

**National Natural
Science Fund
Guide to Programs
2018**

**National Natural Science
Foundation of China**

Brief Introduction

The *National Natural Science Fund Guide to Programs 2018*, in accordance with the *National Natural Science Foundation Regulations* and relevant documents on program management, gives instructions on the application requirement and research integrity requirement, and explains the definition of application quota and introduces the funding policies for various types of programs in 2018. It provides applicants with useful guidance on making independent selections of topics to seek support from the National Natural Science Fund. The Guide introduces the exploration, talent, instrument and convergence program categories in separate sections. It is an important basis for the allocation of the National Natural Science Fund, and also a must-read reference for applicants.

This book can be used as a reference for researchers in universities and colleges of higher education and research institutions, and for people working in areas of S&T management and policy research.

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Foreword

The 19th National Congress of the Communist Party of China was convened triumphantly. Socialism with Chinese characteristics has entered a new era. This is the new historical position for China's development. The report of the 19th National Congress fully affirmed the great achievements in scientific and technological innovation, stressed the important position and function of scientific and technological innovation in building China into a modern powerful country, put forth clear deployments and requirements for building an innovation-oriented country and elevated basic research to a more prominent position in this great task. The National Natural Science Foundation of China (hereinafter abbreviated as NSFC) will earnestly implement the spirit of the Party's 19th National Congress, be guided by President Xi Jinping's Socialist Thoughts with Chinese Characteristics for the new era, fully implement the new requirements for basic research and science fund development in the new era, adheres to the strategy of "supporting basic research and scientific frontier exploration, supporting talent and team building, strengthening China's original innovative capability", and the evaluation principle of "relying on experts, promoting democracy, funding excellent research, and advocating fairness and justness".

NSFC's funding portfolio consists of 4 categories of programs, namely, Exploration, Talent, Instrument and Convergence, with respective preferential focuses, constituting an integrated funding instrument of the National Natural Science Fund. The Exploration Program aims at achieving innovative results in basic research, fostering a balanced and coordinated development of disciplines with special emphasis on certain key areas, stimulating original innovation. Through funding young researchers to conduct independent research and assisting researchers in regions weak in basic research, Talent Program is targeted at nurturing outstanding academic backbones, top talents and innovative research teams and enhancing China's S&T competitiveness in the future. Instrument Program aims at strengthening research facilities, especially increasing support for the development of indigenous scientific instruments, expanding research areas and promoting source research. Convergence Programs caters to scientific frontiers and national needs, focuses on major

issues in basic research, promotes disciplinary crossing and merging, integrates the limited resources, gathers and cultivate high-level talents and builds a highland for scientific research, while channeling social resources, solving common issues in basic research and promoting the independent innovation capabilities in relevant fields, industries or regions.

Until Dec. 14th, 2017, a total of 202,248 proposals were received by NSFC. Following the standard review procedures, a total of 18,136 projects of the General Program, 667 projects of the Key Program, 40 projects of the Major Program, 535 projects of the Major Research Plan Program and 107 projects of the Key International (Regional) Joint Research Program, 370 projects of MoU-based International (Regional) Joint Research Program, 17,523 projects of the Young Scientists Fund, 3,017 projects of the Fund for Less Developed Regions, 399 projects of the Excellent Young Scientists Fund, 198 projects of the National Science Fund for Distinguished Young Scholars, 38 new projects, 9 extended projects after 6 years of the Science Fund for Creative Research Groups, 142 projects of the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao, 83 projects of the Special Fund for Research on National Major Research Instruments (Free Application), 5 projects in the Special Fund for Research on National Major Research Instruments (Department Recommendation), 793 projects for Joint Funds, 155 projects of the Research Fund for International Young Scientists and 543 projects for International (Regional) Exchange Programs were granted. For more information about the submission and funding decisions of the proposals, please refer to the relevant chapters of this *National Natural Science Fund Guide to Programs 2018* (hereinafter abbreviated as the *Guide to Programs*).

In order to reflect the principle of openness, fairness and justness and help scientists better understand NSFC's funding policies, the *Guide to Programs* is published to all applicants for selecting proper categories of programs, research topics, areas and directions when they apply for the NSFC funds.

This *Guide to Programs* mainly introduces the application of various types of projects submitted during the centralized reception period of 2018. After the foreword, it focuses on the information on the application, scientific research integrity, budget request and application limits of various types of programs. It is hoped that applicants read them carefully. The overall funding statistics and priority areas of General Program, Key Program, the Young Scientists Fund, and the Fund for Less Developed Regions will be introduced according to the order of NSFC's scientific departments respectively. For the General Program, in addition to the overall funding statistics, the funding

principles and specified requirements as well as notes on applications are introduced too. Other types of programs are introduced in general terms. Special requirements for each of them are introduced in the main text of this *Guide to Programs*.

Calls for proposals not included during the batch application period will be announced at NSFC's website (<http://www.nsf.gov.cn>). Applicants and host institutes are advised to pay due attention.

NSFC will continue to strictly follow the requirements of the Regulations on the National Natural Science Fund and relevant guidelines for program management, standardize management procedures and optimize the peer review mechanism, strictly observe pertinent regulations on conflict of interest and confidentiality, and sincerely cherish the supervision from the scientific community and the general public. All researchers are welcome to submit high-quality applications for the National Natural Science Fund.

Editorial Committee

Dec. 15, 2017

Information on Application

In applying for NSFC funds in 2018, applicants and their host institutions should comply with the following provisions:

I. Eligibility for applicants

1. As the principle investigator, the applicant should comply with Article 10 Item 1 of the *National Natural Science Foundation Regulations* (hereinafter referred to as *Regulations*), i.e., the applicant has (1) the experience of undertaking basic research program(s) or other basic research activity; (2) a senior academic rank (title) or a doctoral degree, or recommendation from two researchers who are in the same research field and have a senior academic rank (title). Besides, those who apply for certain categories of programs shall meet other specific requirements. (For more information, please refer to the text of this *Guide to Programs*.)

When domestic or overseas applicants not employed full-time at their host institutes submit the applications, he or she should provide the copy of the employment contract from the host institute and the statement (with seal from the personnel department of the host institute) for his or her position, employment period and working hours per year together with the hard copy of application form.

The applicants for the Fund for Less Developed Regions should be full-time employees in the specified host institutes (for more information, please refer to the section on Fund for Less Developed Regions in this *Guide to Programs*), or the technical personnel following national policy and sent by the Central Organization Department on the 3-year or longer aiding mission in Xinjiang and Tibet, who should provide the supporting materials of the aiding mission issued by the Department or the personnel department of the aided institutes. Part-time employees in the specified host institutes, technical personnel from the specified host institutes affiliated under Chinese People's Liberation Army or the excluded host institutes are not qualified to apply for the Fund for Less Developed Regions.

2. When a researcher conducting basic research satisfies the requirements

as prescribed in the preceding paragraph but has no employer or does not work in a host institution, on the condition that he or she has obtained the consent from a registered supporting institution, he or she is able to apply for the General Programs and Young Scientists Fund, but cannot apply for other Programs.

Under this circumstance, the applicant shall fill in the authentic personal information in the basic information page of the proposal and research experiences in CV, together with the agreement signed with the supporting institution (for more information please refer to the *Management Methods of National Natural Science Funds*) in the hard copy of the application form.

3. Students pursuing the postgraduate degree (not obtained by the deadline for NSFC submission) cannot apply for any fund as the Principle Investigator. However, with the supervisor's consent, in-service personnel can apply for certain categories of programs through the employment institution. The applicant should submit the hard copy of application with the following attachments: signed certification of the supervisor's consent which explains the connection between the dissertation and the proposal, and the guarantee of working hours and conditions after the project starts, etc.

In-service personnel pursuing postgraduate degrees can apply for the following program types: General Program, Young Scientists Fund, and Fund for Less Developed Regions. But in-service personnel pursuing the master degree cannot apply for Young Scientists Funds.

4. Researchers outside mainland China and not employed at the supporting institutions in the mainland cannot apply for NSFC programs. Those who are employed at the supporting institutions cannot apply for or participate in NSFC programs both as the international or regional collaborator and domestic researcher at the same time. If the researcher has the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao projects, or the International (Regional) Joint Research project (including Key International (Regional) Joint Research Program and International (Regional) Joint Research Program under Agreements/MoUs) as the foreign Principle Investigator, he or she cannot apply for other types of program as the Principle Investigator before these projects are completed, vice versa. If the applicant has on-going projects other than these two types, he or she cannot apply for the Overseas Chinese Scholars and Scholars in Hong Kong and Macao Program or participate in the International (Regional) Joint Research project (including Key International (Regional) Joint Research Program and International (Regional) Joint Research Program under Agreements/MoUs) as the foreign principle

investigator.

5. Researchers employed at postdoctoral research centers can apply for the following programs only: General Programs, Young Scientists Fund and Programs of Joint Funds. In the process of applying for these funds, the applicant should present the supporting institution's written guarantee that within the funding period the applicant will continue the research before or after he or she leaves the postdoctoral research centers. The guarantee shall be attached to the paper proposal form.

6. Researchers with on-going National Social Science Funds as the principle investigator cannot apply for any NSFC funds other than the National Science Fund for Distinguished Young Scholars. Within the same year, applicant for the National Social Science Funds cannot apply for any NSFC funds.

II. The application requirements

1. Prior to the writing of the proposal, the applicant shall carefully read the *Regulations, Guide to Programs, Management Methods of National Natural Science Funds*, management regulations on various programs, and relevant notice and announcements. In case of a conflict between the existing management regulations and the *Regulations* or this *Guide to Programs*, the later ones shall prevail.

2. The proposal shall be prepared by the applicant in person and in accordance with the outline. The applicant and the main participants should fill in their CVs accordingly. Caution against revealing any content contrary to law or confidentiality. The applicant shall be responsible for the authenticity and legitimacy of the proposal submitted.

3. In accordance with program types, the applicant shall make correct choice of the "funding category", "subclass introduction" and "annotation". Content that requires "choosing" can only be chosen in the pull-down menu; content that requires "filling out" can be written in words; some program's annotation attachments should be written strictly in accordance with this Guide.

4. For 2018, some modifications have been made on the application codes. Code should be chosen in accordance with the research direction or research field and the "National Natural Science Foundation Application Code" in this *Guide to Programs*' appendix. Much attention shall be paid to:

(1) When choosing the code, try to select the full code including the last digit (six or four digits).

(2) The first application code is reference for deciding NSFC's accepting

department and selecting the panel experts. The second application code is supplementary. For some programs, the first or the second application code are designated.

(3) The Key Programs, Major Research Programs and Program of Joint Funds, etc., have special requirements for the application code. For details, please refer to the relevant sections in this *Guide to Programs*.

(4) NSFC further promotes the standardization of “application code”, “research direction” and “key word”. Applicants should accurately select “application code 1” and the corresponding “research direction” and “key word” when filling out the proposal form.

(5) For any questions, please contact departments concerned.

5. The hard copy of application (except for the type of pilot paperless application) should be signed by the applicant and major participants. For participants outside the supporting institution (including post-graduates), their work places are seen as cooperative research institutions whose information shall be included in the proposal’s basic information form and whose official seal should be included on the sign and seal page. The name of the institution and that on the seal shall be identical. The official seal should be used, if the institution is registered at NSFC, and the corporate seal should be used if otherwise (except for the type of pilot paperless application).

The foreign researchers as the major participants shall be seen as individual participants and their foreign work places should not be seen as collaborative research institutes. If the researcher is unable to sign in person, a paper document with the signature and stating his or her consent to participate and perform the related responsibilities shall be sent via mail or fax and submitted with the paper form proposal as attachments (except for the type of pilot paperless application).

The number of any proposal’s cooperative institutions shall not exceed two (unless specified otherwise).

6. In 2018, for Key Programs and Excellent Young Scientists Fund, pilot paperless application is carried out. In process of the submission, the supporting institution shall only confirm the online application and the attachments, without having to submit a paper form application. After the project has been approved, the signature and seal page of the application form should be submitted at the time of submitting the project plan. The signature and seal information should be consistent with that of the electronic application.

7. In the proposal, the applicants and the major participants with a senior academic rank (title) shall indicate in the CV if:

(1) They have more than one supporting institution when applying or participating in NSFC projects in one year;

(2) They have different supporting institutions for on-going NSFC projects.

8. If a research has received funding through other sources, the applicant should specify the funding details and their difference and connection with the current proposal. Applying for funding from different funding agencies for the same research content should be avoided.

If an applicant applies for different types of NSFC programs during the same year, he or she should specify in the application the other NSFC program applications, their titles and information, and the connection and difference with the current application.

9. The start time for research in proposal shall be Jan. 1st, 2019; the finish time shall be Dec. 31st, 201x, depending on the funding periods (unless otherwise specified in this *Guide to Programs*). Researchers at postdoctoral research centers as the applicant should fill out the closing date as the Dec. 31st of the year the project is completed with written guarantee from the supporting institution.

10. The applicant and the major participants should use the same and only identification for application.

Applicants and major participants should use the same identification for application. If they have received funds using other identification as the applicants or major participants, they should explain in the proposal. If not, they will be treated as misconduct and their supporting institutions are responsible for verification.

III. About the supporting institutions' responsibilities

1. The supporting institutions should strictly abide by the *Regulations*, *Guide to Program*, *Working Management Methods for Host Institutes*, other relevant notices and management methods and Funding Management Method, Budget Preparation Notes and Notes on National Natural Science Foundation of China Program Budget Form.

2. The supporting institution is responsible for the proposal's authenticity and integrity, and the qualification of the applicant. No confidential content should be included in the proposal.

3. If the supporting institution allows the applicants without work or whose work place is not registered to apply for funds as listed under *Regulations*

Article 10 Item 2, it shall bear the *Regulations*' relevant responsibilities as listed in Article 13, sign the written contract and attach it to the paper form proposal.

4. The supporting institution should provide written guarantee for researchers in postdoctoral research centers that the applicants will continue to continue the research before and after he or she leaves the research center. Each written guarantee should have the institution's seal and be attached to the proposal.

IV. About application reception conditions

According to the *Regulations*, the application for NSFC funds shall not be accepted in case of any of the following circumstances:

1. The applicant does not comply with the conditions of the *Regulations*, *Guide to Programs* and relevant management methods.
2. The application materials do not comply with the *Guide to Programs*' conditions.
3. The number of proposals does not comply with the Application Limit's conditions.

Scientific Integrity

In order to strengthen the construction of NSFC's scientific research integrity, standardize the application of science fund projects, ensure that the basic information is true and accurate, and prevent scientific research misconducts, the following requirements on scientific integrity are proposed for applicants, participants and supporting institutions during the preparation of applications:

I. About personal information

1. The science fund project should be applied by the applicant himself or herself. Applying under another's name is strictly forbidden, and fabricated applicants and participants are also forbidden.

2. The applicant and the participants shall truthfully fill in the personal information and be responsible for its authenticity; at the same time, the applicant shall also be responsible for the authenticity of the personal information of all the participants. It is forbidden to forge or provide false information.

3. Applicants and participants should fill in the academic degree information which is consistent with the degree's diploma. The time for degree acquisition should be based on the diploma date.

4. The applicant and the participants shall faithfully and accurately fill in the employment information of the formal employment. Forgery or providing false title information is forbidden.

5. If the applicant has no work unit or the unit is not registered as the supporting institution, the applicant should truthfully fill in the work unit and the employment information. False information is strictly prohibited.

6. Applicants and participants should faithfully and accurately complete their resumes. It is forbidden to forge or alter relevant information.

II. About the research content

1. The applicant shall fill out the main body of the application in

accordance with the *Guide to Programs* and specifications and requirements on outline writing, and faithfully fill in relevant research work and research contents. Plagiarism or fraud is strictly prohibited.

2. When filling in the research achievements such as dissertations, patents and awards, the applicant and participants shall strictly follow the requirements of the outline writing, standardize the authors' names of all the research results listed, mark them accurately, and shall not alter the author's order or falsely mark First or Corresponding Author.

3. Applicants and participants shall strictly abide by the academic norms and codes of conduct recognized by the scientific community and shall not include scientific misconducts such as forgery, tampering, plagiarism, entrusting "third party" to compose or submit the proposal, and peer review fraud in process of applying for science funding. Studies involving scientific ethics should provide ethics evidence of the institutions concerned.

4. The applicant shall not submit the funded projects to the same scientific department or different scientific departments for repeated applications; the applicant shall not submit the same or similar application to the same scientific department or different scientific departments for different types of projects. The applicant employed at more than one supporting institutions shall not submit the same project under different supporting institutions. Projects with the same or similar contents shall not be submitted under different applicants.

5. If the research content has been funded by other channels or projects, it is crucial to state in the application the status of the subsidy and the difference and connection with the submitted project. Applicants should avoid submitting the same content to different funding institutions.

III. The relevant requirements

1. The applicant shall inform the participants of the relevant contents of the application and the scientific integrity requirements, so as to ensure that the participants fully understand the relevant contents of the application and are responsible for the authenticity, completeness and compliance of the contents involved.

2. The supporting institution shall be responsible for the applicant's eligibility for application and shall examine the authenticity, completeness and compliance of the application materials.

VI. About accountability

1. If the applicant or the participant violates the above requirements, upon discovering, the NSFC will handle the case in light of its seriousness and in accordance with the provisions of the *Regulations* and the *Guide to Programs*; if there is any faking, falsification, plagiarism, “third party” writing or submitting the research results or peer review fraud and other scientific misconduct, the case will be transferred to NSFC Supervision Committee for further investigation.

2. If a supporting institution fails to fulfill the examination of authenticity, completeness and compliance of the application materials, NSFC will, in accordance with the *Regulations*, *Guide to Programs*, *National Natural Science Foundation Supporting Institution Management Measures* and other provisions, deal with the case depending on its severity.

Application Limit

I. Application limit in general

(1) Applicants shall only apply for one type of program once in a year, excluding the Integrated Program and Strategic Research Program in the Major Research Plan, and the International (Regional) Exchange Program; for Joint Funds, the same type refers to the same program title.

(2) Applicants cannot apply for the same type of program if in the previous year he or she received funding for the General Program (including one-year program), Key Program, Major Program, Major Research Plan Program (excluding the Fostering Program and Strategy Research Program), Program of Joint Funds (referring to the Joint Fund with the same name), Fund for Less Developed Regions (including one-year program), International (Regional) Cooperation and Exchange Programs (unless otherwise notified) and National R&D Program for Major Research Instruments.

(3) The total number of National R&D Program for Major Research Instruments (department recommendation) and Basic Science Center shall be counted as one.

II. One-year suspension from application after unsuccessful application for the General Program for two consecutive years

Applicants with unsuccessful application for the General Program both in 2016 and 2017 (including eligibility rejection) cannot apply for the General Program as the principle investigator in 2018.

III. Restriction on the total number of projects for researchers with a senior academic rank (title) applying for and undertaking

The total number of the following programs the researcher with a senior academic rank (title) applies for (including the applicant and the major participant) and undertakes (including the applicant and the major participant) shall not exceed three: General Program, Key Program, Major Program, Major

Research Plan (excluding the Fostering Program and Strategy Research Program), Program of Joint Funds, Young Scientists Fund, Fund for Less Developed Regions, Excellent Young Scientists Fund, National Science Fund for Distinguished Young Scholars, Key International (Regional) Joint Research Program, International (Regional) Joint Research Program under Agreements/MoUs with direct cost more than 2 million yuan/project (only the principle investigator are counted, the major participants are not counted), National R&D Program for Major Research Instruments (including Special Fund for Major Research Instruments and Special Program of National Major Research Instruments), Excellent State Lab Research Program and Emergency Program over one year (unless otherwise specified; and except for the bureau (division) commissioned task and soft research project).

During the stage of application, Excellent Young Scientists Fund and National Science Fund for Distinguished Young Scholars are not counted, but are counted before receiving NSFC's formal funding decision and after approval.

Limit on the number of Instrument Program: the number of National R&D Program for Major Research Instruments (including Special Fund for Major Research Instruments and Special Program of National Major Research Instruments) a researcher applies for (including applicants and major participants) and undertakes (including principle investigator and major participants), and the National Major Instrument Equipment R&D Program by Ministry of Science and Technology should not exceed one; After the National R&D Program for Major Research Instruments (recommended by the department) is funded, the principle investigator cannot apply for any other NSFC funds other than the National Science Fund for Distinguished Young Scholars before the program terminates.

During the stage of application, Basic Science Center Programs are not counted. After approval, the PI and major participants (key members) cannot apply for any NSFC grants before the Centers Programs are completed except National Science Fund for Distinguished Young Scholars, neither can they use similar materials to apply for any S&T Programs.

IV. Limit for researcher without a senior academic rank (title)

1. The total number of project the researcher applies for or undertakes as the principle investigator should not exceed one. During the stage of application, the Excellent Young Scientists Funds and National Science Funds for

Distinguished Young Scholar are not counted. They are counted after the formal application and before NSFC makes the final funding decision, and also after the approval. The principle investigator of the Young Scientists Fund can apply for the General Program in the last year of the Fund.

2. Under the premise of adequate time and energy, the total number of projects the researcher applies for or undertakes as the major participant is not limited.

V. The limit on the principle investigator for accumulated number of funding

1. For Young Scientists Fund, Excellent Young Scientists Fund, National Science Fund for Distinguished Young Scientists, Science Fund for Creative Research Groups, the applicant can receive the funding only once.

2. Beginning from 2016, for Fund for Less Developed Region Program, the applicant's accumulated number of funding cannot exceed 3. Projects approved before (including) 2015 are not counted.

