauna and flora.

Recipient of the Order of Culture and numerous international prizes in biology



Professor Ohsumi was awarded the Nobel Prize in Physiology or Medicine in 2016 for his research achievements in elucidating the mechanisms underlying autophagy.

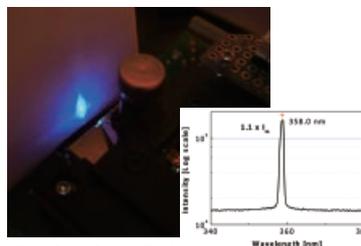
© The Nobel Foundation. Photo: Lovisa Engblom.



New technology to boost the output power of visible and ultraviolet Light-Emitting Diodes (LEDs)

Hiroshi Amano, Professor, Nagoya University

Having a higher efficiency than incandescent or fluorescent lamp, LED lamps are rapidly finding wider use. With earlier device designs, however, light extraction efficiency was too low, requiring development of technology to extract the light more efficiently. Moreover, compared with visible light LEDs, the efficiency of ultraviolet LEDs was extremely low.

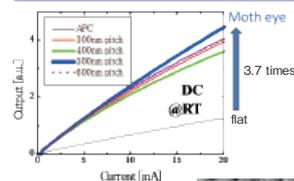


Ultraviolet laser diode

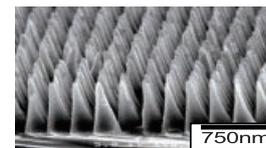
KAKENHI financial support

"Study of a high-performance GaN-based blue LED" (from fiscal 1987, Developmental Scientific Research; Principal Investigator Dr. Isamu Akasaki)

Funding by Kakenhi began in the late 1980s.

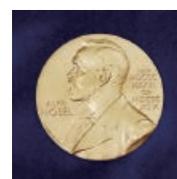


Improvement in blue LED light output



Example of moth-eye structure

Dr. Amano, Dr. Isamu Akasaki of Meijo University, and Dr. Shuji Nakamura of the University of California Santa Barbara, were awarded the 2014 Nobel Prize in Physics for their development of blue LEDs.



© The Nobel Foundation. Photo: Lovisa Engblom.

Research Outcome

It was discovered that, by forming surface irregularities shorter than the wavelength of the light, the overall reflection of light could be suppressed, enabling the light to extract the device. Using low-energy electron beams, a moth-eye structure was created of regularly arranged cone-shaped structures 500 nm wide. The resulting LED achieved 1.7 to 2.5 times higher light output compared with conventional LEDs. Growing crystals at higher temperatures improved the internal quantum efficiency of the emitting layers of ultraviolet LEDs.

Further developments from research achievements

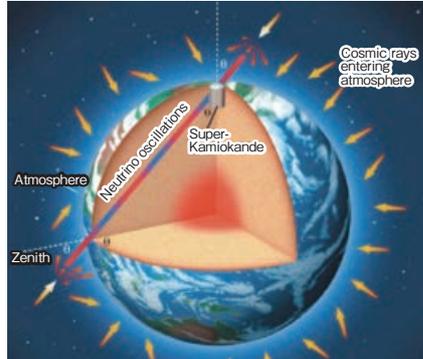
The technology is applicable to white LEDs and a wide range of other LED products requiring high efficiency and output. Ultraviolet LEDs are also thought to be the key for a variety of environmental friendly products, including those for cleaning air and water. They may also have medical applications such as for treatment of skin diseases.



Research on Neutrino Oscillations

Takaaki Kajita, Director, Institute for Cosmic Ray Research, The University of Tokyo

- Neutrinos are elementary particles, of which there are three "flavors"—electron neutrinos, muon neutrinos, and tau neutrinos. Being extremely light, for a long time they were believed to have zero mass.
- Based on the observation that the ratio of the electron neutrino and muon neutrino components of the Kamiokande experiment's atmospheric neutrino data did not agree with expectations, the issue of the "atmospheric neutrino anomaly" was raised. Then the study on atmospheric neutrinos which produced when cosmic rays collide with atoms in the atmosphere was begun.

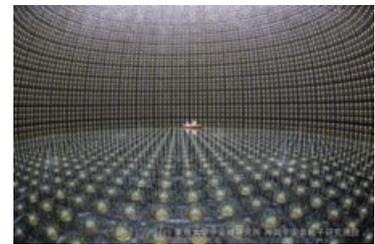
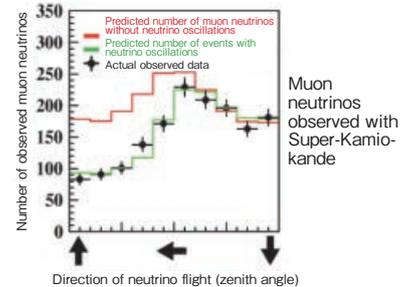


Atmospheric neutrinos produced in the atmosphere on the other side of the Earth pass through the Earth and arrive at the detector.

Further developments from research achievements

- Since this discovery, studies of neutrino mass and of elementary particle theory incorporating these findings have progressed, leading to the confirmation of oscillations of all three flavors of neutrinos in solar neutrino, T2K, and other experiments.
- It is hoped that learning about the properties of neutrinos will bring us closer to solving the mystery of how the Universe came to be made only of matter, instead of equal amounts of matter and antimatter that should have existed when the Universe first came into being.

KAKENHI financial support
 "Study of atmospheric neutrinos" (from fiscal 1995, Scientific Research (C)), etc.
 Funding by KAKENHI began in the 1990s.



Inside of Super-Kamiokande
 Photo: Institute for Cosmic Ray Research, The University of Tokyo
 Kamioka Observatory



The Nobel Prize in Physics was awarded in 2015 to Prof. Kajita and Prof. Arthur B. McDonald "for the discovery of neutrino oscillations, which shows that neutrinos have mass."

© The Nobel Foundation. Photo: Lovisa Engblom.

Research Outcome

- Observations of atmospheric neutrinos using Super-Kamiokande revealed that of muon neutrinos produced on the other side of the Earth, some changed to tau neutrinos as a result of their long journey. Their number was only about half the number of neutrinos that came down from directly above the detector.

- This phenomenon came to be known as neutrino oscillation, neutrinos changing into other types of neutrinos while in flight. This occurs only if neutrinos have mass. The discovery of neutrino oscillations became definitive proof that neutrinos have a mass that is not zero.

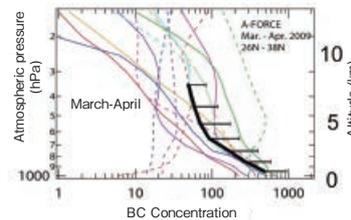


Science of the Global Atmospheric Environment

Yutaka Kondo
 Project Professor, National Institute of Polar Research, Research Organization of Information and Systems
 Professor Emeritus, The University of Tokyo

KAKENHI financial support
 Studies on physical-chemical processes of aerosol-cloud interaction (from fiscal 2005, Scientific Research (A)), etc.
 Funding by KAKENHI began in the late 1970s.

It has become clear that changes in the composition of the Earth's atmosphere caused by human activity have a great impact on the atmospheric quality and climate that enables human survival. Comprehending the distribution of atmospheric composition and elucidating the processes governing its change are tasks of growing importance. In the 1990s, however, no reliable methods of measurement had been established for use in such tasks.



Altitude distribution of BC concentrations, measured with a high-precision BC particle measurement device employing a laser-induced incandescence technique, fitted on an aircraft. These observations enabled assessment of the indeterminacies in a model for estimating the climatic impact of aerosols, which made a major contribution to the IPCC Fifth Assessment Report. (The IPCC is the United Nations' Intergovernmental Panel on Climate Change.)

Research Outcome

- Committed to the basic principle of observation, in other words, the consistent pursuit of high-precision measurement, Professor Kondo played leading roles in joint research projects both in Japan and internationally, while performing balloon-borne, aircraft-borne and terrestrial observations in various parts of the world using measurement apparatus he developed himself.

- The research elucidated the realities of aerosols in the atmosphere, especially the black carbons (BC) that contribute to global warming, and shed light on their climatic impact. It also contributed greatly to the explication of other important issues in this field, including the destructive mechanisms of stratospheric ozone, and a unified understanding of the processes of ozone chemistry, which hold the key to the environment of the troposphere.

Further developments from research achievements

Terrestrial and aircraft-borne observations in Asia and the North Pole region based on the methodology established in this research can be used to advance understanding of the carriage of aerosols from their source, their processes of conversion, and their processes of elimination through rainfall. Comparison of observations and models allows the development of greater precision in estimation of the climatic impact of aerosols, which is expected ultimately to make great contributions to increasing the precision of climate change predictions.