VI. The programs not limited by the total number limit

There is no number limit for Science Fund for Creative Research Groups, Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao, Tianyuan Fund for Mathematics, International (Regional) Joint Research Program under Agreements/MoUs with direct cost of 2 million (or less) yuan/project, International (Regional) Exchange Program, Research Fund for International Young Scientist, Assigned and soft projects by bureaus and divisions in the Emergency Program, Projects which lasts for 1 year or less, and other programs specified in the individual Program Guide.

Special notice

1. During the evaluation period (prior to NSFC's final decision), the proposal shall be counted in the total number limit.

2. In the case that applicants engaged in multiple supporting institutions apply for or undertake through different supporting institutions, the Limit is still applicable.

3. In case the researcher receives the senior academic rank (title), the projects he or she undertakes as the principle investigator shall be counted into

the total number whereas those the researcher undertakes as the major participant shall not.

4. In case of an inconsistency between other management regulations and this Limit in terms of total project numbers, the latter shall prevail.

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General Program

General Program supports scientists to do basic research on bottom-up based topics within the funding scope of NSFC to conduct innovative research and promote a balanced, coordinated and sustained development of all disciplines.

Applicants should meet the following qualifications:

(1) With the experience of undertaking basic research projects or doing basic research;

(2) Have senior professional title or PhD degree, or are recommended by two professionals with senior academic positions (titles). Post graduate students are not eligible to apply for the General Program, but part time graduate students may apply through their employers if agreed upon by their supervisors.

Applicants should be familiar with the current situation of relevant research in China and the world, capable of leading a research group to conduct research. Applicants should follow the guideline to prepare proposals. The proposed research should be of significance and feature scientific merits, sound thematic basis, new ideas, identical objectives, reasonable and detailed research contents and feasible research schemes. The number of collaborative institutions for General Program projects should not exceed 2, and the duration of General Program projects is 4 years. (Only in-site post-doctoral researchers should determine the duration of the project based on the written commitment from the host institutions.)

In 2017, NSFC funded 18,136 General Program projects, with direct cost of 10.6859 billion yuan. The average funding intensity was 589,200 yuan per project. The number of funded projects increased by 1,202 over 2016 with an increase rate of 7.10%. The success rate was 22.59%, which is basically the same as that in 2016 (22.87%). Please refer to the sections of each department for detailed funding information about General Program projects. Applicants are advised to prepare their research proposals in line with the instructions by respective science departments on funding scale.

Please refer to the sections of each department for detailed funding information about General Program projects.

Funding of the General Program Projects in 2017

Unit: 10,000 yuan

Department	No. of applications	Awards				Success rate (%)
		No. of awards	Funding for direct cost	Average funding for direct cost	Share of NSFC total funding for direct cost (%)	
Mathematical and Physical Sciences	5,804	1,673	100,480	60.06	9.40	28.82
Chemical Sciences	6,577	1,671	107,630	64.41	10.07	25.41
Life Sciences	11,028	2,902	170,030	58.59	15.91	26.31
Earth Sciences	6,272	1,683	113,070	67.18	10.58	26.83
Engineering and Materials Sciences	14,706	3,085	185,120	60.01	17.32	20.98
Information Sciences	8,867	1,912	113,880	59.56	10.66	21.56
Management Sciences	4,072	755	36,240	48.00	3.39	18.54
Health Sciences	22,965	4,455	242,140	54.35	22.66	19.40
Total or average	80,291	18,136	1,068,590	58.92	100.00	22.59

Department of Mathematical and Physical Sciences

Mathematical and physical sciences studying deep level structures of matter and the laws of its motion are important foundations of natural science, and the precursor and basis for the development of contemporary science. In their own development, mathematical and physical sciences also provide theories, methods and means for other disciplines. Research findings in mathematics and physics play a key role in promoting the progress of both basic and applied scientific disciplines. Disciplines in mathematical and physical sciences are peculiar in characteristics, such as big differences between or among disciplines, and pure theoretical research (such as mathematics, theoretical physics, etc.) and experimental studies. Many disciplines in mathematical and physical sciences feature “mega-science”, such as high-energy physics, nuclear physics, astronomical physics, high temperature plasma physics, etc.

Mathematical and physical sciences have extensive interactions with other sciences, for example, with information science, life science and management science, physics with materials science, life science, information science and chemistry, astronomy with earth science, and mechanics with engineering science, material science and earth science. The interactions produce a series of interdisciplinary and cross-boundary disciplines and new research areas have emerged, and at the same time research objects and areas in mathematical and physical sciences are also expanding.

The Department will continue to increase its support on basic research that takes as its primary goals advancing the disciplinary development, promoting original innovation and training talented researchers and meeting the needs of national long-term development, as well as interdisciplinary research within the Department and with other departments.

In 2017, the Department received 5,804 applications for General Programs, which is 424 more than 2016, increasing 7.88%. 1,674 projects were funded with a success rate of 28.82%, and the funding per project was 600,600 yuan in average. The funding per project was 480,000 yuan for mathematics, 647,500 yuan for mechanics, 649,000 yuan for astronomy, 647,500 yuan for physics I and 647,500 yuan for physics II.

According to the strategic needs of the development of mathematical and physical sciences and the overall plan of project funding, the Department has taken some measures in project funding performance and has strengthened macro guidance. In 2018, the Department will continue to pay attention to the following aspects:

(1) Emphasize on fostering outstanding young talents. In 2017, the principal investigators under the age of 40 in General Program projects reached 52.00%. In 2018, the Department will further increase funding for young researchers and expand funding scale for applicants under age 40, so as to have more young scientists funded and improve their research capability.

(2) Give more emphasis on creative research and disciplinary development. Multi-level funding to suit the needs of research will be adopted. More funding will be given to studies on developing experimental methods and techniques with innovative ideas aiming to the actual needs. We advise applicant to pay attention to this policy.

(3) Strengthen macro planning, and give preferential support to basic problems in frontier areas and mathematical physics problems in areas of major national needs, so as to promote sustainable development in these areas.

In 2018, preferential support will be given to the following areas:

- (i) Key scientific problems in new types of energy;
- (ii) Key scientific problems in deep space exploration, aerospace, and marine sciences;
- (iii) Innovative research in defense and civil military integration;
- (iv) Basic mathematical physics problems in health;
- (v) Modeling, algorithm and analysis of big data and deep learning;
- (vi) Key technologies for physics and detection of gravitational wave;
- (vii) New computation method and standard software;

Funding for General Program Projects in Department of Mathematical and Physical Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Funding	Success rate (%)	Projects	Funding	Success rate (%)
Mathematic	Mathematics I	201	9,644	29.91	229	10,990	30.41
	Mathematics II	218	10,466	27.98	240	11,520	27.52
Mechanics	Basic problems and methods in mechanics	6	376	25.00	8	498	29.63
	Dynamics and control	62	3,945	28.97	67	4,276	28.76
	Solid mechanics	147	9,783	28.43	142	9,179	28.34
	Fluid mechanics	84	5,752	28.57	83	5,433	28.42
	Bio-mechanics	26	1,676	28.89	26	1,707	28.26
	Explosive and impact dynamics	37	2,423	28.03	37	2,411	28.91
Astronomy	Astrophysics	46	3,065	29.30	49	3,149	29.52
	Astrometry and celestial mechanics	38	2,521	29.01	38	2,497	28.79
Physics I	Condensed matter physics	212	13,940	28.84	217	14,085	28.78
	Atomic and molecular physics	41	2,648	29.08	49	3,170	29.34
	Optics	120	8,033	28.99	127	8,204	28.86
	Acoustics	33	2,245	28.95	45	2,901	29.03
Physics II	Fundamental physics and particle physics	78	4,678	30.95	84	5,047	28.97
	Nuclear physics, nuclear technology and its applications	86	5,846	27.74	97	6,195	28.53
	Particle physics and nuclear physics experimental facilities	65	4,594	26.97	69	4,972	28.40
	Plasma physics	51	3,410	31.29	66	4,246	30.14
Total		1,551	95,045	28.83	1,673	100,480	28.82
Direct cost per project		61.28			60.06		

(viii) Advanced method and key technology of experimental research and development of new instruments.

Please indicate the research directions in the note section of the application form when applying for these projects, and choose the proper application code.

(4) As the governmental investment in the National Natural Science Fund is changing, the average funding for mathematical and physical research projects will also be changed accordingly. Please see the following table for average funding intensity for General Program projects for reference. The funding intensity for experimental research projects will be higher than that of theoretical research projects.

In 2018, the average funding per project for General Programs will be the same as 2017.

Division of Mathematics

The Division of Mathematics encourages creative research on important issues in the mainstream and frontier of mathematics, explorations of new ideas, new theories and methods in mathematics and interdisciplinary applications, intercrossing of different branch disciplines with mathematics, and applied mathematical research on practical issues. Applicants are required to have sound research background and capability. Proposal should be prepared based on deep understanding of the current status of the research involved, main issues and relevant research methods and available approaches. The Division encourages researchers to consolidate research team, foster talents and promote academic exchanges through the funded research projects. Research direction adjustment is allowable when needed.

For basic mathematics, the funding aims at maintaining stable development of research directions where China is traditionally strong and has comparatively large-scale research capability, promoting fast development of research areas that are within the mainstream of international mathematical research but relatively weak in China, and promoting interdisciplinary research among branches of mathematics. Focus is given to algorithm, grid theory and its algorithm, geometrical method in representation theory, comparative geometry and geometric analysis in non-smooth space, application in of modern harmonic analysis in number theory, associate geometry and geometric measure, random analysis method and application, and mathematical problems in quantum field theory.

The funding for applied mathematics and computational mathematics aims at improving applications in solving practical problems, gives more emphasis on basic theory and new methods with strong practical background and sound potentials for application. NSFC encourages mathematical modeling of practical problems, analysis and computation, and statistical methods and theory for big data, support research on mathematical physical logic, algorithm complexity, discrete probability modeling, optimal algorithm, and combinational algorithm. Focus is given to applied researches such as mathematical modeling and theory of new materials, uncertainty theory in data processing, coding theory

and information security, mathematical modeling and analysis in environmental and energy sciences, bio information and life system, pathogenesis and control of infectious disease, mathematical methods for complex bio process and development of diseases, statistical methods in industry and medical science, statistical and optimization method in deep learning and artificial intelligences, modeling and analysis in economic prediction and financial risk management, and mathematical theory and new method for industrial, medical imaging and image processing.

When applying for interdisciplinary projects, applicants should choose the corresponding mathematical disciplines under Application Code I and the interdisciplinary disciplines under Application Code II.

Division of Mechanics

The Division of Mechanics mainly supports research on basic problems and methods in mechanics, studies in areas of branches of mechanics such as dynamics and control, solid mechanics, fluid mechanics, biomechanics, explosion and impact dynamics. The Division supports projects with creative ideas in the frontiers of mechanical research on the one hand and projects closely related to the sustainable development of economy, society and national security, and the development of engineering and technology on the other hand. The Division encourages experimental research using the available experimental facilities and key labs in China and advocates interdisciplinary research conducted by scientists from different disciplines.

Research on basic issues and methods in mechanics should focus on theoretical studies on mathematical methods, rational mechanics and physical mechanics, and strengthen the intercrossing with mathematics and physics.

Applications for research in areas of dynamics and control should pay attention to the theory and methods of nonlinear dynamics, strengthen research on vibration and control of complex systems, dynamic modeling and analysis of problems involving the coupling of solid, flexible bodies, fluid, and magnetic bodies, and promote development of non-smooth and multi-body system dynamics. The Division encourages studies on key issues of dynamics and control problems in major engineering projects, and encourages experimental studies on dynamics and control.

Applications in the area of solid mechanics should give more consideration to intercrossing with physics, materials science, chemistry, information and biological sciences, and strengthen on proposing and studying topics in major engineering application, expand basic theory of continuum mechanics, and promote the development of multi-scale mechanics and multi-field coupled mechanics. Proposals in such areas will be encouraged to address issues as follows: the constitutive theory of materials at macro, meso and micro scales; the theory of strength, damage, fatigue and failure mechanism; the mechanical behavior of new materials and structures; experimental measurement techniques and representation methods, high performance computational methods; structural optimization, completeness and safety evaluations, and the deformation, damage mechanism of rock and soil media and stability of rock mechanical engineering, etc.

Applications in fluid mechanics should pay attention to studies on the laws and

mechanisms governing complex flows. The Division encourages researches on rarefied gas flow, hypersonic aerodynamics, especially theory, simulation and experimental studies on compressible turbulent flow, high speed hydrodynamics, multi-phase complex flow, and key fluid dynamic problems in aerospace, energy and ocean, environment and disaster, and transportation areas.

Applications in biomechanics should pay attention to bio mechanical and mechanical biology problems related to human health and disease and sport competitions, biomechanical mechanism and transformation medicine related to non-infectious diseases such as cardiovascular, bone joint and cancer, and studies on new theory, methods and technologies in experimental studies on biomechanics.

Applications for explosive and impact dynamics should pay attention to frontier areas and major national needs, closely focus on the safety issues of relevant engineering projects, and strengthen theoretical and experimental studies on the dynamic mechanical behaviors of materials, structural response to explosive impacts and detonation mechanisms.

The Division continues to support studies on instruments, new experimental methods and techniques with innovative ideas. Applicants for this type of application should mark “Experimental Techniques and Instruments” in the application form. The Department will keep supporting projects in computational software development, giving stress on the integration and standardization research on the development of the computational mechanics software which may produce independent or shared IPR. Applicants for this type are requested to mark “Computational Mechanics Software” in the application form. Applicants of above two types of projects should have relevant research background.

Division of Astronomy

The Division of Astronomy mainly supports researches on astrophysics, basic astronomy, astronomical instruments and technology. In accordance with the trend of astronomical development in the world and the present situation in China, the Division supports research proposals with emphasis on the development of technology and instrumentation. Studies based on existing observation apparatus or facilities to be built soon in China will be encouraged. The Division promotes the combination of innovative ideas, observation and theories, and studies on new technologies and methodologies for astronomy, especially those closely related to mega-science projects under construction in China. Interdisciplinary research is strongly encouraged so as to gradually build up research teams with special features and influence in international scientific communities. International cooperation and exchange will be given much attention.

In the General Program projects funded in recent years, a good balance have been achieved between astrophysics (including galaxies and cosmology, stellar and the Galaxy, solar and extra solar planetary system, and solar physics), basic astronomy (including astrometry and celestial mechanics) and astronomical technology and methods (including the history of astronomy). Young researchers have become the backbone in astronomical research and more than half of the awardees are under the age of 40.

In 2018, in addition to strengthening continuous support for projects integrating

theory and observation and projects conducted by young scientists, emphasis will be given on interdisciplinary research with physics, space science, earth science and information science, etc., maintain support on research on advantageous directions, promote research related to using large observatory facilities in China, and foster research topics that may have breakthroughs. The Division encourages research on basic physical process on celestial bodies, celestial chemical evolution, and celestial bodies in the solar system, extra solar system planetary system, infrared astronomy, space astronomical measurement, and astronomical research that addresses the national needs. The priority will be given continuously to researches in basic astronomy, astronomical technology and methods, and to relative small scaled astronomical research institutions.

In the next few years, the Division plans to give special support to pre-research for the investigation based on equipment that have already been built or being built, and conceptual studies on new technologies that are urgently needed for large-scale telescope and space exploration For applicant in these research areas, please mark “Major S&T Basic Facilities Project” or “New Astronomical Technology” in the application forms.

Division I of Physics

The funding scope of the Division I of Physics covers condensed matter physics, atomic and molecular physics, optics, acoustics and new research areas formed between these four disciplines and other disciplines.

According to the current status and requirements of disciplinary development, the Division pays attention to study on experimental methods and techniques motivated by creative ideas, encourages researches in new computational methods and simulation software closely related to experimental physics and explorative types, key basic physical issues serving national needs, and new physical concepts and methods in interdisciplinary areas. In-depth studies on important physical problems that have not become hot topics, and researches in basic physical problems on devices, and new areas and directions are especially encouraged.

For the funding in condensed matter physics, the Division will pay attention to singular quantum phenomenon in electron related systems, quantum phenomena and quantum effects in various low dimensional and small-scale systems or devices, device physics and advanced technologies and methods of characterization, structural and physical properties of surface, interface and membrane, and physical issues in the structure, performance, preparation and application of advanced functional materials. Encouraged areas include basic physical issues and experimental methods related to soft matters, life science. We pay special attention to studies on material, device and physics having important application prospects.

For areas of atomic and molecular physics and optics, the Division encourages researchers to pay attention to atomic, molecular and cluster structures and dynamical process, cold atomic and molecular physics and its interactions with optical field, complex interactions of atomic and molecular systems, interactions between laser and atoms or molecular, physical issues in ultra-fast and extremely strong light conditions, propagation

process of light in new media and its characteristics, quantum frequency markers, quantum metrology, quantum information, physics and methods of precision atomic and molecular spectra and precision measurement, high resolution, high sensitivity and high precision laser spectrum and its applications, and research on basic physical issues in micro nano photonics, optical mechanics, and surface plasma exciter, optical field regulation and its applications. The basic research on the generation, transmission, display and application of 3D optical images will be encouraged. In addition, optical electronics as well as frontier physical issues in optical electronics are also important research areas for funding.

In the area of acoustics, according to the major national needs, studies on key fundamental acoustic problems will be encouraged. Physical acoustics and basic research in marine acoustics, ultrasonic and acoustic effect, noise and control, new acoustic materials and devices, acoustic energy exchanger, and issues in information technology, etc. will be in priority.

Division II of Physics

The Division II of Physics mainly supports research on fundamental physics, particle physics, nuclear physics, nuclear technology and its applications, accelerator physics and detectors, plasma physics, and synchronized radiation techniques and methods.

For fundamental physics, funding will be focused on original studies and interdisciplinary research with other disciplines. Stress will be given to important theoretical physical issue raised from scientific experiments and applications.

For particle physics and nuclear physics, the Division will support creative theoretical and experimental research, in particular, the combination of theoretical and experimental studies related to selected large-scale experimental facilities that are in operation, upgrading or to be completed soon both in China and abroad. Funding will be used to guide research towards the understanding of important physical rules related to the latest experimental results, such as the theory and experiments of phenomenology in particle physics and interdisciplinary research of nuclear physics under extreme conditions with nuclear astrophysics and other disciplines.

For support to nuclear technology, accelerator and detector, low-temperature plasma and synchronized radiation, it is hoped that fundamental issues should be drawn from the disciplinary development, national demands and intercrossing with other disciplines, which may facilitate a deeper understanding of physical laws underlying the development of the disciplines and important applications at the same time. Emphasis will be laid on key technologies and innovative ideas in methodology and intercrossing with other disciplines. In addition, the exploration of mechanisms and rules governing the interaction of matter with instantaneous, high energy, high power and strong field radiation (such as charged particles, X/ γ , neutron and electromagnetic fields) are key areas for funding. Attention will be given to new acceleration principles, nanometer micro-beam, high power ion beam, strong current accelerators, plasma radiation source in accelerator and detector and plasma research, and physics and key technologies of all other advanced radiation sources. NSFC gives strong support to new types of nuclear detection technology and method such as large area, high counting rate, high temporal resolution, low cost and weak signals, etc., and

relevant studies on nuclear electronics.

For nuclear fusion and plasma physics, more attention will be given to the exploration of new diagnostic means related to large facilities which are in operation at present or will be built soon. In particular, basic research on advanced magnetic confinement fusion and new approaches to inertial confinement fusion and related fundamental physical problems, and computer simulation and experimental studies of various kinds of plasma will be stressed.

In order to make more efficient use of limited funds, the Division encourages researchers to make full use of big science facilities, small and medium equipment to conduct research, so as to achieve sustainable development in the research. NSFC encourages experimental studies with innovative methods of high resolution diagnosis and detection, and, as well as the development of experimental facilities, detection and diagnosis devices which are important for the development of accelerators, detectors and gravitational wave detections. Applicants may increase the funding request in applications in these areas according to the actual needs. Projects with more young scientists involved in the research team under the same condition will be preferred.

Department of Chemical Sciences

Chemical science is to study the composition, structure, property, reactions and transformations of matters; it is the fundamental means which creates new molecules and builds new materials, and it is the central science which is closely intercrossed and permeated with and into other disciplines. Chemical engineering is aimed to accomplish the transfer and conversion of matters and energy by making use of the principles of the basic disciplines, and to solve scientific issues raised in the large-scale production of chemical materials and products.

The mission of the Department is to improve the overall quality and international status of China's fundamental research in chemical sciences, and foster creative talents and groups in chemical research with international impact. The Department supports multi-level and multi-scale research on the reaction, process and function at different levels of atoms, molecules, molecular aggregation and condensed state, as well as studies on the complex chemical system, in order to realize the precise control and logic cognition of chemical synthesis, process and function. In accordance with major scientific problems raised from the national economy, social development, national security and sustainable development, research on chemical sciences and chemical engineering are encouraged for exploring their role in fields of life, materials, energy, information, resources, environmental science and human health. The Department emphasizes the combination of microscopic and macroscopic research, static and dynamic states, and theoretical research and empirical development of novel experimental methods and precise analysis technologies. It is also encouraged to introduce the latest theories, technologies and achievements from other disciplines into the research in chemical science and chemical engineering for facilitating the sustainable development of research, fostering innovation and interdisciplinary studies, and supporting the emerging frontiers in research.