For his immense contributions to the science of the global atmospheric environment, Professor Kondo was awarded the Medal with Purple Ribbon (2012) and the Japan Academy Prize (2015)
 Image: The Japan Academy



Grassroots Globalization in Peripheral Society

Hiromu Shimizu, Professor Emeritus, Kyoto University;
Specially Appointed Professor, Kansai University

The Cold War came to a close at the end of the 1980s, and globalization progressed rapidly from the 1990s onward. In order to understand the impact of these changes at the grassroots level and how ordinary citizens responded, fieldwork was conducted almost every year since 1998 in Hapao, a remote village home to the Ifugao indigenous people in the mountains of Northern Luzon.

Research Outcomes

Hapao is where Japanese army's main troops under the command of General Yamashita barricaded themselves for three months at the end of the Pacific War. For around ten years from the latter half of the 1970s, it was under the effective control of the New People's Army, part of the Communist Party of the Philippines. Over the past 20 years this remote village has experienced globalization with around 180 residents, or 10 percent of its total population, migrating to 30 countries to work. This research shed light on the context for this change.

Income/remittances from migrant work has been used to cover the costs of children's education and the construction of new homes, as well as funding a revival in traditional rituals, which are conducted in grand style. At the same time as moving across a global social and economic network, villagers have revitalized the local traditional culture, becoming a new type of "glocal" people. The research has analyzed this process in detail and explicated the dynamism of grassroots globalization.



The rice terraces of the research site Hapao were registered as UNESCO World Heritage in 1995.



Receiving a memento from the host after presenting at an ASEAN International Symposium held at Naresuan University in Thailand (2015)

KAKENHI financial support

Developmental Process of Island Southeast Asia and Peripheral World (from fiscal 2002, Scientific Research (A), etc.)

KAKENHI funding began in the 1990s

Further developments from research achievements

· Research outcomes were published in a book *Grassroots Globalization* (in Japanese, Kyoto University Press, 2013), which received the 11th Japanese Society of Cultural Anthropology Award (2016). An English-language version of this book is currently in preparation (Trans Pacific Press 2018) using a Grant-in-Aid for Publication of Scientific Research Results.

· In the Cold War era, the Philippines' economic development was not as smooth as other ASEAN member countries. In line with the rapid advancement of globalization, however, it has begun to achieve strong economic growth. In Japan, on the other hand, the collapse of the economic bubble and the onset of globalization progressed concurrently, causing a protracted economic downturn. Plans are now being made for a research project that develops the micro-level insights gained in Ifugao to compare strategies and approaches to globalization in Japan and the Philippines.



Professor Shimizu's research on grassroots globalization was recognized in 2017 with a Japan Academy Prize.

Photo: The Japan Academy



The Bio-Sonar System of Bats

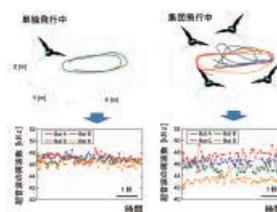
Shizuko Hiryu, Professor, Doshisha University

Also known as "Bio-Sonar," bats possess an advanced capacity for ultrasonic sensing. However, accurate measurement of their acoustic behavior is difficult, and until now little was known of their sensing mechanisms when flying in groups and foraging in the wild. Insights in these areas are expected to find practical applications in the engineering field.

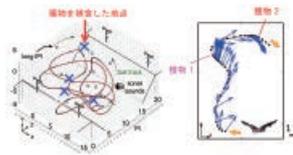
Research Outcomes

· Developed a telemetry microphone which could be mounted on bats, enabling measurement of ultrasound emitted by bats in flight and the returning echoes.
· Arranged a large-scale microphone array outdoors, and succeeded in measuring three-dimensional flight paths of wild bats when foraging and the orientations and directional characteristics of their emitted ultrasound.

· One of the discoveries from the research was that bats flying in groups avoid interfering with one another's signals by adjusting the frequency of the emitted ultrasound.
· It was found that by adjusting the "acoustic gaze" and "beam width" of their ultrasound, bats foresee the location of their prey and select efficient flight paths.



Change in the frequency of ultrasound of bats when flying alone and when flying in groups. In groups, each bat adjusts its own frequency to avoid overlap with others.