Funding for General Program Projects in Department of Chemical Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Success rate (%)
Division I	Inorganic	205	13,175	27.30	200	12,883	26.60
	Analytical	181	11,601	26.70	169	10,884	25.72
Division II	Organic chemistry	268	17,177	26.77	241	15,520	25.72
	Chemical biology				79	5095	27.43
Division III	Physical chemistry	302	19,356	26.65	316	20,353	26.51
Division IV	Polymers	130	8,333	26.97	143	9,211	26.58
	Environmental chemistry	184	11,828	27.42	199	12,818	26.46
Division V	Chemical engineering	306	19,612	22.68	324	20,866	22.18
Total or average		1,576	101,082	25.99	1,671	107,630	25.41
Direct cost per project		64.14			64.41		

In 2017, 6,577 proposals for General Program from 657 research institutions were received by the Department (which is 512 more in number or 8.44% more than that of 2016). 1,671 proposals were funded with the success rate of 25.41% and the average funding intensity of 644,100 yuan per project.

In 2018, the Department will introduce an overall re-organization to disciplines to conduct funding and management based on the main research orientations of chemistry and chemical engineering. This will be helpful for better adaption to the trend of international chemical development and will promote the transformation development of research in chemistry and chemical engineering in China. The applicants should read the instructions of all research areas carefully and select the proper discipline code.

The new research orientations funded by the Department of Chemical Sciences are listed as follows: (1) synthetic chemistry; (2) catalysis and surface/interface chemistry; (3) chemical theory and mechanism; (4) chemical metrology; (5) materials chemistry and energy chemistry; (6) environmental chemistry; (7) chemical biology; (8) chemical engineering and industrial chemistry.

The Department will continue to promote high quality research in the cutting edge fields, lay stress on in-depth and systematic research work, give priority to interdisciplinary research projects, and emphasize the diversity of research ideas, research methods and research contents to avoid the convergence and homogenization. Besides, the Department will take effective measures to support original creative and high risk research, so as to lead the breakthrough innovation, unblock the bottleneck of chemical research limitation in China and achieve the transition from quantity to high quality research outcomes. In the process of assessment, scientific merit will always be the core concept, and the balancing, coordinating and sustainable development of all related disciplines will be thoroughly considered for the promotion of the fundamental research of chemical sciences in China at international frontier. In 2018, the average funding intensity per project will be at the same level as that of 2017.

Synthetic Chemistry

Synthetic chemistry is a science which focuses on material transformation and synthetic methodology. It involves the synthesis and assembly of inorganic, organic, and polymeric materials. Through the selective control of molecular creation and material transformation, accurate preparation and application of new substances with specific properties and functions are gradually obtained in synthetic chemistry. As the basis and core of chemistry, synthetic chemistry actively expands the cross-integration with related disciplines, promotes the solution of major scientific problems in relevant fields and boosts the economic and social development of the country.

Synthetic chemistry faces the demand for new substances, new materials and new devices in life sciences, materials sciences, information sciences, energy sciences and environmental sciences. The research focuses on the theoretical design, reaction process, synthesis and assembly methodologies with high efficiency and high selectivity of new function-oriented substances. Explore the mechanism and essential rules of the synthesis reaction and substance conversion process; learn from the biosynthesis and evolution process of living systems; Develop new synthesis strategies and synthesize various of compounds and materials with specific structures and functions by combining research methods and technologies of physics and material science. Synthetic chemistry has stepped into a green, economical, efficient and highly selective way, and the synthesis of new substances has become more precise and environmentally friendly. The development of synthetic chemistry will follow this trend and will pay more attention to human health, effective utilization of environmental resources and social sustainable development. The encouraged study in synthetic chemistry are focused on: (1) synthetic chemistry driven by new reagents, new reactions, new concepts, new strategies and new theory; (2) synthetic methods and techniques of atomic economy, green sustainability and precise control; (3) biology and biomimetic synthesis driven by chemical principles; (4) synthetic chemistry under unconventional and extreme conditions; (5) non-covalent synthesis based on various intermolecular interactions; (6) synthesis and preparation of novel function-oriented materials.

Original breakthroughs of basic research focusing on molecular creation and material transformation are encouraged in synthetic chemistry, as well as the original contributions to industrial applications.

Catalysis and Surface/Interface Chemistry

Catalysis and surface/interface chemistry is to study the structure and properties of the surface/interface and reveal the basic rules in the physical and chemical conversion processes that occur at the surface/interface.

The areas funded by catalysis and surface/interface chemistry include chemical catalysis, surface chemistry, colloids and interfacial chemistry and electrochemistry. These systems involve solid surfaces, gas-solid interfaces, gas-liquid interfaces, liquid-liquid

interfaces, liquid-solid interfaces and solid-solid interfaces and gas-liquid-solid multi-phase interfaces.

Supports in the field of chemical catalysis are focused on developing new catalytic theories and concepts, creating new catalysts and systems with specific functions, emphasizing the cross-over and fusion between multiphase, homogeneous and biomimetic catalysis, enhancing the structural design and regulation of catalytic active sites, developing new catalytic characterization methods and technologies with the properties of in situ, dynamic and high temporal-spatial resolution, and laying emphasis on coupling and functional integration during the catalytic reaction.

Surface chemistry mainly supports chemical and physical processes related to solid surface/ interfaces, as well as their characterization techniques and methods. Encouraged research orientations include: solid surface/interface structure, performance and control; dynamics and energy transfer theory in surface/interface reaction; the new research methods for physical and chemical processes of surface/interface.

Colloid and interface chemistry encourages researches including: (1) the usage of theoretical chemistry and advanced experimental techniques to deepen the understanding of the essences of colloids and interface systems; (2) the design and construction of new surfactants, dispersion systems and nanoparticles, and further understanding of the interface adsorption, assembly and infiltration behaviors; (3) construction of colloidal systems with self-healing and outfield responsiveness; (4) basic research of colloid chemistry in the fields of petroleum exploitation, food, household chemicals, life science and environmental governance.

Proposals of electrochemistry should pay attention to the electrochemical basis and theory, as well as the construction and characterization of electrochemical interface. The study focus includes: (1) develop new methods of in situ electrochemical spectroscopies, and recognize electron transfer, ion transport and molecular conversion in complex interface on microcosmic and molecular level; (2) design and screen electrocatalysts by theoretical calculation, and reveal their structure-activity relationships to improve the electrocatalytic efficiency; (3) pay attention to the scientific basic research of various electrochemical energy conversion and storage devices, electrochemical processing and surface modification, and bioelectrochemistry.

Chemical Theories and Mechanisms

Chemical theory and mechanism aims to establish and develop new chemical theories and experimental methods to reveal the mechanisms and basic rules of chemical reactions and their related processes.

The areas of research supported by chemistry theories and mechanisms include theoretical and computational chemistry, chemical thermodynamics, chemical kinetics, structural chemistry, photochemistry and spectroscopy, chemical reaction mechanisms, polymer physics and polymer physics chemistry, and cheminformatics.

Projects in the field of theoretical and computational chemistry should focus on the development of new theories and computational methods and their applications in real systems, especially, to develop: (1) electron-interrelated methods and electronic structure

theory of excited state; (2) efficient low-scale algorithms for macromolecules and condensed phase systems; (3) multi-scale and non-adiabatic dynamics for complex systems; (4) statistical mechanics for non-equilibrium and small systems. Research in theoretical and computational chemistry must pay great attention to the design and development of innovative chemical software programs. For chemical thermodynamics, there is an urgent need to develop theoretical and experimental methods for real systems, to improve calculation and measurement accuracy, to reveal the intrinsic relationship between the thermodynamic properties and microstructure of the system, and to focus on the study of the applications of chemical thermodynamics in important interdisciplinary fields. Research in chemical dynamics will focus on the development and utilization of new experimental and theoretical methods to explore the structure and kinetic properties of the transition state of chemical reactions, the observation of resonance state, the non-adiabatic processes during the reaction, dynamics of vibration excited state, the conformation and dynamic calculation of high-precision potential energy surface in chemical reaction. Applicants are encouraged to combine methods for efficiently preparing molecular excited state and technologies for detecting coherent light source to carry out chemical dynamic research. Applicants for structural chemistry should focus their proposals on the studies of structural features, theoretical predictions, controllable synthesis and self-assembly methods, dynamic transformation and structural control of complex functional systems. Research of photochemistry and spectroscopy should be carried out by combining short pulse laser technology with spatial resolved and time-resolved spectroscopy technologies. The research of chemical reaction mechanism should focus on the microscopic mechanisms and basic rules of chemical reaction. Polymer physics and polymer physics and chemistry should focus on the chain behaviors and interactions of the macromolecule, the formation and evolution mechanisms of different scales of structures, the connection and control between the microstructure and its macroscopic properties. For cheminformatics, it is encouraged to develop new theories and algorithms for the storage, retrieval and transformation of molecular structure information based on principles of systems by integrating with artificial intelligence and big data processing technologies.

Chemical Metrology

Chemical metrology aims to develop chemistry-related measurement strategies, principles, methods and techniques, and to develop various analytical instruments, devices and related software to accurately obtain the temporal and spatial variation rules of the matter's composition, distribution, structure and properties.

The studies of chemical metrology should focus on new methodological research, interdisciplinarity, methodological integration and signal correlation, instrumental creation based on new principles and performance improvement of key components to allow full play to the important role of chemical metrology in national security, major demands and socioeconomic development. The funding scope of chemical metrology ranges from the detection and analysis of macroscopic to microscopic complex systems, aiming at establishing new strategies, new principles, new methods and new technologies or broadening the application of existing technologies in important scientific fields. The

research of this field includes sample treatment and separation, spectroscopic methodologies and applications, chemical and biological sensing, chemical imaging and the development of instruments. The research priorities include chromatography, spectroscopy, electrochemistry, mass spectrometry, nuclear magnetic resonance, paramagnetic resonance, calorimetric analysis, energy spectrum analysis, as well as some emerging fields such as omics analysis, single-atom/molecule/cell analysis, in-vivo analysis, and micro/nano analysis.

The priority funding areas for chemical metrology include: (1) processing, separation and identification methods for complex sample; (2) ultrafast space-time resolved spectroscopy and chemical imaging; development and application of multidimensional spectroscopy principles and technology; (3) precise measurement of single atom, single molecule, single cell and single particle; in-vivo real-time detection and imaging; structural and functional parsing of biological macromolecules; biomolecular recognition and major diseases diagnosis; (4) monitoring and imaging of rapid chemical processes and electron transfer processes; early warning, screening and traceability of public safety; (5) creation of miniature instruments and devices; chemical measurements based on big scientific facilities.

Materials Chemistry and Energy Chemistry

Materials chemistry and energy chemistry embrace two areas, material chemistry and energy chemistry.

Materials chemistry is a science that studies the design, preparation, structure, property and application of materials, which bridges the gap between chemistry and material science, life science, medicine and information science. Material chemistry is an application-oriented branch of chemical science and is the molecular basis of new material systems. In the field of material chemistry, principles and methods of chemical science are used to design new materials at atomic and molecular levels, to develop preparation techniques and to study the structure-property relationships. Achieve the control of the materials' macro-property through structure function transfer, integration and coordination at multi-scale and multi-level. Create new high-performance and multi-functional materials as well as their applications in the fields of energy, health, environment and information.

Studies in material chemistry emphasizes the precise preparation of new materials with specific functions, accurate construction and control of the structure and properties of materials, the crossover and integration of multi-disciplinary, the correlation between structure and properties. Explore the molecular basis, principles and rules of material systems using various characterization techniques. Material chemistry faces the major national needs and focuses on the deep utilization of characteristic resources in our country.

Studies of material chemistry should focus on the discovery of functional materials and molecular basis of materials and molecules that have the characteristics of electricity, optics and magnetism, and materials related to biology, medicine and pharmacy. Attentions should be paid to the design of the structure of new advanced materials as well as their preparation using artificial intelligence, and to the development of methods and principles of material chemistry in the digital processing (such as 3D printing) of advanced materials. Studies of energetic material chemistry should focus on the basic problems in storage,

release and application of high-density chemical energy, and pay attention to the design and preparation of novel energetic materials such as materials of total nitrogen structure, ionic type and coordination type.

Energy chemistry is a science that uses chemical principles and methods to study the energy conversion, storage, transmission and utilization. Its basic task is to study new energy conversion and storage mechanisms, design new materials, fabricate new devices and develop new methods to achieve efficient utilization of green energy.

Study of energy chemistry should pay attention to developing efficient and green utilization of fossil resources, as well as the design and preparation of highly efficient solar cell materials, device assembly and integration of the photoelectric conversion process. It should also pay attention to the selectivity of biomass conversion and biofuel batteries. Strengthen the study on preparation chemistry of clean energies such as non-fossil liquid fuels and hydrogen energy, storage materials and their efficient energy conversion. Electrochemical energy focuses on various batteries with power and energy storage and corresponding devices of wearable and microelectronic systems. Attention should be paid to developing materials of energy conversion and storage, such as electrolytes and battery separators, to optimizing phase changed energy storage materials and electrode materials. Conversion process of important new energies such as thermoelectricity, photoelectricity and optothermal should also be paid attention to.

Biomass energy is a new resource of renewable energy. Green chemistry in the process of converting biomass into energy and material is the core research of this field. Based on this, study the selective depolymerization of biomass molecules to prepare small molecule platform compounds as well as the directional conversion of these platform compounds; prepare new types of energy and material chemicals; study biomass gasification synthesis and catalytic pyrolysis; prepare high quality liquid fuels.

Environmental Chemistry

Environmental chemistry is to study the principles and methods of the existence, characteristics, behaviors, effects and pollution control of chemical substances in environment. It is an important branch of chemical science and a core area of environmental science. In recent years, research on environmental chemistry has been developed rapidly. Research contents are gradually opened up from microcosmic mechanism to macrocosmic rule, and their creativity, systematization and practicability are enhanced step by step. Currently, environmental chemistry is playing an increasingly important role in promoting discipline development and solving national major environmental problems.

Major funding fields of environmental chemistry cover the following branches: environmental pollution chemistry, pollution control and remediation chemistry, environmental toxicology and health, theoretical environmental chemistry, radiochemistry/radiation chemistry, safety and security chemistry.

Environmental chemistry encourages the applicants to refine the key scientific issues and to develop and apply modern scientific and technological means and methods, in conjunction with the major demands in the prevention of environmental pollution. It is also expected to study environmental characteristics, molecular transformation, ecological and

health effects, and the principles of control technology of pollutants through combining the laboratory simulation, field research with theoretical calculation. Major research orientations include: (1) characterization and analysis of pollutants in complex environmental media; (2) behavior of multi-media interface and its regulation; (3) mechanism, health risk and control of air combined pollution; (4) control and remediation of soil contamination and water pollution; (5) environmental exposure and health effects of persistent toxic pollutants; (6) environment chemistry and toxicology of nano-materials; (7) spread and control of antibiotics and antibiotics resistant genes in the environment; (8) environmental behavior of radioactive material and its prevention and control.

Chemical Biology

Chemical biology is the science to accurately modify and manipulate biological systems at the molecular level by means of exogenous chemical substance, interventional chemical methods or pathways. It not only develops new reactive technologies and molecular tools, but also provides new thoughts and concepts for research in the area of life science. It is playing an increasingly important role in the research of visual, controllable and creatable life processes (or function).

Chemical biology focuses on the processes and dynamic rules of important molecular events in life science, and gives full play to the characteristics and creativity of chemical science. Study focuses are: (1) to achieve, explore and regulate the living action in real-time, in-situ and in quantitative analysis by means of the construction and discovery of molecular probe; (2) to achieve modification and labelling of biological molecules by means of the orthogonal and coupling technology and study the biological functions of biological macromolecules, such as protein, nucleic acid, polysaccharide, lipid compounds, as well as metal species and trace elements; (3) to establish and optimize small molecule compounds library and high-throughput screening technology to detect and interfere the biological process in cell, thereby to reveal unknown pathways and new life activities of interaction of biological molecules, promote the study of signal transduction and gene transcription based on active small molecules, and realize the identification of drug targets and the discovery and development of leading compounds; (4) to analyze the biosynthesis mechanisms of substance in life activities, and to synthesize target molecule or complete special chemical reaction by using biosystem and/or basic parts; (5) on the basis of creating and developing innovative chemical tools and techniques, to develop new theory for chemical biology, carry out chemical assembly and simulation of complex living system, reveal chemical essence of life activities.

Chemical biology preferentially supports the themes as follows: (1) the discovery and construction of chemical molecular probe as well as its application on the study of molecular mechanism and functional regulation of important biological events and serious diseases; (2) research of solving biological and medical events by use of chemical means and methods; (3) basic research on the chemical reaction mechanism and theory of living systems for promoting intercross and cooperation between chemistry discipline, and biology and medicine.

Chemical Engineering and Industrial Chemistry

Chemical engineering and industrial chemistry is to study the motion, transfer, reaction and interrelation in the conversion processes of matter. It is aimed to reveal the transfer phenomena and rules in the conversion processes of matter and its effect on the reaction and properties of products, develop technologies, flow chart and equipment for the green and high effective conversion of substances, and establish theories and methods of design, scale-up and regulation and control for application in industrial production. The intercross of chemistry and chemical engineering will be especially emphasized to apply the new ideas, concepts and methods to industrial process.

Major funding fields of chemical engineering and industrial chemistry cover chemical thermodynamics, transfer process, reaction engineering, separation engineering, chemical equipment and process enhancement, systems engineering and chemical safety, biochemical engineering and light chemical, fine chemical and green manufacturing, chemical engineering of materials and products engineering, energy chemical, resources and environmental chemical engineering. In recent years, key common scientific issues extracted from the research and practice in complex industrial systems gradually form systematic theories and key techniques step by step, which have become a major trend in areas of chemical engineering and industrial chemistry. A lot of new research contents are raised as follows: (1) the research is more focused on the observation, measurement and simulation in the optimization and regulation of micro-/meso-structure, interface and multi-scales, and great attention is paid to the reinforcement of processes and scale-up rules; (2) the research pays more attention to the uncommon and extreme processes; (3) the research further expands from chemical processing engineering to the chemical product engineering and full life cycle process.

The following research areas will be encouraged in the chemical engineering and industrial chemistry: spatial and temporal dynamic structure at mesoscale; systems and synthetic biotechnology; chemical big data and virtual processes; intelligent chemical systems and manufacturing; transfer and reaction processes under unconventional conditions; green chemical engineering; product engineering as well as chemical science related to energy, resources and safety.

Department of Life Sciences

The Department of Life Sciences funds a broad spectrum including biology, agricultural sciences and basic medicine, which extends to various fields of resources, environment, ecology, population and health, etc. In recent years, with the support from NSFC and other funding sources, together with unremitting efforts made by Chinese scientists, research in life sciences has achieved extraordinary progress in China. Not only the number of authentic research articles published by Chinese scientists in international authoritative journals is climbing, but the quality of research is improving rapidly.

In 2017 the Department of Life Sciences received 11,028 proposals, of which,

10,703 were accepted for General Program and 2,902 projects were funded, including projects of Small Fund for Exploratory Studies, with a success rate of 26.31% (accounted by the accepted proposals, and all the data bellow are also calculated by the number of accepted proposals). The average direct cost is 585,900 yuan per project, among which, there are 2,782 projects funded as 4-year General Program projects. The success rate for 4-year General Program projects is 25.23% and the average funding intensity is 600,400 yuan per project. In the future, the Department will continue to emphasize on funding decision according to the research quality and actual need rather than funding in equal intensity. The Department also expects that the home institutions of applicants should pay close attention to academic standard of research and improve the quality of proposals. In 2018 the funding of General Program projects is expected to keep constant as the previous year. **The applicants should apply for funding according to the actual need for their research.** For proposed research having more exploratory nature but with weak research basis, it is suggested that applicants should apply for lower funding. For those with solid research basis and recent important progresses in previous work and requiring more funding to carry out further investigation, applicants may apply for higher intensity of funding according to the actual need. It should be noted in particular that the budget in proposals will also be evaluated by peer reviewer and the panel.

The Department has been encouraging researchers to carry out original study with innovative ideas, as well as novel technology and approaches, particularly for those playing a pivotal role of promoting the development of related disciplines with authentic ideas. Emphasis will be put on proposals with novel theories, firm hypotheses and the interdisciplinary importance based on previous research over a long period of time. The Department will pay attention to important frontiers and new emerging fields in life sciences in the future, while keeping a balanced and harmonious development among various disciplines. The Department continues to encourage studies concerning basic research on morphology, structure and function of cells, tissues, organs and systems, and actively support researches related to human physiology, biochemistry, immunology, reproduction, development, aging, stem cell and tissue engineering, etc. Studies will be encouraged on aiming at fundamental level scientific questions of life sciences using various disease models. Pivotal investigations to agriculture sciences and environmental ecology are encouraged.

The Department encourages researchers to carry out systematic and innovative work on key issues over a long-term period, therefore, great importance to project management at later stage. The Department implements the funding policy depending on the performance of previous funded project, and gives preferential consideration to applicants with good performance in their previous projects under equivalent conditions. **Moreover, considering the problems commonly occurred during the application and peer review processes in recent years, the Department reminds applicants to pay special attention to the following points when writing proposals:**

(1) In the explanation of the *Guide to Programs* of the Department of Life Sciences, as well as of the eight scientific divisions, the funding scope of the specified division is emphasized and the categories that are not to be accepted have been clearly noted. Therefore applicants should read carefully according to their subject of application. It should be stressed, that **the categories not to be funded by the Division in the General Program may apply to other types of programs in the same Division.**

Funding for General Program Projects in Department of Life Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Success rate (%)
Division I	Microbiology	171+7*	10,605+175*	24.65	187+7*	11,209+175*	26.15
	Botany	189+7*	11,716+175*	28.08	199+7*	11,931+175*	28.41
Division II	Ecology	167+7*	10,334+175*	25.78	179+7*	10,764+175*	26.76
	Forestry	166+7*	10,273+175*	22.67	177+7*	10,593+175*	23.87
Division III	Biophysics /Biochemistry /Molecular biology	146+6*	9,061+150*	30.58	155+5*	9,311+125*	34.48
	Immunology	72+4*	4,454+100*	29.12	76+4*	4,567+100*	32.65
	Biomechanics and tissue engineering	84+5*	5,193+125*	25.87	83+5*	5,587+125*	25.00
Division IV	Neurosciences	77+5*	4,804+125*	26.71	85+5*	5,088+125*	26.47
	Psychology	49+4*	3,026+100*	20.46	53+4*	3,208+100*	22.89
	Physiology & integrative biology	77+4*	4,752+100*	31.15	80+4*	4,806+100*	32.56
Division V	Genetics and bioinformatics	126+6*	7,850+150*	26.67	141+6*	8,456+150*	28.77
	Cell biology	101+5*	6,263+125*	32.02	94+5*	5,622+125*	34.86
	Developmental biology and reproductive biology	73+4*	4,515+100*	29.73	80+4*	4,820+100*	31.94
Division VI	Agriculture and crop sciences	200+8*	12,398+200*	23.19	214+8*	12,817+200*	23.39
	Food science	180+7*	11,175+175*	19.34	201+8*	12,068+200*	22.00
Division VII	Plant protection	127+6*	7,864+150*	23.67	141+6*	8,485+150*	23.60
	Horticulture and plant nutrition	140+6*	8,663+150*	22.92	151+6*	9,089+150*	24.49
Division VIII	Zoology	130+5*	8,081+125*	32.69	142+5*	8,552+125*	34.59
	Animal husbandry and grassland science	116+6*	7,228+150*	21.75	127+6*	7,648+150*	23.33
	Veterinary medicine	118+6*	7,309+150*	22.30	129+6*	7,721+150*	23.52
	Aquaculture	71+5*	4,426+125*	22.22	78+5*	4,688+125*	23.25
Total		2,580+120*	159,990+3,000*	24.99	2,782+120*	167,030+3,000*	26.31
Direct cost per project		60.37 (62.01**)			58.59 (60.04**)		

Note: * Pilot projects of Small Fund for Exploratory Studies; ** Average funding for General Program project excluding Small Fund for Exploratory Studies; + Success rate including projects of Small Fund for Exploratory Studies.

(2) Concerning applications related to medical ethics, applicants should provide the hard copy of the certification of ethic committee from their host institutions or the superior administrative agencies, as well as electronic copy submitted as attachment in NSFC's information system.

(3) Concerning applications related to operation with highly pathogenic microbe, applicants should abide by national regulations concerned, and perform under bio-safety qualified conditions.

(4) The signature of both the applicant and all participants should be in regular script, and the signature should be the same as the one in printed form in the application.

(5) The applicants should note that the fund is filled in the unit of 10,000 yuan. Misfiling will cause errors in the budget, leading to a decline.

(6) Please fill in the research period according to the notes requirement for application in this guide. If the start time is earlier than the deadline of the applications, they will be declined.

(7) The application code should be specified to the final level. Applications fail to provide the detailed code will be declined. Please refer to the division guides for specific requirements on application codes.

Applicants should follow the requirement of the *Guide to Programs* and the application syllabus when writing their proposals, or the proposals will be rejected or not funded.

Division I of Life Sciences

The funding scope of Division I covers two disciplines, namely microbiology and botany.

Microbiology

The Microbiology discipline supports basic research in the area of microbes, including fungus, bacteria, achaea, virus, prion and other microbes. Major funding fields in this discipline include resources and taxonomy of microbe, microbe ecology, microbe group behavior, metabolism, physiology and biochemistry of microbes, microbe genetics and evolution, microbe epigenetics, microbe morphological differentiation, structure and function of microbes, synthetic biology of microbe, the interaction between microbes and their hosts, the relationship of microbes and environment, and pathogenic microbes, etc.

There has been an obvious lack of balanced development of different branches in microbiology, observed based on previous years of grant application and funding situation. The number of proposals aiming at study on mycoplasma, rickettsia, chlamydia, spiroplasma, phage, prion, etc., is relatively small, indicating that the related research team needs to be augmented and intensified. The Division encourages researchers to carry out fundamental and authentic studies in the fields listed above. Preferential support policy will be given to these fields.

In 2018, the Division will continue to give preference funding to areas in the taxonomy of microbes, especially rare and difficult to cultivate microorganisms. It is encouraged to a combinational use of genome and big data and other modern technology together with traditional methods, to promote the study of classification and phylogenetic taxonomy, strengthen talent training.

The Division encourages the exploration of novel techniques and methodologies applied to basic research of microbiology, and especially welcomes scientists in

mathematics, physics, chemistry, and information sciences to carry out interdisciplinary studies related to microbiology; encourages research based on single microbe cell, structural compositional research of microbe, basic research in pathogenic microbe and marine microorganism, and functional research on microbe in complex system; systematic research to mechanisms of frontiers in life sciences applying microbe as model system is preferentially encouraged.

In order to promote the development of microbial research on the new technology and novel method, convergence of multi-field academic thoughts, research methods and technical tools as well as to break the traditional disciplinary barriers for solving of complex scientific problems, strengthen the integration of mathematics, physics, chemistry and microbiology, information technology and engineering and other related disciplines, the Department pilots to spend 5 million yuan as special support for non-biology education background researchers (including whose undergraduate or graduate professional stage were with mathematics, physics and chemistry, electronics, information engineering, etc.) in the discipline of Microbiology. In 2018, the application code for this kind of interdisciplinary research is C0104.

Botany

The discipline of Botany supports basic and part of applied basic researches on plants. It mainly covers structure of plants, taxonomy (including flora geography), plant evolution biology, paleobotany, plant physiology, plant biochemistry, plant morphology, plant development, plant reproductive biology, plant chemistry and natural product chemistry, endangered species protection, resource plant (including economic botany), marine/ocean botany, ethno botany, interaction between plant and environment, plant secondary metabolism, plant nutrition and substance metabolism, plant germplasm (including conservation and innovation of germplasm), as well as the exploration of new techniques and methodologies related to botany.

It can be seen from the applications accepted and funded in recent years that the development of each branching field within the Botany discipline is unbalanced. There are relatively more applications in areas such as plant phylogeny, plant hormone, growth and development, and resistance physiology, and therefore the research quality is relatively high. Systematic and creative research should be further strengthened henceforth. Besides, emphasis on interdisciplinary study is put to the application of novel technologies on those relatively developed fields listed above. On the other hand, there are fewer applications in the fields such as paleobotany, biological nitrogen fixation, photosynthesis, respiration, water physiology, mineral elements and the metabolism, organic synthesise and transportation, physiology of seed, plant introduction and acclimatization, plant germplasm, hydrophytes and ocean plant and resources, etc. Applications that have research basis in the above-mentioned subjects will be encouraged.

Applicants are also encouraged to carry out their studies in the fields of systematic plant biology, plant tropism biology, invasive plant biology, molecular basis of plant cell totipotency as well as plant response to environmental change, etc.

The Division of Botany will continue to give preferential support to plant taxonomy in 2018, especially to strengthen the support to young taxonomists. The discipline encourages applicants to carry out research on species revision of certain families and genus

on the world wide range and plant resources research in key areas and special environment.

The interdisciplinary studies with other related fields will be strongly encouraged, especially with mathematics, physics, chemistry, geosciences, and ecology, genetics, genomics, proteomics, metabonomics, phenomics, bioinformatics, computer science and social sciences, etc. Studies are also encouraged on the discovery and development of novel instruments, technologies and methodologies applying to further research in botany, such as new detection techniques, high-throughput screening techniques, advanced imaging techniques, analysis techniques of high efficiency, etc. To encourage applicants to put forward unique or typical scientific issues based on their strength and research basis, the discipline will intensify its support to projects with high degree of creativity. In order to achieve better use of local advantages, resources advantages, and talent training, the discipline will encourage collaborations among applicants with institutions or groups having unique special advantages.

Division II of Life Sciences

The Division supports researches in areas of ecology and forestry.

Ecology

Ecology studies the interaction between organisms or between organisms and the environment. It plays a pivotal role in solving the national ecological problems that are getting increasingly important. The Ecology discipline covers molecular and evolutionary ecology, behavior ecology, physiological ecology, population ecology, community ecology, ecosystem ecology, landscape and regional ecology, global change ecology, microbe ecology, pollution ecology, ecological security evaluation, soil ecology, conservation biology and restoration ecology, and evaluation of ecological safety, etc.

In recent years, significant progress has been achieved in ecological study in China, whereas follow-suit is still popular and the overall quality of fundamental ecology needs to be improved. The discipline will strengthen its support to applications with strong innovative ideas, multidisciplinary research and cutting-edge growing subjects, give priority support to proposals focusing on the basic research frontier of international ecology, closely connected with the national ecological and environmental issues, give preference to researches with possibility of making breakthrough in new theory and novel method, and strengthen basic research with long-term observation and experiment of field work, and encourage researches perform study on landscape and regional scale. Studies on the problem of the Belt and Road regional ecological and sustainable development are especially encouraged.

In 2017, a large number of applications were accepted in fields of ecosystem ecology, physiological ecology, pollution ecology, globe change ecology, population ecology, conservation biology and restoration ecology, microbiology ecology, and molecular ecology, etc., while relatively fewer applications in the areas of evolution ecology, behavior ecology, landscape and regional ecology and civil ecology. Scientific questions and research aims in globe change ecology are lack of proper variations. In the future, the Division will strengthen its support to biological ecology, including micro evolution ecology, species

differentiation, and pedigree ecology. The discipline encourages studies on behavior ecology, civil ecology, landscape and regional ecology, and soil ecology. Continuous encouragement is put on special-regional ecology studies in the Fund for Less Development Regions. Regional ecology and sustainable studies are encouraged in the Belt and Road region.

The discipline reminds applicants to pay attention to the following points in 2018: The content of research proposal should focus on key points with clear definition of scientific issues, and special attention should be paid to scientific aspect and feasibility of the research route and methods. Proposals regarding to the multidisciplinary and macro research should put enough emphasis on the combination of the theoretical study with the national need.

Forestry

Forestry is to reveal the essence and mechanisms of the biological phenomena by taking forest and xylophyta as its research objects, in order to carry out the cultivation, protection, management, and utilization of forest resources. The Forestry discipline covers studies in fields of forest resources, forest resources information, wood physics, chemistry of forest products, forest biology, forest soil science, silviculture, forest management, forest health, tree genetic breeding, non-wood product forest science, landscape architecture, desertification, and water and soil preservation, as well as related new technology and methodologies in forest related studies.

In recent years, there is a rapid growth of basic research on forest, but the unbalanced development among sub-disciplines remains the key issue. It is shown from applications in recent years that the number of proposals submitted to branches such as wood physics and the chemistry of forest products is large, while there are much fewer applications to the more classical sub-disciplines like silviculture, forest soil science and forest management, indicating a trend of shrinking. The proposals failed to focus on important basic scientific issues in some important fields, such as silviculture and non-wood product forestry. Some applications in the field of forest genetic breeding on homologous gene cloning and function verification failed to carry out the research from the angle of biological characteristics of trees, as well as lack of close relation with forestry production.

There are two major features in basic research of forestry. The first one is to meet the national needs for forestry development. Therefore applicants should pay close attention to formulating the important and key scientific questions from the forestry industry. The second is to carry out continuous and in-depth studies regarding to perennial woody plants for a relatively long period of time. In the future, the discipline will continue to prioritize to support basic research in such core fields like silviculture, the health care, the efficient utilization of forest resources, etc. The discipline will encourage researchers to carry out investigation in fields of advanced generation tree breeding theory and methods, multi-service function of forest and management, forming mechanism of wood superior traits, the analysis of the specific growth, silviculture, forest soil science, forest management, garden planning and landscape architecture and development mechanisms of trees, long-term field test and experimental research.

In 2018, applicants should pay close attention to the following: (1) the discipline of Forestry will not accept proposals on pharmaceutical functional verification of effective components targeting at animals; (2) the discipline of Forestry will not accept

research and development projects for forestry machinery and wood cutting tools; (3) the discipline of Forestry will not accept projects in the field of Wood Physics (C1603) applying to the direction of Forest Product Chemistry (C1604). Proposals should focus on targeted scientific questions with a precise title.

Division III of Life Sciences

The Division covers disciplines as follows: biophysics, biochemistry and molecular biology; immunology; and biomechanics and tissue engineering.

Biophysics, Biochemistry and Molecular Biology

Biophysics is a cross discipline to investigate mechanisms of biological problems and phenomena, applying the theory and method of physics; Biochemistry and molecular biology is a discipline to study chemical composition of living organisms as well as chemical changes during the process of life, and to research the life phenomena and activities of life process at the level of biological molecules. The Division mainly supports studies on the following issues: (i) structure and function prediction of biological macromolecules, protein crystallography, NMR, biological mass spectrometry, electron microscopy, small angle scattering and its composites; structure of protein complex and membrane-proteins; novel structural biology methodology for functional study and predictions of macromolecule; (ii) the interaction between macromolecules (including small molecules); (iii) the role of post-translational modifications on stability and function of proteins; (iv) classical biochemistry of protein and peptide, nucleic acid and enzymology; (v) molecular mechanisms of metabolism regulation on biological macromolecules, such as protein, sugar, lipid and nucleic acid; (vi) computational biology, bioinformatics, systematic biology and synthetic biology; (vii) interaction and regulation between bioplasma membrane and membrane proteins; (viii) studies on polysaccharides and glycoconjugates; (vi) the effect and role of the physical environment to organisms, including microgravity and space radiation; (x) novel technology and methodology in biophysics, biochemistry and molecular biology.

The applications received in the past three years, fields with more applications as well as more approved grants show the following features: structure and function of protein complexes, which have in-depth researches with sound background and accumulation. Among studies on protein structure, the number of applications aiming at function of protein complex as well as membrane proteins is climbing; researchers and application numbers of cryo-electron microscopy are developing fast; NMR study on macromolecules remains the same with previous years. The proposals accepted on the interaction of biological macromolecules can carry out their research closely connected with important vital movement of cells. There were comparatively high-quality applications in areas of nuclear biochemistry, including non-coding RNA metabolism, post-transcription modification and their interactions with proteins for various function and regulation. As for studies on the structure and function of biomembrane, the quality of applications is relatively high in transmembrane signal transduction and transportations across membrane. Proposals in areas of structure computing and theoretical forecasting of large biological

molecules and bioinformatics have well reflected the character of the intercrossing of disciplines. Researches on bio-effect and functional mechanisms of ionization and the electromagnetic radiation to organisms, and proteomics are inadequate in the quality of proposals. Applications for structure and function research on glycoconjugates and environmental biophysics showed significant improvement in recent years. Applications on acoustic biophysics, photo-biophysics and space biology are few. There is a wide range of research directions covered by new techniques and methods in the area of biophysics and molecular biology, and some applications have creative ideas in terms of the development of disciplinary intercross methodology and new technology in recent years. Interdisciplinary studies for novel technology and methodology are encouraged.

As a discipline with bio-molecules as the object of study, focusing on methodology, the discipline will continue to encourage studies on investigation of life phenomena on the level of molecules. Funding priorities is given to the following fields: (i) researches on the methods of structure computing and forecasting of large biological molecules and complexes, protein crystallography, nuclear magnetic resonance spectrum, bio-mass spectrometry, electronic microscope, small angle scattering, etc., for studying the structure and function of protein and complexes; biological studies on the protein complexes and membrane protein structure, and the development of new structural biology methods for the structure determination and function study of proteins and other large bio-molecules; (ii) applications with new methods and ideas from mathematics, information sciences, and interdisciplinary subjects, to carry out researches on bioinformatics, systems biology or integrative biology; (iii) molecular mechanism studies of the regulation of glucose, polysaccharide glycol-conjugates and lipid biochemistry will be moderately encouraged; (iv) applications on the mechanisms of environmental physical factors to organisms, and research on the effect of space factors to organisms in micro gravity, space radiation conditions will be moderately encouraged.

Immunology

Immunology is a frontier and leading discipline in life sciences and basic medicine. The funding areas of the discipline include molecular immunology, cell immunology, immune response, immune tolerance, immune regulation, immunogenetics, reproductive immunology, mucosal immunology, vaccine, antibody engineering, and novel technologies and methodologies of immunology, etc.

The discipline mainly supports basic research aiming at the structure, development, function and abnormal mechanisms of immune molecules, cells, tissues, organs, and immune systems. The core funding areas include: (i) Gene expression and regulation, structure and function of immune molecules; structure basis of immune recognition; recognition, activation and effects of innate immunology; molecular mechanisms of antigen presentation; structure, function and immune-pathogenic of cytokines and chemokines; (ii) The differentiation, development, migration, tissue distribution of immune cells and sub-cells and their functional modulation, evolution and comparative immunity; (iii) Identification, response and regulation of innate and adaptive immune; infectious immunity; tumor immunity; self-immunity; hypersensitivity; initiation, progression and elimination of inflammation; mechanisms and intervention of non-infectious diseases; (iv) Cell and molecular mechanisms of immune tolerance; malfunction of immune tolerance;

mechanisms of transplant immune tolerance; abnormal immune response and immunodeficiency; (v) Molecular and cellular mechanisms of immune regulation; abnormal of immune regulation; nerve-endocrine-immune network; immune metabolism; (vi) Immune heredity; genetic basis of immune-related diseases; epi-genetic regulation of immune response; (vii) Immunological mechanisms of reproduction and pregnancy; cross-interaction between reproductive endocrine and immune system; (viii) The function and mechanisms of mucosal immunity and local immunity; (ix) Basic immunology problems during the manufacture of vaccine; (x) Studies of antibody structure and function, design, screening, optimization, reconstruction and remodel; (xi) New techniques, methods and new research system of immunity.

It is clearly demonstrated from the applications in 2017 that there has been a rapid progress of immunological research in China, with the proposals covering a wide range of subjects, and the quality of research contents improved obviously. Most of the proposals were based on solid background and pre-studies; some applications analyzed the possibilities of technical failures and were able to provide alternative resolutions as backup plans; a few proposals were carrying out systematic cutting-edge studies based on novel hypothesis. However, there are problems such as lack of substantial subject intercrossing, etc.

In 2018, the discipline will support applications with creative academic thoughts; encourage applicants to concentrate scientific problems from their former research and practice to carry out in-depth exploration of mechanisms targeting at specific scientific target; encourage the establishment of typical research system and techniques platform, and highlight the setting-up and application of various novel methods and techniques in immunological studies; encourage study in areas of systems immunology, immunomics and computational immunology; encourage basic research relating to the structure of immune system and abnormal function, and the close cooperation of scientists working in basic and clinic studies.

Biomechanics and Tissue Engineering

This discipline is a branch intercrossing of life science with other research areas. The funding scope covers biomechanics and biorheology, biomaterials, tissue engineering, biomedical electronics, bionics and nano-biology.

The funding of biomechanics and biorheology fields includes: the coupling of molecules-cellular mechanics-chemistry on cellular-subcellular-molecular level, the mechanical property and its mechanisms on system-organ-tissues aspects, mechanical simulation and modeling, and mechanics of biomaterials.

The funding of biomaterials mainly covers studies on the regenerative medicine; biomaterials for tissue engineering; implants, interventional biomaterials, and biomaterials of artificial organs; drug or gene carrier biomaterials; surface and interface of biomaterials and its biological effects, compatibility and safety of biomaterials.

The funding of tissue engineering fields includes: regeneration and construction of tissues and organs of normal human, studies on in vitro three-dimensional constructions of malfunction tissues such as tumor, as well as new techniques and methods on bioreactor, bio-manufacturing, micro-tissue and organ reconstruction, etc.

Bioelectronics and bioimaging mainly cover biomedical-signal detection and

recognition, biosensor, biomedical imaging and image processing, appropriators and systems of biosystem detection.

Subjects mainly involved in the field of bionics include: molecular bionic, bionic function and mechanism, bionic materials, bionic surface interface, bionic device and system.

Nanobiology mainly covers nano-biodetection, nanocarriers and delivery, nano-biological effect and its safety.

Applications in recent years indicated an imbalanced development among the above five sub-disciplines. In 2017, in the sub-discipline of biomechanics and biorheology, projects were mostly in such fields as biomechanics of cellular and molecular biomechanics, bone and other tissues and organs of the movement, while biomechanics studies on other organs were rare; biomaterial is a well-developed research area, in which applications in 2017 focused on interventional and implantable biomaterials, gene delivery biomaterial, drug delivery biomaterial, biomaterial surface and interface, biocompatibility and bio-safety; in tissue engineering, most projects focused on bone and cartilage tissue engineering, oral tissue engineering, stem cell transplantation and tissue regeneration, but were lack of proposals on other important organ tissue engineering, as well as novel methodology; in the biological image and bioelectronics devices sub-discipline, there was a lack of study on biomedical signal detection and analysis, biomedical sensing, biomedical detection and system applications; in the field of nano biology, few studies were proposed on nano-bio safety evaluation; in addition, applications in bionics continue to be few in number (less than 10). Most of the proposals funded in 2017 showed solid research basis and provided clear scientific questions with novelty. The main weakness of applications was lack of original ideas, or lack of substantial interdisciplinary collaboration.