Flight path of wild bats when feeding (left) and the "acoustic gaze" of their ultrasonic waves when continuously hunting prey in a short period of time (right). This shows how bats grasp the location of their next prey in advance.

KAKENHI financial support

Investigation of real-time spatial search algorithms by active sensing of bats using ultrasound (from fiscal 2012, Young Scientists (A), etc.)

KAKENHI funding began in the second half of the 2000s

Further developments from research achievements

· Verifications and simulations in an actual field using an autonomous vehicle are revealing that the bats' use of ultrasound and the mechanisms of their sensing behaviour is based on a variety of schemes to achieve more robust sensing within a simple system.
· Through advanced behavioral measurement and modelling, the research aims to propose and pursue engineering applications for new navigation algorithms modelled on the active sensing of bats, which interpret the intentions, judgments, and other advanced strategies of higher-order animals.



For her research on the bio-sonar system of bats, Professor Hiryu was awarded the Minister of Education, Culture, Sports, Science and Technology's Young Scientists' Prize (2013) and the JSPS Prize (2017).

Photo: Japan Society for the Promotion of Science



Mineral Transport Systems in Crops

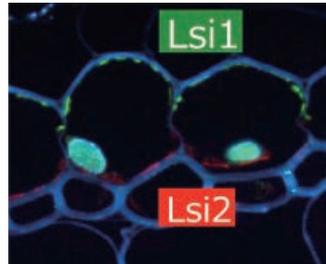
Jian Feng Ma, Professor, Okayama University

Transport of mineral elements in crops affects not only crop productivity but also our own health. Prior to this research, however, few of the transporters for mineral elements had been identified, and understanding of the transport system at the molecular level was limited. With a focus on rice, this research used a variety of methods to start identification of mineral transporters and understanding of their regulation mechanisms.

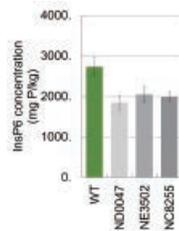
Research Outcomes

- The transporters necessary for the uptake of silicon, manganese, and other elements in rice were identified. The polar localization of these transporters was found.
- Transporters involved in the accumulation of toxic elements such as arsenic and cadmium were identified and their roles were elucidated.

- Roles of rice nodes in mineral element distribution were clarified and transporters involved was identified and functionally characterized. Moreover, mathematical models of distribution were developed.
- Numerous genes involved in the aluminum tolerance of rice, barley, and other crops were identified, and their expression regulation mechanisms were elucidated.



Transporters Lsi1 and Lsi2, necessary for the uptake of silicon in rice.



Knockout of a phosphate transporter located at the rice nodes results in a decrease of around 20% in phytic acid concentration, reducing the loss of phosphorus into the environment and alleviating the inhibition of absorption of minerals such as zinc and iron by humans.

KAKENHI financial support

Integrated analysis of mineral transport system in crops (from fiscal 2016, Specially Promoted Research, etc.)

KAKENHI funding began in the 1990s

Further developments from research achievements

- Identify unknown transporters involved in various processes of mineral transport in plants, and characterize their functions and structures.
- Use mathematical modelling to construct individual-level transport systems, and achieve an perform integrated analysis of mineral element transport systems in plants.
- Anticipated outcomes include breeding of mineral stress-tolerant crops, highly safe, toxic mineral-free crops, and crops with high nutrient-use efficiency through manipulation of transporters.

Professor Ma has received numerous prizes including the JSPS Prize, Kihara Memorial Foundation Academic Award, and the American Society of Plant Biologists Corresponding Membership Award.



Professor Ma received a Japan Academy Medal (2006) for his Studies on Tolerance Mechanisms of Mineral Stresses in Higher Plants.

Photo: The Japan Academy



International Comparative Research on Recovery and Livelihood Reconstruction of Disaster Victims

Kumiko Yamaji
Visiting Researcher, Osaka Prefectural University

This research involved conducting surveys in collaboration with other researchers and practitioners both in Japan and internationally. It was informed by the lack of interdisciplinary, longitudinal international comparative studies dealing with developed countries in the field of disaster research.