In 2018, the discipline will continue to encourage applications to carry out systematic multidisciplinary research in fields of biomechanics and biorheology, biomaterials, tissue engineering, biomedical electronics, bionics and nano-biology. Researches should aim at key scientific issues in the process of important tissue/organ reconstruct engineering, as well as interdisciplinary studies, especially long-term, systematic and in-depth study in tissue/organ replacement and repair, engineering reconstruct and transformation of regeneration. In particular, the discipline encourages and supports the basic research in tissue biomechanics basis and the practical application, other than bone/joint motion system, and cardiovascular system; study on interaction mechanisms and new effect features between biological materials and the body; the novel methods and new technology of tissue engineering (such as 3D printing, biological manufacturing); studies on bioelectronics and biological systems related to the study of bionics, and nano biodetection, nanometer biological safety evaluation and application of ethics.

Special notes for applicants: biomaterial and bionic research other than biology/biomedical applications is excluded by the Division.

Division IV of Life Sciences

The Division's funding areas cover three disciplines: neuroscience; physiology and integrative biology; and psychology.

Neuroscience

This discipline is to study the structure and functions of nerve system, and investigate the essence and mechanisms of human/animal behaviors and cognition activities. The goal of neuroscience study is to reveal the essence of human neural activity, from a primary sensory and instinctive behavior, to a higher level of language, learning, memory, attention, awareness, thinking and decision-making at all levels of the nerve function.

The funding areas of neuroscience cover molecular neurobiology, cellular neurobiology, developmental neurobiology, sensory neurobiology, system neurobiology, behavioral neurobiology, computational neurobiology, and other related studies concerning techniques and approaches of neuroscience.

In 2017, the largest number of the proposals submitted and projects funded focused on molecular neurobiology and cellular neurobiology, whereas there are fewer applications under the applying code of tactile neurobiology, computational neurobiology and neuronal informatics. The funded proposals normally demonstrate high degree of novelty, with precise description of scientific questions and proper research plans. Areas with the most funding include neuronal development, behavior, and neuro-degeneration diseases. Major reasons that applications not funded include lack of innovation, concise scientific issues unclear, weak basis of the previous work, as well as insufficient feasibility of the project. In addition, applications should have clear scientific hypothesis, research should focus more on key scientific issues, and the proposals should meet requirements of writing standards. Applicants are required to select correct “second-level subject application code” and “research area”. Please be noted that the research design must match the selected subject application code. For proposals of computational neuroscience, neuroinformatics and researches with strong interdisciplinary nature, applicants are advised to carry out experiments targeting at concrete questions in neurobiology research instead of simply focusing on modeling and computational theory.

In 2018, the discipline will continue to encourage basic research in the following areas: analysis of molecular, cellular and circuit mechanism of brain activity; interdisciplinary study of neuroscience with chemistry, physics, and materials, etc.; studies related to malfunction of neuronal system to reveal mechanisms of diseases at various levels such as molecules, cells, circuit and body; neurobiological research on primates is encouraged.

Special notes for applicants: cognitive studies with human being should go to Psychology.

Physiology and Integrative Biology

Physiology is to study the phenomena of life activities, principles and regulation, a bridge between biology and clinical medicine. The funding scope covers the physiological function and its mechanisms of homeostasis control under normal conditions, as well as the change of structure and function of human cells, tissues organs and the sustainable homeostasis control and the related research. Integrative biology is an emerging discipline of science to depict quantities and predict biological function, phenotype and behavior, and to investigate the operating law of information flow. The discipline emphasizes on innovative studies in the area of integrative biology from molecules to the body level, revealing the mechanisms of body homeostasis control. The discipline also encourages

studies of basic and common problems of scientific development mechanism with special environment or under disease model conditions.

In 2017, amount of applications in system physiology, sports physiology and integrated physiology was relatively large. Funding for circulation physiology is mainly for researches on blood pressure regulation, blood vessel malfunction and system, arrhythmia, and myocardial remodeling and function renovation; proposals funded in the area of respiratory physiology focus on respiratory dynamics; structure, function, regulation and abnormal in respiratory system; lung injury and repair; respiratory centers and respiratory regulation; pulmonary vascular smooth muscle and pulmonary arterial hypertension. The area of digestive physiology covered investigation on the function of stomach, intestinal, liver, gallbladder, pancreas and body's protection mechanisms upon damage. Proposals funded in the area of urinary physiology covered regulation and control mechanisms of water-salt metabolize of kidney, renal fibrosis, and functional regulation of ladder. Most of the applications supported in the area of reproductive physiology cover researches on the occurrence and fertilizing of germ cells, implantation of embryo, and the regulation and control mechanism of the placenta function. Most of the applications in neurosystem concentrate their researches on the hypoxic-ischemic encephalopathy, neurodegeneration, injured nerve repair, brain and cognitive behavioral, etc. Most of the applications in the area of exercise physiology mainly focused their researches on the physiology mechanisms of the health by exercise, and the prevention and treatment of diseases. Most of the applications in the area of human anatomy concerned about basic research of applied anatomy. The embryology, which covers regulation mechanisms of embryo development, tissue damaging and regeneration, is the major funding area as well. Moreover, endocrine, and glucose metabolism, lipid metabolism, insulin resistance, trace elements (include calcium and phosphorus metabolism) nutrition, senescence, and biological rhythm as well as hemopathology are the key funding areas as well. The discipline will continue to encourage innovative researches on aging and biorhythms, as well as studies on the functional integrative and regulative mechanisms between different systems.

Please note in particular that applications concerning researches about plants, traditional Chinese medicine, wild animals (except comparative physiology) and livestock are not accepted in this Division.

Psychology and Cognitive Science

Psychology studies human mind and behavior, aiming at ultimately understanding initiation, development, performance and regulation mechanisms of cognition, emotion, motivation, intelligence, consciousness, and personality, via various levels of investigations from molecule, gene, physiology, brain, to behavior, population and computational modeling. Scientific experiments and quantitative analysis are introduced to allow psychology growing into an independent discipline from philosophy. Due to the complexity of study object, psychology research is becoming a combination of multi-level and multi-angle one, with more and more specialized branches and series of interdisciplinary layers. Armed with novel technologies and methodologies of neural science, information science, medical science and engineering science, multiple branches of psychology study are providing interpretations and analysis to the material basis of psychological activities: brain and its structure and function. Cognitive science is the science of studying the essence

and rule of human cognition and intelligence. Its research scope includes human cognition and intelligence activities at different levels and aspects, such as perception, attention, memory, action, language, reasoning, choice, thinking, consciousness and even emotional motivation.

The main subjects supported in psychology discipline include cognitive psychology, experimental psychology, developmental and educational psychology, physiological and medical psychology, social and personality psychology, genetic psychology, health psychology, clinical psychology, consulting psychology and applied psychology (including engineering psychology, exercise and sports psychology, management psychology), as well as the brain structure and neural basis of cognition, learning and memory, attention and consciousness, language and thinking, and techniques and methods of cognitive science, etc.

There has been unbalanced development among the branches of this discipline. Many researchers are focusing on fields of cognition psychology, biology psychology, medical psychology, development psychology and social psychology, whereas fields in education psychology, applied psychology and sports psychology are relatively left behind. In the near future, it is speculated that studies in the following fields will achieve breakthrough: psychology process and mechanisms of learning and memory, sensory perception and multi-channel integration, psychology mechanisms of emotion and behavior control, psychology stress and intervention, human cognition and development of social behavior, as well as mechanisms of mental disorders and early recognition.

In 2017, most grants applied to cognition psychology, making 25% of total applications. Development psychology, brain structure and neural basis, social psychology and medical psychology covered 10% each, while there were fewer grants on genetics psychology, stress psychology, individual psychology and cognition simulation. The number of applications for personality psychology is relatively small, and there is no general grant application of cognition simulation. Statistics from funded grants indicated that topic on perceptual information processing, memory and thinking mechanism in cognition and neural mechanism of decision making and problem were mostly funded in cognition psychology; social development and cognition development were the most funded areas in development psychology; social behavior and mental disorder in medical psychology were top sub-fields in social psychology.

In 2018, while continually supporting priority areas, the Division will pay more attention to genetic psychology, personality psychology, medical psychology, etc. The discipline will continue to encourage multi-discipline study, applying novel neuronal imaging, gene analysis, brain stimulation, big data analysis, system tracking, etc., so that to prompt the increase of the scientific significance and research level of psychology study. The discipline encourages interdisciplinary studies so that to concrete national requirement of development, especially to stress researches on social hotspot with Chinese characteristics, and to encourage applied research to play fully the prompting role of psychology to the national social development.

Please note in particular, the cognitive science projects, with the only subject of experimental animals, are suggested to apply to neuroscience.

Division V of Life Sciences

The funding scope of the Division covers the following three disciplines: genetics and bioinformatics; cell biology; and developmental biology and reproductive biology.

Genetics and Bioinformatics

Genetics is to study the inheritance and variation of organisms on various levels of molecules, cells, individuals and populations. Bioinformatics is an interdisciplinary field of biology and computing science, aiming at the exploration and improvement of methods and means to obtain, store, manage and analyze biological data.

The funding scope of the discipline mainly covers human genetics, plant genetics, animal genetics, microbe genetics, genomics, molecular genetics, epigenetics, cell genetics, population and evolution genetics, bioinformatics, behavioral genetics, biostatistics, synthetic genetics and systems biology, etc.

The genetics discipline will give priority support on the following fields: the study of genomic variation and evolution law of complex biological characteristics, including the identification, analysis of key genetic function and its regulating rules; genetic diversity; the correlation between phenotype and genotype; the genotype in analysis and the express prediction of complex traits and complex diseases; the evolution model and mechanisms of genetic variation for important populations; study on the genetic and molecular basis of genetic disease of single gene and complex diseases of multi-genes, including identification of genomic function variation, recognition and prediction of disease genes, and molecular signal route concerned; studies on basic genetic laws and the molecular mechanisms of gene expression and regulation by using model organisms; the establishment of genetic operating system, new methods and technologies of phenomics and genetic breeding; basic researches on the genetic law of typical resources, major agriculture crops, microbe, etc.; and the molecular basis of genetics and variation of organisms under extreme or special environment; novel genetic fields such as genetic editing, chemical genetics, photo-genetics, phenotype-nomics, 3D/4D genomics, algorithms and methodology in biological big data, etc.

In 2017, the numbers of applications received in areas of animal genetics, microbe genetics, cellular genetics, population genetics, behavior genetics and evolution genetics were relatively small, whereas those fields are pivotal concepts in classical genetics research. The Division will prioritize proposals with solid previous studies and novel scientific questions in the above branches. Heredity and variation in human genetics support studies on molecular mechanisms of heredity and variations. In 2018, the Division will continue to encourage original studies on genetic mechanisms and basis.

As for bioinformatics, the discipline mainly supports the development of new algorithm and analysis techniques, which are used to study genomic structure, function and evolution; mass data integration and systems biology analysis; curation of biological data, integration, standardization and visualization of bio big data; design and synthesize of molecular module and network. It is encouraged to carry out combination study between bioinformatics analysis and experiment verification of organisms. The Division will continue to encourage and support research on new theory and methodology, as well as interdisciplinary study of genetics.

Cell Biology

Cell biology is to study the principles and mechanisms of life activity. Cell biology mainly aims at revealing the structure, function, phenotypes and regulation mechanism at molecular, cellular and individual levels within organisms, as well as studies on cytological mechanisms of phenotype and functional abnormal occurrence of organisms.

The funding scope of the discipline mainly includes: cellular and organelles structure, components and their assemblage mechanisms; regulation mechanisms of cell growth, division, and cell cycle; stem cell biology; cell differentiation; cell polarization; maintenance of cell homeostasis; cell senescence; cell death; autophagy; movement of cells; cell signal transduction; extra cellular matrix; vesicle transportation (including endocytosis and exocytosis); material and energy metabolize of cell; intercellular interaction; cell and environment; cell and microbes; host cell interaction with virus; new materials, new technology and methodology used in cell biology study.

Studies on the structure and function of cells have been the major aspects supported by the discipline. Applicants are encouraged to carry out integrated studies on the mechanisms of synthesis, modification, degradation, localization, and translocation of protein with the aggregation, dissociation, location of its components, and the activity diversification with time and space of protein complex during the process of cell signal transduction with dynamic change mechanisms of life activities of cells. Highlight will be given to endeavors on solving important problems in basic cell biology upon using cell models or model systems, in combination with techniques and methods of genetics, developmental biology, chemical biology, and cell imaging technologies, etc.

Among the applications accepted in 2017, there were fewer applications in areas of cell growth and multiplication, extra cellular matrix, establishment of cell polarity, cell substance transportation, cell metabolism, plant cell biology and research of new methods, whereas the above areas are pivotal in cell biology and have foundations in related researches in China. The Division will prioritize funding to applicants who present their proposals with scientific issues from their solid research background on these aspects.

In 2018, the Division will continue to emphasize on functional and mechanism issues, highlighting the utilization of various novel research technologies and methodologies in cell biology. The Division will actively promote the development of techniques in cell in situ and real time, dynamic and high-resolution analysis, and highly value integrated researches from molecular to cellular and individual levels, so as to reveal different molecular mechanisms closely linked with cell function and biological effect and regulation network.

Developmental Biology and Reproductive Biology

The funding scope of this discipline covers three research fields including developmental biology, reproductive biology and stem-cell biology. The ultimate goal is to explore the basic rules of gametogenesis, fertilization, embryo development, the occurrence and growth, homeostasis, damage recovery and regeneration, aging of various organism tissues and organs.

The key biological issues in developmental biology (animals, including human) include: proliferation and migration of embryo cells; the determination of embryo polarity; the inducement and differentiation of germ layers; cell lineage and cells fate determination;

morphogenesis of tissues and organs; growth and shape control of tissues and organs; organ homeostasis maintain and regeneration; tissue and organ senescence; abnormal development and related diseases; evolution of development mechanisms and influence of environment to development, etc. The key biological issues in the area of plant developmental biology concern mechanisms of organogenesis and cell differentiation, especially the molecular regulating mechanisms study of fertilization, zygotic activation, the development of embryo and endosperm, nutrition, and the occurrence and development of breeding organs; organ aging; resolution of signal transduction of flower induction and gamete development; the study of the maintain of stem-cells and its function of growing point; and the exploration of the relationship between development and evolution; resting and activation of stem cells; the proliferation of stem cells and maintaining of pluripotence; self-renewal of stem cells; cell cycle regulation of stem cells; the directional differentiation of stem cells; senescence of stem cells; malignant transformation of stem cells; stem cells and microenvironment; immunogenicity of stem cell; cell trans-differentiation.

The key biological issues in reproductive biology include: sex determination; gonad differentiation, development and aging of reproductive organs; the fate determination, migration, multiplication of primordial germ cells; the occurrence and maturation of gamete; development of plant anther and ovary; occurrence of follicular and ovulation; interaction of germ cells and somatic cells; the sperm-egg reorganization and fertilization; early embryo development and implantation; and apomixes; influences of genetics, epigenetics and environment factors on reproductive health; the mechanisms of reproductive system diseases; the security of assisted reproductive techniques; and the regulating role of reproduction, and the regulation function of reproductive endocrinology.

Among the proposals received in 2017, studies in organogenesis and development as well as the stem cell field aimed at the international forefront with relatively high starting point; studies in the field of reproductive biology were closely combined with the important scientific problems in the field of human reproductive medicine. Research in both basic and applied research reflects the trend of transformation of basic research to clinical medicine. In the future, the Division will continue to encourage applicants in the field of developmental biology and stem cell biology to carry out cutting-edge research. Basic research closely related with human needs for reproductive medicine is encouraged and preferential funding in reproductive biology will be delivered.

Modern developmental biology and reproductive biology emphasize on the continuity of development and dynamic process of change, emphasize the collaborative function of multi-cells and multi-genes, value the relationship of development and diseases, and encourage the exploration of molecular regulating mechanisms of development and reproduction by using model organisms. Applications will be encouraged on the creative development of research methods and systems, as well as the establishment of model diseases concerning development and reproduction, so as to provide basis for clinical transformation. In the field of plant development and reproduction, applications of basic research which may provide theoretical guidance for modern molecular breeding will be encouraged.

Division VI of Life Sciences

The Division covers two disciplines: basic agriculture and crops, and food sciences.

Crop Science

The discipline mainly supports basic and applied basic researches targeted at crops. The studies emphasize on scientific questions of the laws of crop growth and development, the interaction between crops and environment, the genetic improvement of crops and the production of crops covering branches of basic agriculture, crop cultivation and farming system, physiological ecology of crop, germplasm resources, genetic breeding of crops and crop seed science, etc.

The main funding scope in crop science are as follows: the germplasm and gene resources of crops; genetic and molecular mechanisms of important crop property formation; the interaction between crop and environment; the high-yield theory of crop, rules of resource utilization with high efficiency; and the quality control of crop seed and yields. The discipline encourages scientists to carry out researches driven by scientific issues based on crop production and sustainable development of agriculture, focusing on basic study around the above fields. The Division will encourage basic research with the combination of modern genomics, biotechniques, bioinformatics and traditional crop science for targeting on scientific frontiers of crops and the national future demands of agriculture industry. Studies on crop information science, which combine information techniques, computing biology, systems biology with crop science, will be promoted. Researches on crop physiological ecology and cultivation regulation carried out around the high-yield, fine quality, high efficiency, the resilience production of crop, and as well as the high efficient utilization of resources will be encouraged. Endeavors on studies of cultivation, physiological and genetic system by using crop varieties and their parental materials which are broadly used in production, and studies on germplasm resources innovation by using new techniques and methods (like atomic energy, etc.) and related theory will also be encouraged.

It is reflected from the applications in recent years that there was a climbing number of proposals with basic issues on topics meeting the national demand of agriculture, an obvious increase in interdisciplinary studies around basic agricultural issues. However, major problems remain as the following: (i) researches on crop genome are generally concerned, but more attention is yet to pay on further exploration of mechanisms of physiology and genetics; (ii) following-up work with the international frontier is increasing, but it should be performed in close combination with practical issues of national agricultural production, so that to provide potent support of basic research to applied research; (iii) some of the applications are lack of systematic and sustainable studies; (iv) there are more applications in agricultural information, utilizing physical methods (such as spectrum, infrared, remote sensing, 3D photography, etc.) to acquire agricultural information, but there is a lack of in-depth theoretical study, and difficulty exists on actual utilization; (v) some of the proposals are not standardized with inaccurate information, such as untrue or incorrect contents in the resume part, especially in the order of authors for publications, or the list failed to present the real contribution of the applicant and others.

Applications to this discipline should take crops and crop products as their research objects, and the interdisciplinary studies with other subjects should not depart from the principal object; otherwise proposals will be rejected.

The Division does not accept applications with research objects of agricultural animals, animal products, microbe, forest, vegetable, traditional Chinese medicine, algae, woods, and model plants of *Arabidopsis thaliana*.

Food Science

Food science studies the physical, chemical, biological, nutritional and safety properties of food and food materials, as well as principles of food storage processing, the theory and methods enhancing the nutrition value of food and security. The discipline mainly supports basic researches based on food and raw food material as research objects, covering basic food materials science, food biochemistry, food fermentation and brewing, food nutrition and health, biological basis of food processing, food storage and fresh keeping, food safety and quality control.

Problems existing in proposals accepted in 2017 include: (i) false or inaccurate content, especially on the representative research achievement; (ii) incorrect or incomplete application code; (iii) the writing of proposals is not up to the required standards, especially with untrue or unprecise CV contents; (iv) lack of continuity for some of the applicants; (v) loose research contents, failing to concisely demonstrate their key scientific issues, etc.; (vi) some proposals in food cosmetics and materials were tracking up study, lack of novelty or in-depth research.

Proposals submitted to this division shall focus on food and related raw materials and be fit to the funding scope of this division. The requirement also applies to interdisciplinary research proposals. Researches of disease prevention and treatment, health care products and drugs based on food and related raw materials are advised to be submitted to other relevant divisions of NSFC. In 2018 this division continues to encourage applicants to respond to national needs, find scientific questions from food production process, give more emphasis on food safety and quality and conduct innovative basic research and applied basic research within the funding scope of this division.

The Division will not accept proposals in the following areas: (i) prevention and treatment of human diseases by food and food ingredients; (ii) research related to health products; (iii) research on the development of drugs or their components; (iv) the preliminary clinical trials to human body; (v) projects involving the growth, metabolism of growth and metabolic physiology of plants; (vi) research on food machinery, packaging materials, food processing technology, product development and food chemical modification.

Division VII of Life Sciences

The funding scope of the Division covers two disciplines: plant protection, and horticulture and plant nutrition.

Plant Protection

The discipline covers plant pathology, agricultural entomology, agricultural weeds, agricultural rats and other pest, plant chemical protection, biological prevention and cure, quarantine of agricultural pests, invasion biology, and biological techniques of plant protection, etc. Recently, the theory and technologies of genomics, proteomics, metabolic and molecular genetics are widely applied in the innovation of theory and techniques of pest control. However, basic research of plant protection in China is relatively weak, and especially there is a large gap between China and developed countries in the basic research on functional genomics of the interaction of important pests and crops, mechanisms of pest's virulence and crop resistance (sensitivity), law of pest disaster, production and safe utilization of new pesticides with high efficiency, low poison, and environment-friendly property, etc.

The following problems exist in the 2017 applications: (i) for some of the researches, emphasis was put on the simulation studies in the laboratory at the molecular levels, whereas more attention should have been paid to the field study and verification; (ii) quite a number of applications simply traced or imitated researches related at home and abroad, or grafted one research method (or material) to another material (or method), with a lack of original ideas; (iii) some research topics were over broadly laid out, with a lack of concrete of scientific problems, and the research contents were not precise, lack of in-depth studies and substantive subject intercrossing; (iv) some of the proposals aiming at too large target with too many goals that were not achievable, as well as the lack of a deep mechanism research plan; (v) some of the grants are inadequate of working basis and lack of systematic continuity.

In 2018, the Division will continue to encourage researches focusing on the national security of agricultural production, quality safety of agricultural products, and eco-environmental safety. Researches should focus on scientific issues concentered from practice of agricultural production, and put more emphasis on the innovation of new theory and methodology in plant conservation, and on the original creativeness of research. As for research contents, it is encouraged to carry out explorations of the reciprocity mechanisms of crop-pest-environment (biotic and abiotic) at either microscopic or macroscopic level; principles of disaster of hazardous organisms; monitoring, forecast, prevention and control of pests; and the basic and applied basic research of pesticide toxicology and its safe utilization. Special attention should be paid to new scientific issues, combining with the factors of the national crop of ecological features of different regions, to study the adjustment of industrial structure, improvement of cultivation measures, and the global climate change, etc. On the research approaches, emphasis should be put on the combination of new theory and new technologies with traditional methods, as well as integration of laboratory work with field experiment. For interdisciplinary studies, the specific aim of solving major scientific questions in the plant protection field should be elaborated. Preferential support will be given to continuous and systematic research. Excellent proposals will be prioritized funded in the field of agriculture weed, farm rats and diseases and pest forecasting of agricultural crops, etc., in order to promote the balanced development of different branches in plant conservation.

Applications taking woods or model organisms such as Arabidopsis and Drosophila as main research objects will not be accepted.

Horticulture and Plant Nutrition

The funding scope of this discipline covers two research subjects, namely horticulture and plant nutrition.

The funding scope of horticulture covers pomology, olericulture and fruit science, ornamental horticulture, horticultural facilities, post-harvest biology of garden crops and food mycology. In recent years, there has been a rapid development of basic research in horticulture in China. The quality and activity of research work have been much improved in the field of horticulture: the research objects have broadened and diversified, and research approach has been gradually transferred from traditional organism level and cell level to molecular level; studies based on -omics have been actively carried out in horticulture. Great achievement has been made in the study on basis of trait formation of horticulture crops, regulating measures, gene mining and function identifying, germplasm excavations and innovation, mechanisms and control of quality formation, response mechanisms to adversity, mechanisms of rootstock-scion interaction, the formation and regulation of unfavorable components of horticultural products.

The funding scope of plant nutrition covers the heredity of plant nutrition, physiology of plant nutrition, manure and fertilizer science, nutrient resources and recycling, crop-soil interaction and regulation, etc. Based on the frontier of the discipline and the national demands on agricultural resource environment, plant nutrition has been focusing its basic research on the interdisciplinary study of the plant-soil-microbe interactions, especially on root microbe-omics and regulation so as to reveal the coupling mechanism of high efficiency use of plant nutrition elements and water resources; studies on the functional genomics, genetics and physiology of plant nutrition, which are formed by the combination of plant nutrition with modern biotechnology; quantitative study in the process of soil-crop system in the combination of plant nutrition with information techniques, etc.; researches on the new theory and methodology in manure and fertilizer science; and the exploration and sublimation of modern plant nutrition theory from practice of traditional agricultural production.

In 2017, major problems in the application for horticulture were the following: (i) the research content in some of the applications was too broad and lack of the precise layout of basic technique requirement for research approach and method, indicating low level of feasibility to achieve proposed research goals; (ii) there were a large number of proposals pertaining to copying and tracing research, but only a few demonstrated original creativeness and systematic study; some applications concentrated their researches on practical problems of horticulture, but lacked of sufficient scientific issues; (iii) some of the applications in the field of facility horticulture neglected the combination of facility gardening environment and its regulation with biological problems of garden crops; (iv) some of proposals were inadequate of working basis and lack of systematic continuity. Main problems in the applications for plant nutrition were as follows: (i) many applications put their study emphasis on molecular biology of plant nutrition, without in-depth study on mechanisms on the physiology and genetics aspects of plant nutrition; (ii) there was a lack of substantial interdisciplinary studies among crop-soil-microbe, and in-depth study on the efficient nutrient utilization under intensification conditions; (iii) lack of basic researches on nutrient resources and fertilizing science.

In 2018, the Division will continue to encourage endeavors on scientific issues based

on national agricultural practice and agricultural industry development, with a close combination of new approaches with traditional methods. Priority funding will be given to original, continuous and systematic and distinctive research. The discipline of horticulture will support proposals which take horticultural crops as their research objects, and address scientific problems on the features of horticulture crops, and production yield, quality, fastness, and constancy. Proposals originated from the assessment, extravagant and utilize of germplasm resources of the nation or wild garden crops will be strongly encouraged. Research on specific biological problems, such as winter dormancy of horticulture crops, flowering phase, scion interaction and organ formation and development, is especially encouraged. As for applications in facility horticultural studies, proposals should emphasize on the substantial combination of facility gardening environment and its regulation with biological problems of garden crops. Studies on the genetic, physiologic and molecular mechanisms of nutrient utilization of high efficiency, interaction between crop, soil and microbe and its control, and the coupling mechanisms of soil water and fertilizer, and its effectiveness to crops will be prioritized in funding. It is especially encouraged to apply for the experimental testification of laboratory research in the field and excellent proposals in “manure and fertilizer science”. Researches on the nutrient mechanisms of middle and trace elements will also be encouraged for an active promotion of healthy development of all branches in plant nutrition.

Applications using forest or model plant like Arabidopsis as its research objects will be not accepted by this Division.

Division VIII of Life Sciences

The funding scope of the Division covers four disciplines: zoology; animal husbandry and grassland science; veterinary science; and aquatic science.

Zoology

Zoology studies the life phenomena and principles in animal morphology, taxonomy, physiology, behavior, ecology, evolution and genetics. The effective application of theory and techniques in molecular biology, bioinformatics, computing biology, and related subjects has greatly enriched the research contents of zoology. Studies on animal diversity, ontogeny and phylogeny, co-evolution and phenotypic evolution, animal behavior and adaptability have become cutting-edge research areas; whereas research on animal taxonomy, zoogeography and animal resource utilization, and conservation biology has been deepened and integrated continuously. Laboratory animal science has acquired more and more recognition.

Applications accepted by the discipline in recent years have demonstrated that researches in some subjects have already formed their own features and acquired significant international impact. It can be also observed that not only the formulation of scientific problems as well as rationality of designs, but also the creativeness of academic thoughts of the proposals are greatly improved. However some problems still exist, for example, the excessive pursuit of hotspots without solid research basis, and the lack of justification for proposed research and feasibility of technical routes; insufficient experimental

accumulation was provided by some of applications, or the description of detailed research progress and contents; some proposals were lack of scientific problem or hypothesis with explicit definition, or overstating research objectives; the budget for research is impractical in some proposals; repetitive application still exist on a small scale.

In the future, the identification and description of unknown species of animals, and revised study of known species of animals will remain the key funding areas by the branching field of taxonomy. Taxonomy of ocean animals should also be highly valued. Key research areas currently focus on the animal phylogeny and zoogeography, as well as the life history around the evolution. The Division will encourage researches on animal physiology, animal behavior, and the establishment of model animals, etc. Support will be strengthened for researches on conservation biology for endangered animals, the sustainable utilization of important resource animals, and related biological researches for important alien invasive species and bio-safety. Basic research of zoology for specific species in China and fragility of western and remote areas will be continually encouraged. In addition, the discipline will pay more attention to basic research on zoology; encourage original studies and exploration based on animal resources and regional features in China and the application of new theory and technologies. Interdisciplinary studies will be encouraged.

Special attention for applicants: this Division will not accept grants for clinical diagnosis and treatment as well as with model organisms as study materials.

Animal Husbandry and Grassland Science

The major funding scope for animal husbandry and grassland science is to study the growth, development, feeding and breeding of domestic animals; the utilization of animal products, and grassland plant resources; quality and higher yield forage grass and the synthesized utilization of resources for maintaining pasture conditions and increasing productivity of grass and livestock.

In areas of animal husbandry and grassland science, the Division supports basic researches on resources, genetic breeding, reproduction of livestock and poultry, nutrition of monogastric animals, poultry nutrition, ruminant nutrition, feedstuff, behavior of livestock, environment and animal husbandry engineering, grassland and grazing, grass germplasm and breeding, grassland environment and disaster, forage production and processing, grassland physiology and functional genomics, sericulture and apiculture, etc.

Applications accepted and funded in 2017 covered all branches of this discipline, among which, the majority of applications focused their studies on mining excellent genes of typical excellent domestic animals of the country and their functional genome, molecular genetically breeding, reproduction and development model, molecular mechanisms of regulation, new theory and methods related to molecular nutrition, and the development of fine grass germplasm resources and fine variety cultivation, the livestock of low emission, and the interaction of animal husbandry development and its environment. Quite a few studies in the above fields have formed their features in many aspects.

In 2018, the discipline will give more priority to studies on excellent gene mining of typical livestock, poultry, grass, silkworm and bees of China, and cultivation of fine species; encourage basic research on nutrition of domestic animals, prolificacy of live stocks, and the genetic breeding of grazing; and the high efficiency utilization of feedstuff and forage resources. The discipline will also give moderate preference to researches on the

environment of domestic animals and pollution, behavior and welfare, mechanisms of the physiological adaptation of productivity, and grassland pasture, sericulture and apiculture, etc.

Special notes for applicants are the following: (i) study object of the research should be livestock, poultry, grass, silkworm, or bee; interdisciplinary studies with other subjects are not allowed to depart from the main research aspect above; otherwise the proposal will be not funded; (ii) for research topic selection, please grasp the essence of key scientific issues in related fields, instead of simply following up the new research progress at home and abroad.

Veterinary Science

Veterinary science is to study the occurrence, development, diagnosis, prevention and cure of animal diseases. The discipline covers the following branching: animal diseases, zoonoses, public hygiene, laboratory animals, veterinary medicinal industry, etc., as well as other related novel interdisciplinary research areas.

The discipline supports basic researches taking animal diseases as major objects on animal infectious diseases, zoonoses, most common diseases and comparative medicine. The funding scope covers: basic veterinary science, animal (veterinary) pathology, veterinary immunology, veterinary parasitology, veterinary epidemiology, traditional Chinese veterinary, veterinary pharmacology and toxicology, and clinical veterinary science.

Proposals accepted and funded in 2017 covered all subjects of this discipline. Among them, the majority were focused on veterinary epidemiology, basic veterinary, clinical veterinary and veterinary immunology. Some of them were able to aim at the international frontiers, highlight the creativeness in the selection of their research themes, and actively prompt the international standard of research work. However, problems still existed as demonstrated here: some of the applications paid much attention on the international hotspot, but were lacking of enough concentration of scientific issues; basic research on topics such as traditional Chinese veterinary, animal (veterinary) pathology, etc., were yet to be concerned.

The Division will continue to encourage studies on the epidemiology, pathogenic biology, mechanisms of pathogenic infection and immunity about important animal epidemic diseases and zoonoses, meanwhile, strengthen researches on the basic veterinary immunology, the non-infectious disease of animal mass populations, food safety of animal source, and related research, and give moderate preferential support to studies on traditional Chinese veterinary, and animal (veterinary) pathology, etc.

In 2018, the Division requests applicants to take animal diseases as their main research objects and interdisciplinary studies should not deviate from the research objects. This discipline encourages research for the development of national animal husbandry and veterinary science, aiming at defeating new and recurrent animal diseases. Special note to applicants: when involving highly pathogenic microbes, the operation of the project must strictly abide by the relevant provisions of the state, with the biological safety of the appropriate conditions.

This discipline does not accept research on Animals, bees, silkworms.

Aquatic Science

Aquatic science is to study basic rules of the development, growth, breeding, genetics, physiology and immunology of aquatic organisms and their breeding ecology, breeding engineering, nutrition and foodstuff, control of diseases and pests, and the protection and utilization of aquatic resources, etc.

The main funding scope in this discipline covers basic aquatic biology, the genetic breeding of aquatic organisms, aquatic resources and conservation, the nutrition and feed science of aquatic organisms, aquatic breeding, the immunology and control of diseases and pests, breeding and fishery engineering, and new techniques and methods of aquatic biological research.

In 2017, most of proposals accepted and funded were in areas of immunity and control of diseases and pests of aquatic organisms, aquatic basic biology, genetic breeding of aquatic organisms, as well as aquatic resources and conservation, etc. Relatively in-depth studies were conducted on important economic traits of aquatic animals, molecular characters of important pathogens and their pathogenesis, etc., and some of studies have formed their own research features and superiority in some aspects. It can be seen from peer review and panel meetings that the creativeness of academic thoughts of proposals were obviously improved. However, only a small portion of applications were able to propose original research on the important scientific issues of aquaculture, whereas for most of the studies, concentration of specific scientific issues was yet to be improved.

In 2018, the Division will request applicants to focus their studies on research fields of aquatic science, and aim at the frontier and important demands of production. The interdisciplinary study on aquaculture subjectively with other disciplines will be encouraged. It will be strengthened to support proposals with original ideas. Applicants should choose topics based on new development of subjects concerned at home and abroad, and their research background, aim at scientific problems, focus on original innovation, and avoid over emphasizing on R&D for technology while lacking of key scientific issues. Research on model organisms should be based on aquaculture science. The Division will encourage cooperation of applicants with superior units and teams, so as to fully exert regional and resource priority, and enforce cultivation of talents. The Division will prioritize applications in the following areas: genetic rules and gene function of economic traits of important breeding organisms; epidemiology and pathogenesis of important aquatic organisms; host immunity and diseases prevention and treatment; molecular basis and regulation mechanisms of breeding and development of important aquatic organisms; regulation mechanisms of the utilization as well as metabolism of nutrient stuffs for aquatic animals. Moderate support will be provided in the following areas: basic research of aquatic breeding and interaction with eco-environment, conservation of aquatic resource, new model and new techniques of breeding, etc.

Department of Earth Sciences

Earth sciences study the origin and evolution of the planet earth system. Earth sciences include geography, geology, geochemistry, geophysics and space physics, atmospheric and oceanic sciences, as well as the interdisciplinary research among these disciplines and other fields.

The above sub-disciplines of earth science are the core and bases for the progress of earth science. The General Program aims to promote the balanced and harmonized development for all disciplines of earth sciences, facilitate original innovation and expand the frontier of research, and hence to build up a robust basis for the development of the earth science. In 2017, the Department received 6,272 proposals for the General Program submitted from 697 institutions. Among them, 1,683 were funded with a total budget of 1.1307 billion yuan (direct expenses, and hereinafter), with a success rate of 26.83% and an average budget of 671,800 yuan for individual project. Among the funded projects from the General Program in 2017, 997 (59.24%) were from universities and 661 (39.28%) from research institutes. The PIs of 1,182 projects (70.23%) were younger than 45 years old. There were 112 interdepartmental and interdisciplinary projects, and the proportion of interdisciplinary projects supported by different divisions inside the Department of Earth Sciences was even higher. Small Fund for Exploratory Studies with 1-year research was set up for highly exploratory, innovative and high risk projects or projects with uncertainty. Altogether, 9 proposals were approved as the Small Fund for Exploratory Studies projects in 2017 and 1.8 million yuan were allocated.

Funding for General Program Projects in Department of Earth Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Average funding for direct costs	Success rate+ (%)	Projects	Average funding for direct costs	Success rate+ (%)
Division I	Geography (including soil science and remote sensing)	534+2*	35,017	23.83	573+3*	36,780	24.17
Division II	Geology	365+2*	26,488	27.72	390+2*	27,634	26.96
	Geochemistry	137+1*	9,809	28.93	148+1*	10,145	31.63
Division III	Geophysics and space physics	182+1*	12,816	29.85	194+1*	13,355	29.15
Division IV	Marine science	191+1*	13,349	26.82	204+1*	13,902	27.89
Division V	Atmospheric science	156+1*	10,781	32.17	165+1*	11,254	29.64
Total		1,565+8*	108,260	26.81	1,674+9*	113,070	26.83
Average funding per project		68.82 (69.07**)			67.18 (67.44**)		

Notes: * The number of projects of Small Fund for Exploratory Studies for 1 year; ** Average amount for individual projects with a full term (not including Small Fund for Exploratory Studies projects); + Success rates include the projects of Small Funds for Exploratory Studies.

The criteria for the selection of General Program projects in 2018 are as follows: (1) Innovation and academic value of the overall research approach; (2) Research capability of the applicants; (3) Clearly stated scientific issues and well defined ideas; (4) Availability of necessary research basis and conditions. During the selection of the proposals, the department pays close attention to the importance of the basic or traditional disciplines, maintain the international status of the privileged discipline or fields in China, promote the disciplines which are still weak or even “endangered” in China yet predominant in the world, encourage the intercrossing, integration, infiltration and synthesis among disciplines, improve the development of the frontier and basic sub-disciplines, foster the development of the sub-disciplines closely related to experiment, observation, data integration and

simulation, and recognize the importance of the intercrossing of the earth science and other disciplines. While advocating innovations, the accumulation of research work should be emphasized. Under the same condition, preferential support will be given to those applicants who have a good accumulation of previous studies and high-quality results obtained from their recent completed projects, as well as who apply to continue their studies. Applicants are required to address the relation between the proposed research work and their accomplished projects. In regard to the exploratory, unforeseeable and long-term running for basic research, special attention will be paid to the high risk, interdisciplinary and frontier research. Scientists will be encouraged to face the great challenging scientific issues and to carry out risky and exploratory research. The average amount of individual grants will be constant to that of the previous year.

In 2018, the Department of Earth Sciences adjusted the structure of sub-disciplines in order to strengthen support for Environmental Geoscience. Applicants should pay close attention to the changes.

Environmental Geosciences

The scope of funding: soil science, hydrology and environmental geosciences (including environmental geochemistry, environmental geology, environmental ecology, atmospheric and environmental science, etc.).

Taking the Earth's surface system as the study object, this discipline focuses on the physical, chemical and biological processes of the evolution of the atmosphere, hydrosphere, surface lithosphere, biosphere, pedosphere, and their interaction and biogeochemical cycle of matters, as well as the interaction between human beings, geological systems and ecosystems on the Earth's surface.

The main research directions include: soil science which mainly discusses the pedogenic processes and distribution patterns of soils, the composition and characteristics of soils, and the temporal and spatial evolution of soil functions, with emphasis on investigating the physical, chemical and biological mechanisms of the changes of soil quality and soil functions caused by high-intensity utilization of human beings.

Environmental geosciences mainly study the variations of the Earth's environment using the theories, methods and techniques of geosciences (geology, geochemistry, geophysics, geography, etc.). The concerns include the changes of the atmospheric environment, water environment, soil environment and their relationships with the evolution of the biosphere, the occurrence and development of various geological and environmental disasters and risk assessment theories under the influence of natural factors and human activities, together with various fundamental scientific problems on restoration and rehabilitation of polluted environments and degraded ecosystems. The studies of multi-disciplinary and systems science for the sustainable development of human society are especially encouraged.

Geography

The scope of funding: physical geography, human geography, remote sensing and geographic information system.

Physical geography focuses mainly on interactions, spatial heterogeneity and evolution processes of modern natural environmental elements at multiple tempo-spatial scales, and concerns the human-land relationship since the Quaternary Period, especially Holocene.

Human geography concentrates mainly on the different types of modern human elements, spatial structure and evolution processes of their information carrier, and concerns natural background, historical development and human mechanism of regional human elements' spatial structure formation.

Geographic information science (remote sensing and geographic information system) is a discipline of acquiring, processing, analyzing, presenting, transmitting, memorizing and managing geographic tempo-spatial information of terrestrial surface assisted by the modern technologies of remote sensing (RS), geographic information system (GIS) and global position system (GPS), especially concerns the study on geographic information interpreting.

Geology

Geology is the knowledge about the composition, structure and evolution of the Earth. The aims of modern geology are to disclose the structure and composition of the Earth, to explain the mechanism controlling the transition of Earth materials, to elucidate the Earth's environment and life evolution recorded in these materials, to reveal the agents and processes which modify the Earth's surface, and to apply the knowledge of geology to explore the utilizable energy, mineral and water resources, to uncover the relationship between geological processes, life evolution and human activities, to protect the Earth environment and to mitigate geo-hazard.

The development of geology is based on the advancement of fundamental theory and cutting-edge technology. The introduction to plate tectonic theory has brought about revolutionary changes to the understanding of the Earth. The disclosing of complexity of continental dynamics and the tectonic schemes predating the plate systems are raising new themes for the advancement of plate tectonic theory. Due to the emerging new framework of Earth system science, the correlation between deep processes and surface impacts of the solid Earth has become the frontier for geological sciences. The enhancement of abilities to obtain and to analyze data has become a major driving force for promoting the development of geological sciences. The implementation of high precision, in-situ and real-time analytical methods for the composition and structure of terrestrial materials has enhanced the capability to constrain the composition and evolution of the Earth. The development of geophysical exploration, space-based observation, and geological drilling technology has increased the integrity and accuracy for the understanding of the Earth's structure. New

high-tech approaches such as information system, internet of things and photoelectron technology have helped to realize real-time monitoring of crustal movements, earthquakes and volcanic activities. The reproduction and predication of important geological processes have been made possible through the development of computer simulation and high-temperature/high-pressure experiments. This Department encourages characterized proposals of basic research on fundamental theory based on field and site observations by using of the abundant materials and data recently acquired and accumulated by geology-related agencies and institutions. Multidisciplinary approaches, such as the application of concept, theory, technology and methodology of mathematics, physics, chemistry, bioscience and computer science, are encouraged to use to study geological issues. International collaboration is also advocated for promoting geological researches and theory advancement with a global scientific view.