Research Outcome

- Comparative surveys of recovery systems and field surveys in countries including Japan, the United States, South Korea, Taiwan, and Italy revealed that the characteristics of Japanese support systems for disaster victims are centered on the head of a household as defined in the Disaster Victim Certificate (according to the damage of housing), and that there is a need for more support for other household members.
- Problems of disconnection between disaster victim support and social welfare system were revealed in relation to "the victim support regime in Japan", and proposals were made for addressing these problems.
- Problems were identified in eligibility for residence in post-disaster public housing and support for the development of newly resident communities.
- Empowerment schemes and programs were proposed for pre-disaster recovery planning for gender and diversity issues especially for women, and for non-Japanese nationals.
- Disaster storytellers (*Kataribe*) were connected and networks formed across a variety of disaster-affected areas in Japan.



Working with disaster victims to promote community development for disaster mitigation in areas unaffected or differently affected by disaster nationwide and advancing the internationalization of networks.



Great East Japan Earthquake "Recovery Café for Women" (Kesennuma City, Miyagi Prefecture)



National Disaster Storytelling (*Kataribe*) Symposium (Awaji City, Hyogo Prefecture)

KAKENHI financial support

Gender in Disaster Recovery and Disaster Reduction: An International Comparative study on Institutional Design and Livelihood Reconstruction (from fiscal 2013, Scientific Research (B)), etc.

Funding by KAKENHI began in 2010.

Further developments from research achievements

- Insights gained from the research were explained to the Study Group of the Reconstruction Design Council in Response to the Great East Japan Earthquake. Proposals were submitted to the national government and applied in various government programs.
- In terms of support for household members, deployment at an individual level unit was achieved under "the Disaster Victims Support System" of Disaster Victim Directory (a register of disaster victims developed by Nishinomiya City, Hyogo Prefecture)
- At research seminars, workshops, disaster recovery cafes, and symposiums within and beyond Japan, discussions were held with researchers and community members and the design of new systems considered.
- The outcomes were disseminated as issues for society as a whole, through international conferences, lectures given in various parts of Japan, appearances on television including NHK's *Shiten Ronten*, and newspaper interviews.



Studies on Automatic Speech Recognition of Meetings and Lectures

Tatsuya Kawahara, Professor, Kyoto University

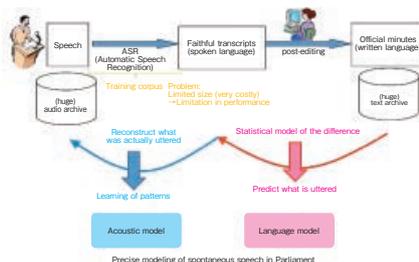
Automatic speech recognition (ASR) technology has been deployed in services such as voice search and speech translation by smartphones, but there was no highly accurate system for transcribing natural speech in human-human interactions (for example, question and answer sessions in Parliament), which have a high degree of spontaneity.

Research Outcome

Elaborate acoustic and language modeling from a huge database of meetings and lectures, consisting of speech audio, transcripts, and minutes, was investigated for automatic speech recognition technology.

Future research challenges

Further improvement of accuracy and applications to general, academic, and classroom lectures.



Overview of the ASR model training

Features of the automatic speech recognition technology:

As it is capable of semi-automated incremental training, changes in the composition of speakers and topics can be automatically taken into account in the acoustic and language models for continuous improvement.

KAKENHI financial support

"Structure extraction and visualization of spontaneous speech communication" (from fiscal 2007, Scientific Research (B)), etc.

Funding by KAKENHI began in the 1990s.

Further developments from research achievements

- Adopted in the meeting transcription system in the Japanese House of Representatives. In all plenary sessions and committee meetings, audio data captured in the meeting rooms are automatically transcribed and an initial draft of the verbatim record is generated. With a recognition accuracy of about 90% and ability to delete fillers, the system has streamlined the process of the meeting record creation by parliament stenographers.
- The technology is licensed to companies that want to develop meeting transcription systems. Moreover, new services to caption audio media for the hearing-impaired or non-Japanese speakers are being investigated.



Study of Liquid Electrode Plasma

Yuzuru Takamura, Professor,
Japan Advanced Institute of Science and Technology

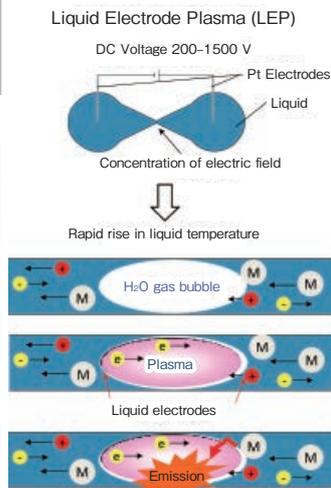
· The growing needs for analysis of minute amounts of elements in fields such as safety and health management have created a demand for simpler analysis devices.

Research Outcome

· This research clarified the properties of liquid electrode plasma, a microplasma generated when liquid is put into a narrow-center microfluidic channel and high-voltage DC pulses are applied at both ends. Using this principle, a liquid electrode plasma method was established for easy and high-sensitive analysis of the elements and their concentration in a sample solution based on the wavelength and the intensity of light emitted from the plasma.

· The method does not require high power and plasma gas, which prevented downsizing, making possible an ultra-compact, lightweight elemental analyzer.

Principle of Liquid Electrode Plasma



KAKENHI financial support

"Development of integrated biochemical chip using electroosmotic linear stepping actuator" (from fiscal 2001, Scientific Research (B)), etc.

Funding by KAKENHI began in the late 1990s.

Further developments from research achievements

- The research results led to development of a small, low-cost, and portable elemental analyzer, enabling quick, on-site high-sensitive measurement of more than 40 elements, including mercury and cadmium, which previously could be analyzed only in laboratories with large-scale analysis equipment.
- Currently, an elemental analyzer is being developed for direct on-site measurement of toxic metals in food, well water, soil, factory effluent, and waste materials. Such a device will be useful in monitoring heavy metals and other types of environmental pollution.



Ultra Compact Elemental Analyzer
(Photo: Micro Emission Ltd. website)



Studies of the Applications of High-Voltage Pulsed Power and Plasma

Koichi Takaki, Professor, Iwate University

Developed a pulsed power generator and carried out measurements, numerical analysis, and other studies on plasma generation in order to optimize high-voltage pulsed power circuit for its applications, and to control the discharge plasma temporally and spatially.

Research Outcome

Developed a compact high-voltage pulse generator as a tool for experimental research on plasma remediation of polluted water and gas exhausted by the combustion engine.

Achievements or advances not anticipated at the start

In a collaborative study with a forestry association and mushroom farmers in Iwate Prefecture, when electrical stimulation was applied to Shiitake mushroom-cultivated logs, the harvest yield increased twofold.



Upper log: Without high-voltage stimulation
Lower log: With high-voltage stimulation

- A compact high-voltage pulse generator has been developed with collaborative companies and marketed commercially.
- Utilizing Prof. Takaki's research work, a company collaborated with Ehime forestry association has developed and marketed a high-voltage electrical stimulation machine to increase mushroom yield.

KAKENHI financial support

"Plasma production by capacity-coupled multi-discharge and its control" (from fiscal 2004, Scientific Research on Priority Areas), etc.

Funding by KAKENHI began in the 1990s.

Research on agricultural applications

- Studying the use of plasma discharge in water for sterilization and vegetable growth promotion, with promising applications to hydroponic systems in plant factories.
- Studying decomposition and removal of ethylene gas by nonthermal plasma, with the aim of commercialization of a technology for keeping freshness of vegetables and fruits during transportation.
- Studying technologies to preserve fresh foods such as agricultural and marine products using pulsed electric fields.

Research on environmental applications

- Studying the use of discharge plasma to purify and remove pollutants from the gas stream.
- Studying the use of plasma in water to purify and decompose pollutants as a promising new method of water remediation.

100th
Anniversary

科研費
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研究者と共に百年。これから先も。

Contact information for KAKENHI:

Scientific Research Aid Division, Research Promotion Bureau, Ministry of Education, Culture, Sports, Science & Technology

3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo 100-8959

Tel: +81-3-5253-4111 (Reception) (ex. 4087, 4094) (Scientific Research Funding, etc.)

Fax: +81-3-6734-4093

URL: http://www.mext.go.jp/a_menu/shinkou/hojyo/main5_a5.htm

Research Program Department, Japan Society for the Promotion of Science (Research Aid Planning Division, Research Aid Division I, Research Aid Division II)

5-3-1 Kojimachi, Chiyoda-ku, Tokyo 102-0083

Tel: +81-3-3263-0964, 4796, 0976, 1431

Fax: +81-3-3263-9005

URL: <https://www.jsps.go.jp/english/e-grants/index.html>

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