Geochemistry

Geochemistry is the discipline that investigates the chemical composition, chemical process and chemical evolution of the epigeosphere, earth interior, celestial bodies and cosmic matter etc. It applies primarily elements and isotopes tracing, analysis of macroscopic and microscopic structure, analysis of organic matter and biology, isotope and chemical dating, etc. Geochemistry focuses mainly on substances evolution and interaction of different geospheres in the Earth's history. Also, it emphasizes the distribution, state, migration, transformation, cycle and fate of the substances of the earth surface system under human activities stress and natural state.

Geochemistry is not only the basic discipline to cognize the earth and cosmos but also the applied discipline to solve the problems such as natural resources, ecological environment, geologic hazard faced by people to survive and develop. There are three aspects to promote jointly the further development of geochemical basic theory and applications: the development of planetary science, earth system science, interdisciplinary, the progress of analysis technology, the needs of human sustainable development demanding on mineral resources and fossil fuels, ecological safety and environmental protection. The geochemical research area covers all aspects of chemical composition, chemical process and chemical evolution of rock, soil, water, atmosphere, volatile matter of earth interior and organism, etc.

The characteristics of modern geochemical studies include the following: (1) In the solid geochemistry field, the research hotspots have shifted from the material composition and chemical reactions of the interior Earth to the interactions of different geospheres and their boundaries. It gives full play to advantages of geochemical microprobe in situ analysis with high-resolution, high-precision and high-sensitivity. It pays more attention to geochemical processes and composition structure of Earth's layers. It emphasizes the integration of plate tectonics evolution and global change research. (2) Research methods and techniques have shifted from statically semi-quantitative description to dynamically quantitative simulation, focusing more on the research of four-dimensional space-time evolution. (3) It pays attention not only to the reconstruction of ancient geologic events on long time scales, but also to the description of physical, chemical and biological processes

on short time scales, and the prediction and simulation of environment changes in the future.

Geophysics and Space Physics

The scope of funding is geophysics, space physics and geodesy.

Geophysics

Geophysics, which includes direct observation and theoretical studies on the basic physical fields of the earth and planets, for instance, seismic, gravity, magnetic field, electric field, stress field, heat flow, etc., is not only essential for effectively understanding of internal structures of the earth and planets and their components and dynamic processes, but also the foundation of new methods and technology development of resource exploration. Moreover, explorative study on mechanism of earthquake and other natural disasters has important significance for protecting the earth and disaster alleviation.

Space Physics

Rapid progress in space physics has been made in recent years, especially in multi-level energy transferring and coupling, and the comprehensive theory framework of the disturbance of solar-terrestrial system. In addition, studies on the interaction between the solar wind and the atmosphere of the moon and planets are also initialized. This progress provides a foundation for rapid development of space weather. Proposals dealing with scientific issues in these fields are encouraged.

Geodesy

Researches based on such development, including the development of the ground- and space-based observation system and theories, are encouraged to understand the shape and gravity of the earth, the crustal deformation field and its changes which provide space, time and gravity datum for the national defense.

Geophysics, including solid-earth geophysics, space physics and geodesy, utilizes the theories and methodologies of physics and mathematics to understand the earth and the solar-terra space as well as the corresponding physical processes. These studies play an important role in solving the emergent problems of resources, environment and natural hazards for the sustainable development of the society.

In the near future, continuous support to fundamental research, and more efforts will also be given to new growth and pioneering studies, specifically those regarding to breakthroughs of well-defined scientific issues. Special attention will be given to the application of new technology, innovative tools and especially new observational data to the study of geophysical and space systems. Support will be focused on frontiers of space weather, satellite gravity, environmental geophysics, experimental geophysics, geophysics of the earth's deep interior, and comparative studies of the earth and other planets, as well as the theory of seismic wave propagation. In addition, during the research on the earth's interior structure of China, encouragement for more observational study in these areas

where short of seismic data and developing new methods of integrating various data sources, so as to promote sharing of seismic data.

Marine Science

The scope of funding: marine science and polar science.

Marine science is a discipline studying sea water and seabed, and various processes at interfaces between ocean and atmosphere, and between sea water and coastal estuaries, including physical oceanography, marine geology and geophysics, marine chemistry, biological oceanography, marine environmental science, coastal estuaries, marine engineering, marine monitoring and survey techniques, marine remote sensing, integrated coastal zone management and other branches. Basic sciences, such as mathematics, mechanics, physics, chemistry and biology have been continuously applied to marine science. Meanwhile, new and high technologies, such as space technology, information technology, biotechnology and deep-diving technology, have been continuously applied to marine science. These have formed a new frontier in marine science. Research within this new frontier is also encouraged by the Division.

Marine science is a comprehensive research, characterized by the accumulation of observational and experimental data, the application of new and high technologies, the development of simulation models, and the tendency towards globalization and internationalization. The advancement of marine science can make social and economic development achieve sustained benefits from ocean resources, which is an important measure of national scientific and technological strength. The current strategic position of marine science has been leveled up greatly with a tendency toward “global change” and “deep-sea research”, forming a new pattern extending from the shore to the interior ocean and from the shallow water to the deep ocean.

Marine science is a science essentially based on observation. The promotion of its academic thoughts and research abilities depends on long-term observation and data accumulation. To meet the demands of research projects in ocean observation, NSFC initiated the pilot Ship-time Sharing Project. Scientists are encouraged to participate in the NSFC Open Research Cruise (NORC) to obtain more continuous, systematic and comprehensive data. The program aims at encouraging scientists to conduct in-situ observation and laboratory analysis using new technologies and methods focused on the scientific issues to be investigated, and provide technical support for exploiting new research fields and new results. In order to promote a balanced development of marine science in China, it is also encouraged that scientists may join in existing cruise plans carried out by other agencies to do research on the deep ocean. To aim at the integrated development of marine sciences, the scientists are encouraged to conduct researches related to physical oceanography, marine chemistry, marine geology and biological oceanography on different spatial and temporal scales.

For those who want to participate in the NORC, it is required to describe the necessity, contents and expected data outputs of the proposed observations in the proposal. Applicants are suggested to pay close attention to the related bulletin and announcements for cruise timing.

Polar science is a discipline studying various natural phenomena, including the processes and changing rules peculiarly in polar region as well as its interaction with other components of the Earth system. It is a comprehensive discipline consisting of several sub-disciplines including polar biology and ecology, polar oceanography, polar space physics, polar atmosphere science and climatology, polar geology, geophysics and geochemistry, Antarctic astrolithology, polar glaciology, polar mapping and remote sensing science, polar management and information science, polar observation and engineering technology, etc.

For the past few years, significant progress has been achieved in international polar research. However, it is still the weakest area in earth science. Comprehensive and interdisciplinary study is the current trend in polar science, which is focused on the key scientific issues on global change and sustainable development for carrying out research on large-scale interactions of the five spheres in the polar region as well as their interactions with the middle and low latitudes. Polar science in China should focus on key scientific issues such as global change and sustainable development based on the accumulation of the previous studies.

Atmospheric Science

The scope of funding: meteorology, atmospheric physics, and atmospheric chemistry.

Atmospheric science is a discipline studying various phenomena and their changing regulations occurring in the atmosphere so as to serve the mankind. In recent years, with the introduction of the Earth system science and sphere interaction concepts, atmospheric science enters into a new historical phase of development. The atmosphere is one of the most active spheres in the Earth system. Its changes are affected and controlled by other spheres in the system and celestial bodies such as the Sun; at the same time the response of the atmosphere to the changes simultaneously results in direct impact on the ocean, terrestrial surface, ice and snow, as well as the ecosystem on the Earth. The atmosphere plays an important role in the interaction among different spheres of the Earth system, and regulates the whole behavior of the Earth system with the interaction of other spheres. Therefore, beside the study of dynamical-physical-chemical process within the atmosphere, atmospheric science currently focuses on the comprehensive researches on the essence of the atmospheric change in terms of the interaction among hydrosphere, lithosphere, cryosphere, biosphere, human activities and global climate, the regulation of weather, climate system and theories and methods of climate change prediction, the regulating technology and measures affecting weather and climate, the impact of human activities on weather, climate and environment system, and the influence of weather, climate and environment system change on human society. Atmospheric science deepens the study on its various sub-directions, and meanwhile, pays attention to the mechanism of the disastrous events occurrence and development of the weather, climate and environment, as well as the forecast and prediction; study on issues of global climate and environment change, and its impacts, adaptation and mitigation; the comprehensive, integrated, modeling and systematical studies on various processes; the interdisciplinary study which could provide

the scientific basis for the livelihood and the sustainable development of society.

In 2018, the Division will continually encourage proposals for exploratory, original and prospective basic studies in areas as follows: the various phenomena, processes and mechanism in atmosphere, and the physical-chemical-biological processes of the substance and energy interaction between the atmosphere and other spheres by applying new ideas, methods, advanced equipment and technologies; applications regarding to synoptic meteorology, atmospheric dynamics, atmospheric physics, atmospheric chemistry, atmospheric environment, atmospheric detection and remote sensing, boundary layer, stratosphere and mesosphere; the climatic change and its relevant extreme synoptic and climatic events; new theories and methods for weather forecasting and climate prediction; new theories and methods for numerical model and data assimilation; basic research on the satellite and radar meteorology; analysis and applied research on the data received from the large scientific experiments and science plans being initiated, conducted or already completed, as well as large observation network established in China and aboard; research on the principle and method for meteorological observation, data analysis and applications; interdisciplinary research concerned on the key areas such as national defense, agriculture, energy, transportation, forestry, hydrology, health, economy, ecology, etc., as well as the national demand such as the Belt and Road Initiatives and major engineering support, to serve the livelihood and the sustainable development of society.

Department of Engineering and Materials Sciences

Engineering and materials sciences deliver scientific and technical supports to national security, the improvement of people's living standard and the sustainable development of the society and economy. Aiming at cutting-edge areas and meeting the national strategic demands of the social and economic development as well, and committed to discoveries, inventions and innovations concerned, researches in engineering and materials sciences should pay full attention to scientific creativity and innovation, especially original creativity and innovation with independent intellectual properties, promotion of the sustainable development of interdisciplinary integration, so as to achieve a higher level of sustainable development and broad international impact in the field of engineering and materials.

The Department will continue to support interdisciplinary and cutting-edge researches, especially the researches with such great significance that new knowledge could be formed, industrial development could be promoted and international competitiveness could be raised. Researchers are encouraged to focus on original and integrated innovation and to pay more attention to key scientific issues coming from application and propose related research contents. Priority is given to the researches that can lead the development of disciplines, and have the potential to obtain independent intellectual properties, especially those combined with national conditions.

The Department encourages various projects with distinctive characteristics of basic

research and high technology. Applicants should pay attention to the following priority areas and put forward idea-driven proposals. The areas include microstructure and deformation mechanism of metastable metallic materials, preparation, processing, and property tailoring of high performance light metal materials, low dimensional carbon materials, new inorganic functional materials, new theories and methods of polymer materials processing, carrier materials for biological active materials controlled release/delivery system, theories of efficient development of fossil energy and disaster prevention/control, green metallurgical processes toward resource saving, highly efficient metallurgical extraction and processing, preparation and processing of high performance materials, mechanical surface and interface behaviors and regulation, technology foundation for additive material manufacturing, heat and mass transfer and advanced thermal system, regulation of combustion reaction, new generation energy power system, foundation of high efficiency high quality motor system, design theory for whole-life overall reliability of structures under multiple disasters, design theory and principles of green buildings, life cycle periodic performance evolution performance major dam and ocean platform, etc.

Funding for General Program Projects in Department of Engineering and Materials Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Average funding for direct costs	Success rate (%)	Projects	Average funding for direct costs	Success rate (%)
Materials sciences I	Metallic materials	219	13,573	20.86	238	14,284	21.02
Materials sciences II	Inorganic and non-metallic materials	220	13,611	21.19	231	13,845	21.51
	Polymer materials	315	19,536	20.43	339	20,355	21.23
Engineering sciences I	Metallurgy and mining science	305	18,938	20.00	344	20,624	20.66
Engineering sciences II	Mechanical engineering	540	33,486	21.38	565	33,965	21.41
Engineering sciences III	Engineering thermo physics and energy utilization	213	13,214	21.24	228	13,680	21.67
Engineering sciences IV	Architecture, environmental and structural engineering	579	35,918	19.78	643	38,564	20.64
Engineering sciences V	Electrical science and engineering	195	12,161	19.42	217	12,993	19.87
	Hydrology and marine engineering	265	16,463	19.98	280	16,810	20.91
Total		2,851	176,900	20.45	3,085	185,120	20.98
Direct cost per project		62.05			60.01		

In 2017, the Department received 14,706 proposals (331 rejected), increased by 5.49% in comparison with that in 2016, and among them 3,085 were supported with a total direct cost of 1,851 million yuan. The average direct cost is 600,100 yuan per project and the success rate is 20.98% (20.45% in 2016).

Applicants should pay full attention to the following:

(1) The Department will support preferentially basic research with scientific merits and applicable prospects, with considerations to practical conditions and resource characteristics of China, which can either give an impetus to the development of relevant sciences or lead to independent intellectual properties. Proposals that meet the needs of national economy and sustainable development of the society will be encouraged.

(2) Interdisciplinary researches will be encouraged so as to promote the progress of the cross disciplines involved. Applicants should put forward new conceptions and ideas as creative as possible with specific scientific issues.

(3) The fundamentality and innovation should be fully discussed in proposals. Applicants should pay attention to proposing key scientific issues, concentrating research contents and highlighting research focus. For different types of projects, please refer to the relevant project administrative policies, and put forward proposals according to the requirements.

(4) When applicable, applicants are required to provide the research achievements of the previous completed project(s), and list the scientific papers published in domestic or foreign academic journals. The provided information must be objective and accurate; otherwise it will be treated as a research integrity issue.

(5) Please refer to the funding amount of different projects, and put forward proposals with a reasonable budget plan according to actual demands of various expenses.

Division I of Materials Sciences

The Division supports fundamental research on metallic materials and organic polymer materials.

Metallic Materials

Research proposals should present the merits of the proposed fundamental research clearly, including clear objectives and scientific significance of the project, and the suitability of the methods to be employed. Proposals should target either to advance the materials science in cutting-edge areas or to promote development in the relevant areas that meet the national demands. The funding scope of the Division covers compositions, microstructures, phases, surfaces and interfaces, scales effect, impurities and defects in metals, alloys, metal matrix composites, inter metallic compounds and metal-like materials, and their influence on mechanical, physical and chemical properties and performance; basic issues in the preparation and processing of metallic materials, including heat treatment, casting, forging, welding and cutting; basic issues in the strengthening and toughening, deformation and fracture, phase transformation and alloy design; fundamentals in energy materials, environment-friendly materials, biomaterials, and materials in transportation, aeronautic and astronautic industries; interaction mechanisms of metallic materials and environment, damage, functional degradation and consequent failure mechanism, recycling mechanism and relevant fundamentals; theoretical fundamentals on metallic materials; development of theoretical methods, calculating methods, modern analysis and test methods, big data analysis and processing methods incorporating basic and applied basic researches of metallic materials.

In 2017, the Division received 1,132 proposals for the General Program, increased by 7.81% in comparison with that in 2016. Totally, 238 projects were granted with an average funding intensity of 600,200 yuan per project and a success rate of 21.02%.

It is noticed that the areas of metastable metals and alloys, functional materials and surface engineering kept the leading place in term of the amount of proposals. It is hoped that researchers should pay attention not only to the frontiers and the hot areas, but also to other fundamental issues with scientific merits and creative ideas, especially those common key issues beyond materials systems. In addition, attention should be paid to the new understanding of classical issues in basic materials. Applications in the field of composites and surface engineering should focus on scientific aspects and proposing unique ideas. Applications with a cross-disciplinary background should focus on issues within the funding spectrum of the Division.

The Division would give more support to the selected areas that meet the national demands or is expected to achieve a breakthrough in the form of General Program project groups. In 2018, the following research orientations will be given preferential financing: (i) formation and evolution of defects and performance regulation of advanced nuclear energy materials; (ii) structural regulation and catalytic properties of nanoporous metals.

Organic Polymer Materials

The Division mainly supports the following areas in the field of organic and polymeric materials science: preparation chemistry of organic and polymeric materials; theory and method for the characterization of polymeric materials; processing of polymeric materials; the surface and interface of polymeric materials; the implementation of high performance and functional properties of general polymer materials; polymer-based composite/hybrid materials; functional organic and polymeric materials and organic solid materials; biomedical polymer materials; organic and polymeric materials related to energy, transport, ecological environment and resource utilization; smart and biomimetic polymer materials; special polymer materials.

In 2017, the Division received 1,074 proposals for the General Program, with an increase of 3.5% compared with that in 2016. Finally, 231 applications were granted with an average funding amount of 599,400 yuan per project and a success rate of 21.51%. Quite a few applications were involved in the following areas: polymer blend and composite materials, biomedical polymer materials, functional inorganic/organic composite materials, photo, electro, magnetic functional materials, environment-related polymer materials, and structure-property relationships of polymeric materials, etc.

The Division encourages interdisciplinary basic researches involved with mathematics, chemistry, physics, life science, medical science, information science, energy, environment, mechanical and manufacturing science, transport and aerospace science, and oceanography, etc., which lead to creativity and innovation. To be specific, the researches in the following areas are encouraged: scientific issues in the preparation of polymeric materials, including high efficient and controllable synthetic methods of polymeric materials, synthetic chemistry of polymer materials with high performance, including new monomers, new routines and new technologies, the preparation of functional polymer materials, new method and theory in polymer processing, the relationship between the aggregation structures and the properties of polymeric materials and their composite

materials; the method and theory in the implementation of the high performance and functional properties of general polymer materials; low-cost and green method in the preparation of functional organic and polymeric materials, the structure-property relationship and the implementation of their stability; performance-directed biomedical polymer materials and the evaluation method of their application; new concept in the design theory and preparation method of smart and biomimetic polymer materials; the controllable preparation and assembly methods of supramolecules and polymer materials with multilevel structures and their functionalization, eco-environmental polymer materials, including the structures, properties and efficient utilization of natural polymers, as well as the design theory and preparation method of environment-friendly polymer materials, the recycling and utilization of polymeric materials; polymeric materials for environmental control and improvement in water, soil and air pollution, and the stability and aging of polymeric materials. The Division encourages enhancing the design of polymer materials with the guidance of theories. The Division also encourages basic research aiming at the difficult problems existing in the preparation, modification and processing of the main assortments of domestic polymer materials.

Division II of Materials Sciences

The Division II of Materials Science, Inorganic Non-Metallic Materials, supports the fundamental and applied basic researches on various inorganic non-metallic materials. Along with the development of material design theories and the innovation in fabrication technologies, lots of new inorganic non-metallic materials emerged, including 2D materials, smart materials, biomaterials and new energy materials, etc. The researches on inorganic non-metallic materials are becoming more and more active. At present, for different research areas in inorganic non-metallic materials, functional materials are developed toward the routes with high efficiency, high reliability, high sensitivity, smartness and functional integration; and structural materials tend to possess toughening, functionalization, extreme environment endurance, eco-friendly fabrication and high reliability. Meanwhile, conventional inorganic non-metallic materials are constantly being remolded, upgraded and developed as well. More attentions are given to the applications on inorganic non-metallic materials in information technologies, life science, energy and environmental science, aerospace, and so on.

In 2017, the Division received 1,597 applications for the General Program, with an increase of 3.57%, and 339 projects were funded with an average funding of 600,400 yuan per project. The success rate is 21.23%.

From the proposals submitted in the past three years, it is demonstrated that the researches involve various areas with a broad interdisciplinary range, and the applications increase year by year. 59.75% of the applications is for the researches on functional materials, which is the most active field and thus forms many hot subjects including energy conversion and storage materials, low-dimensional carbon and 2D materials, ferroelectric and lead-free piezoelectric materials, photoelectric information functional materials, multi-functional composite materials, biomedical materials and so on. Among them, applications regarding energy conversion and storage materials (about 13.64% of the total

in the year 2017) ranked above all the others. There were also many applications in photoelectric information functional materials, low-dimensional carbon and 2D materials, biomedical materials, in which the creativity needs to be further improved. The applications in structural ceramics accounted for 5.51% of the total and were relatively concentrated among a few institutions. A fairly large number of proposals for inorganic non-metallic composites were also received, among which the number of the proposals on functional composite materials increased a bit more than before. However, in terms of the quality, quite a number of them were of follow-up, low level repetition, and lack of both innovation and basic issues in inorganic non-metallic materials.

The Division will support the innovative researches, and substantive interdisciplinary researches of inorganic non-metallic materials cross-cutting with other related fields. It encourages and supports: the related applied basic exploration on new inorganic non-metallic materials based on domestic resources; new fabrication science and researches on new theories, new effects, new technologies and characterization methods; applied basic researches on novel inorganic functional materials and smartness materials, advanced structural materials, photoelectric information functional materials, low-dimensional carbon and 2D materials, biomedical materials, novel energy materials, eco-environmental materials, etc.; the researches on the surface, interface and composite design of materials; the basic researches on “structure-function” integrated composite materials; and the applied basic researches on the improvement and remolding of conventional inorganic non-metallic materials using new theories, new techniques or new processes.

Division I of Engineering Sciences

The Division supports the fundamental researches on Mining and Metallurgical Engineering, which are mainly involved in natural resource exploitation, safety science and engineering, mineral engineering and separation science of substances, physical chemistry of materials and metallurgy, ferrous and nonferrous metallurgy, materials preparation and processing, ecology of mining and metallurgy, and resource recycling and utilization, etc.

The Division received 1,665 research proposals in its general program in 2017, with an increment of 9.18%. 344 of the proposals were granted, with an average funding of 599,500 yuan per project, and the success rate was 20.66%.

In recent years, benefited by continuously financial supports, and driven by both national major needs and the trend of international science and technology development, Mining and Metallurgy Engineering in China have obtained great progresses through continuous innovations. The research capability has improved, and some researches have reached international frontiers. Many significant research results have been achieved. The developmental trends of the discipline include: (1) Discipline differentiation and extension. The theory of the discipline is much deepened and improved by assimilating novel methods and techniques from other disciplines during the transition from macro scales to micro scales. (2) Interdisciplinary and integration. The more disciplines are subdivided, the more their integrations are strengthened. New research areas have emerged one after another due to further development of interdisciplinary, for example, multi-field and multi-scale

coupling, drilling and mining information and intelligent, both from the interdisciplinary and integration, and moving along the intelligent. (3) Relationship between fundamental research and application is getting closer. The applications, such as mining and metallurgical equipment, system monitoring and control, metallurgical reaction engineering and systems engineering, and ecological technology of metallurgy, etc., heavily depend on theoretical innovation of the fundamental researches. The obvious characteristics include process integration, technology integration and disciplinary integration. Therefore, it is getting faster and faster in integration, interaction and transformation of science and technology. Science and technology have also been integrated. At present, Mining and Metallurgical Engineering is in the intersection of resource, energy and environment. Due to gap between demand and development, the developmental concepts including innovation, coordination, green, open, and sharing should be practiced to upgrade traditional industries and to improve ecosystem. Hot research topics of the Division include oil and natural gas exploitation, metal and nonmetal mining, safety science and engineering, metal materials preparation and processing, mineral engineering, electrochemical metallurgy, and battery electrochemistry.

Focusing on engineering science, the Division emphasizes on quality sustainability rather than guarantee of quantity. The Division will continuously enhance interdisciplinary, explore new methods, pay close attention to new theory, concepts and methods, and their creative applications. More attention will be paid to the fundamental research with Chinese characteristics and the aim is to enhance China's competitiveness in petroleum, mining industry, metallurgy, and materials preparation and processing. In the aspect of natural resources exploitation, research emphases will be placed on the engineering and scientific issues relative to recovering, safety and environmental friendliness. In the aspect of technology, process, and equipment, emphases will be placed on structure optimization and adjustment, process intensification, and the scientific law of Engineering. Researchers are encouraged to conduct original research and boldly put forward their own hypotheses to form their own research features. They are also encouraged to take advantages of the cooperation between universities and industries, and to promote the application of new technologies. The priority will be given to the fundamental researches (1) which have originality, (2) which have theoretical significance, (3) which have potential applications and foresights, and (4) which may become new growth point of knowledge.

The following research fields are encouraged: (1) new theory and method for drilling, production, transportation and storage of oil and gas; (2) interaction mechanism of complex oil and gas operation conditions; (3) EOR on low-grade oil & gas and mature fields; (4) green mining theory of mineral resource; (5) theory of material green separation; (6) clean and efficient extraction of mineral resources; (7) thermodynamic basis and metallurgical theory for the production of high quality metal materials; (8) formation, transportation and control of pollutants produced in the metallurgical process; (9) preparation of high performance materials under the action of multi-fields and near-net-shape forming; (10) information acquisition and data processing of mining and metallurgy; (11) accident prevention and system evaluation of hazardous chemicals.

Division II of Engineering Science

Division II supports fundamental research in the fields of mechanical and manufacturing science.

Mechanical science is a fundamental technological discipline involving the study of functional synthesis, quantitative representation, and performance control for various mechanical products. In addition, mechanical science involves applying related knowledge and technologies regarding mechanical systems to develop novel design theories and methodologies, including mechanics and robotics, transmission mechanics, mechanical system dynamics, strength theory for mechanical structures, mechanical tribology and surface technology, mechanical design, and mechanical bionics. Manufacturing science primarily involves studying manufacturing theories, methods, technologies, processes, equipment, and systems concerned with high-efficiency, low-cost, intelligent, and high-performance production methods. Critical processes include component forming and machining, manufacturing systems and automation, mechanical measurement and test theory, and micro/nanomechanical systems.

In 2017, 2,639 research proposals for standard grants were received, a 4.47% increase from the previous year. A total of 565 proposals were funded; the average direct cost of funding was 601,200 yuan per project and the success rate was 21.41%.

The particular focuses are (1) fundamental research concerning national strategic priorities, developing the frontiers of disciplines, and realizing potentials for industrial applications; (2) research aiming at the environmentally friendly, resource-saving, and energy-efficient integration of sustainable design and manufacturing; (3) research concerning innovative design, new manufacturing principles, and measurement theories for ultrahigh-precision, high-tech, and, in particular, large or heavy equipment and instruments, including processing mechanisms, prototyping theories, and technologies; (4) methodologies for designing and manufacturing under extreme working conditions involving, for instance, parameters ranging from conventional to extraordinary or extreme conditions, and macroscale to mesoscale, microscale, nanoscale, and multiscale tasks; (5) multidisciplinary research, multifield coupling analysis, and design methods.

The Division will continue to support research in emphasizing fundamentals, frontiers, explorations, and innovations by encouraging continual in-depth research in specific fields and high-risk exploratory research for original breakthroughs and disruptive innovation. It will preferentially support research that has yielded innovative achievements and are expected to result in major breakthroughs; moreover, the Division will preferentially support substantial and profound interdisciplinary research, especially in topics involving multi-disciplinary areas such as electronics, information technology, biology, materials, and medical science, with the primary objective of resolving scientific problems in the field of mechanical engineering provided that applications do not deviate from the funding scope of the division. In 2018, substantial financial support will be provided by the General Program in two areas, Basic Theories and Methods for Maintaining the Service Performance of Mechanical Equipment and Intelligent Manufacturing Driven by Big Data.

The principal investigators of on-going projects are suggested to focus on their ongoing projects rather than applying for new projects. Junior researchers are advised not to

participate in proposals that are irrelevant to their own research fields.

Division III of Engineering Sciences

The Division supports fundamental research in fields of engineering thermo-physics and energy utilization that involves in engineering thermodynamics, refrigeration and cryogenics and dynamic characteristics of thermodynamic systems, aerothermodynamics, heat and mass transfer, multi-phase flow, combustion, thermo-physical properties and measurement, and renewable energy utilization, as well as other fundamental and innovative researches related to engineering thermo-physics and energy utilization.

In 2017, the Division received 1,052 proposals for the General Program, increased by 4.89% compared with that in 2016. Totally, 228 were supported with an average funding intensity of 600,000 yuan per project with a success rate of 21.67%.

The main development trends of the discipline are as follows: (i) research on the basic issues has been deepened from macro-level to meso-level and micro/nano-level, from isolated studies to coupled studies, from common parameters to parameters under ultra- or extreme conditions, from routine thermo-physical problems to random, unsteady, multi-dimension, multi-phase and complicated thermo-physical problems and intercrossing research in the discipline; moreover, research becomes more quantitative and precise; (ii) research themes have been crossed over traditional disciplinary borders and integrated with related disciplines, for example, physics, chemistry, life science, information science, materials science, environment and safety. Researches in the following areas are active: the mechanism of new type thermodynamic cycles and non-equilibrium thermal dynamics, refrigeration and low temperature engineering, dynamics, optimization and control of complicated systems, turbulence properties of internal flows and properties and control of unsteady flows, porous media and micro-scale heat and mass transfer, radiation and heat exchange by phase transformation, clean, supersonic and micro-scale combustion, thermo-physical problems in the prevention of disasters, mechanism of interaction between phases and thermo-physical model in multi-phase flow, new principles and methods in thermo-physical measurement, and new thermo-physical principles in energy conservation, renewable energy transformation and utilization, energy and environment. In 2018, encouraged research areas are fundamental issues on renewable energy utilization and fundamental issues on energy transformation and utilization under extreme conditions. If they are interested in these areas applicants should focus the research on one of the above encouraged research areas in their proposals.

The Division will give priority to fundamental researches with theoretical importance, potential application and prior prospect, which might be the new fields for knowledge production, continuously promote interdisciplinary studies and the exploration of novel methods, and encourage original ideas and creations. It will continue to support the researches with interdisciplinary nature, or international cooperation background or good achievements acquired in the completed projects.

Division IV of Engineering Sciences

The Division's funding scope mainly covers architecture, environmental engineering and civil engineering. The development trend of architecture is to study the development of region, city and building, and the innovation of construction techniques from the viewpoint of human-environment relationship, as well as the basic theory, methods of planning and design, and construction technology innovation based on sustainable development strategy. The environmental engineering research is focused on the water or air pollution control and quality amelioration, as well as theories and methods for the treatment, resourcelized and harmless disposal of various pollutants and wastes. Civil engineering stresses that studies should be closely combined with engineering practice to investigate basic theoretical issues and solve foresight key technological issues arising from engineering construction. The interdisciplinary interaction, application of advanced experiment and information technologies and adoption of new materials, new structures and new technologies are the major features in the development of these research fields.

In 2017, the Division received 3,116 proposals for the General Program, increased by 6.46% in comparison with that in 2016. Totally, 643 were supported with an average funding intensity of 599,800 yuan per project with a success rate of 20.64%.

In the area of architecture, emphasis will be given to new scientific issues arising from urban construction, scientific method in urban planning and building design, and the exploration and innovation of new technologies and new methods. Research on environmental engineering will emphasize key scientific issues related to new theories and technical bases of new high-efficiency and low-consumption technologies, which include water purification, wastewater treatment and utilization, municipal water supply and drainage system, urban refuse disposal and utilization, air cleaning and air pollution control and renovation of the polluted water environment. Municipal sewage regeneration and resourcezation are priority areas for grant. In the area of civil engineering, more attention should be paid to innovative research on design theories and methods of complex structures. Key scientific issues on the following topics are encouraged: new structure systems and performance design theories, disaster effect and civil infrastructure failure mechanism and performance control, modern structure experiment, on-spot measurement and digital simulation technology. In the area of geo-technical engineering, researchers should focus their attention on the engineering properties of soil under complex conditions, and invalidation mechanism and control methods of geotechnical engineering.

Division V of Engineering Sciences

The Division mainly supports researches in electrical science and engineering, hydro-science and water research, hydraulic engineering and ocean engineering.

Electrical Engineering

The subject of electrical engineering includes two main parts: electric (magnetic)

energy science and the interaction between electromagnetic fields and materials, and common basic areas: electric network theory, electromagnetic field theory, and electromagnetic measurement. The related research fields mainly include the electrical energy conversion (power conversion of new type renewable energy, mutual conversion and substitution between electric power and other kinds of energy), electric machine and its control, electrical apparatus, power system, power electronics device and system, superconducting technology, pulse power technology, high voltage and electrical insulation technology, engineering dielectrics, discharge and plasma technology, electromagnetic biological technology, electromagnetic compatibility, environmental electro-technology, electric sensing and measurement, electric drive and motion control, communication and information of power system, new technology of electric energy storage and power saving, etc.

In 2017, 1,092 proposals were received for the General Program, increased by 8.76% in comparison with that in 2016. Totally, 217 proposals were funded with an average funding intensity of 59,880 yuan per project with a success rate of 19.87%.

As for electric (magnetic) energy science, the priority is given to new theory, new technology and new equipment related to high efficiency, flexibility, safety and reliability, and eco-friendly electrical (magnetic) energy conversion, transmission and utilization. The research fields mainly include power generation of new energy and renewable energy, smart grid, wireless power transfer, high efficient conversion and utilization of electric energy, electric machine system (including electric motor drive and control in robot), electric drive and motion control (including electric vehicle, railway traffic, ship and aircraft), superconducting electrical technologies, pulse power technology, efficient power consumption and also the involved information technology, control theory and method for electrical engineering.

As to the interaction between electromagnetic fields and materials, the priority is given to investigation on new phenomena, exploration of new principles, and the establishment of new models and discovery of new applications, such as the safety and reliability related to power apparatus, novel high power electronic devices, advanced electrical materials, measurement of electromagnetic characteristics, coupling between electromagnetic pulsed energy and its applied objects, discharge theory and high active plasma generation, and electric energy storage. The proposals are highly encouraged for investigations mainly based on electromagnetic science for the interaction between electromagnetic field and biomatter, extracting and utilization of biologic electromagnetic information.

Hydro-Science and Water Research, Hydraulic Engineering and Ocean Engineering

The Division supports basic researches in three areas, hydro-science and hydraulic engineering, geotechnical engineering and hydro-power engineering, coastal and ocean engineering. The research themes include hydrology and water resources, water/soil science and irrigation engineering, water environment and water ecology, dynamics of river, coast and sediment research, soil/rock mechanics and geotechnical engineering, hydraulics, hydro-machinery and hydro-informatics, hydraulic structural and hydro power engineering, coastal and offshore engineering, naval architectures and ocean engineering.

In 2017, 1,339 proposals were received for the General Program, increased by 0.98% in comparison with that in 2016. Totally, 280 proposals were finally granted with an average funding intensity of 600,400 yuan per project and a success rate of 20.91%.

In 2018, encouraged research areas are urban flooding, aquatic ecology and eco-hydraulic engineering. Those who are interested in these areas should focus the research on one of the above encouraged research areas in their proposals.

In the field of hydrology and water resources, one of key issues is to study the impact of climate change and human activities on hydrological cycling, extreme flood and drought disasters, and simulation and forecasting of watershed hydrological process. Researches in the field of water/soil science and irrigation engineering are mainly focused on the transfer and interaction of water, heat and chemicals in farmland, mechanism of crop water-saving and high-efficient irrigation and drainage scheme and their ecological and environmental impacts. Physical, chemical and biological processes related with hydrological cycling and their responses to large projects are emphasized by researches in the field of water environment and water ecology. Since water resources are closely correlated with economy, society, environment and energy, the interdisciplinary and integrated research is encouraged in fields of water resources, water environment and water ecology. Researches in the area of river and coastal hydrodynamics and sediment dynamics should give their focuses on the fundamental theory of sediment transport, river and estuarine evolutionary, and sediment problems related to large hydraulic works. The key frontiers of hydraulics consist in the subjects related to water disaster mitigation and eco-environmental protection. The current emphasis of hydro-machinery is on the transit process. Hot topics in the field of soil/rock mechanics and geotechnical engineering include constitutive modeling of geo-materials, multi-fields and multi-phases coupling, mechanism and process of geo-deformation, mechanism and prevention of geo-hazards. New breakthroughs need to be made in the basic research on hydraulic structural engineering under complicated conditions. Environment-friendly and function-based design is an important trend of development in the field of hydraulic engineering and materials. The recent hot research topics in coastal engineering include: port and waterway engineering, marine resources and offshore renewable energy as well as environment protection, disaster prevention and mitigation in extreme situation; in the area of ship and ocean engineering, more emphasis are put on the motions and response theory of ship and marine structures, new hull form design theory, deep-sea probing technology and relevant theory of deep water resources exploitation, numerical experiments and field test technology, new type underwater sound transducer and communication technology.

According to application and funding statistics in recent years, there is a growing trend of interdisciplinary research in proposals of hydraulics and ocean engineering. Both the number of proposals and the number of grants are increasing. In 2017, areas with more application and funding included ocean engineering (E0910), aquatic environment and ecological hydraulics (E0903) and rock and soil mechanics and geotechnical engineering (E0907). Areas with less application and funding included coastal engineering (E0909) and hydraulics and hydroinformatics (E0905).

Department of Information Sciences

The Department of Information Sciences funds researches in areas of the generation of signals, acquisition, storage, transmission, processing and utilization of information. Based on the trends of disciplinary development and social progress, the following priorities are set for funding: new generation of mobile communication theory and technology, air ground coordination theory and technology, marine information acquisition, high performance detection imaging and identification, interactions of electromagnetic wave and complex targets, theoretical computer science, new computing system structure, high performance parallel and distributed computation, key technologies in computer application, cyber space security, modeling, analysis and control of complex systems, advanced navigation technology and system, intelligent robot theory, technology and system, intelligent optimal manufacture theory and technology, automation of artificial intelligent driving, semiconductor photo electric devices, integrated circuits, inferred and tetra hertz technology, quantum information, new types of laser, cognitive science and artificial intelligent and educational information processing, etc. Preferential support will be given to basic researches that meet social demands and have far-reaching importance in promoting the national economic and disciplinary development.

Funding for General Program Projects in Department of Information Sciences in 2016 and 2017

Unit: 10,000 yuan

Science divisions		2016			2017		
		Projects	Direct cost Funding	Success rate ⁺⁺ (%)	Projects	Direct cost Funding	Success rate ⁺⁺ (%)
Division I	Electronics and technology	165	9 698	23.61	176	10 656	21.20
	Information and communication system	169	9 743	23.94	181	10 724	21.47
	Information acquisition and Processing	155	9 010	23.63	143	8 463	21.34
Division II	Theoretical computer science, computer software and hardware	141	8 310	23.15	128	7 609	21.77
	Computer applications	263	15 585	22.29	285	17 039	21.74
	Network and information security	151	8 941	23.30	163	9 762	21.91
Division III	Control theory and control engineering	197	11 427	25.89	176	10 481	20.75
	Systems science and system engineering	45	2 524	16.98	74	4 237	23.49
	Artificial intelligence and intelligent systems	163	9 390	23.06	166	9 781	21.15
Division IV	Semiconductor science and information devices	174	10 187	23.48	175	10 482	21.63
	Information optics and photoelectric devices	119	6 979	23.52	120	7 182	21.78
	Laser and technical optics	119	6 806	23.71	125	7 464	21.82
Total		1 861	108 600	23.28	1 912	113 880	21.56
Direct cost per project		58.36			59.56		

Scientific and technical issues in information sciences are increasingly interdisciplinary by nature. Therefore, the Department pays great attention to proposals for interdisciplinary researches between information science and mathematics, physics, chemistry, life sciences, medical sciences, materials sciences, engineering, geosciences and management sciences, and so on. The Department encourages cooperative research among scientists with different backgrounds and knowledge to put forward cross-disciplinary research proposals in smart education and service sciences. It also encourages scientists to combine theory with practice and explore basic theory and key technical issues that have important application potentials for national economy and security. The Department will continue to encourage scientists to conduct substantial international cooperative research with scientists abroad in frontier areas of information sciences.

Due to fast development of science and technology, the Department has made changes in the application code. Starting from 2018, the new system of application code will be used. Please pay attention when submitting proposals.

Please select the correct code, research directions and key words when submitting applications.

In 2017, the Department received 8,867 applications for General Program, increasing 10.91% from that in 2016, and funded 1,912 projects with a total direct cost funding of 1.1388 billion yuan. The average direct cost funding is 595,600 yuan per project. Some projects were related to interdisciplinary areas with mathematics and health. In 2017, 347 applications were received for the projects of interdisciplinary research between Information Sciences and Mathematical Sciences and 76 projects were funded with average direct cost funding of 500,000 yuan per project with a success rate of 21.90%.

In 2017, 125 small grants were funded in the General Program, with total direct funding of 20 million yuan, and average funding of 160,000 yuan per project.

In 2018, the Department of Information Sciences encourages creative basic research that is different from traditional research ideas, and welcomes researchers conduct discussions and studies on new concepts, new theories, new methods and new technologies. The PIs of those projects making important progress will be given preferential support towards their new applications.

Division I of Information Sciences

The Division mainly funds basic research in areas of electronic science and technology, information and information system, information acquisition and processing and related interdisciplinary areas.

Researches in areas of circuit and system, electronic science and technology, magnetic field and wave, as well as electronics and applications. Funding areas mainly cover the design, test and verification of circuits and system, diagnosis, reliability, micro-nano circuit and system design theory, methods and technology and low energy consumption design method, power, radio electronic circuit and system design theory and method, circuit and network theory, electromagnetic theory and computational methods in electromagnetic fields and waves, characteristics of electromagnetic field and waves in new types of media, scattering and back-scattering, mechanism of interaction between

electromagnetic field and wave and objects, electromagnetic compatibility and electromagnetic environment, electromagnetic spectrum management, acquisition of electromagnetic energy, electronic wave transmission and antenna, micro wave optics, tera hertz science and technology, transient electromagnetic field theory and application, vacuum device, cathode electronics, surface and membrane electronics, superconducting electronics, quantum electronic theory and device, plasma electronics, molecular and nano electronics in physical electronics, electromagnetic effect in bioelectronics, biochips, medical imaging, medical information detection and processing, medical imaging navigation and key medical instrument technology; information processing and analysis in bio informatics, analysis of bio big data, detection and identification of cell and bio molecular information, information network and analysis in bio systems, modeling and simulation of bio system functions, methods and technology of bionic information processing; sensitive electronics and physical, chemical, bio and bio chemical sensors, properties of new types of sensitive materials and sensors, and sensor theory and technology.

Researches on the theory and key technologies for information transmission, exchange and application in fields of information and communication. The main funding areas include informatics, signal coding, channel coding, network service theory and technology, information system modeling and simulation, information system and communication network security, cognitive wireless in information theory and information system; wireless, spatial, underwater, multimedia, optical, quantum, computational, transducer network communication theory and technology, body network, new network access technology, mobile wireless internet technology, and new mobile communication theory and network, future information network theory and transmission mechanism, network communication theory and system, etc.

Information acquisition and processing related to the theory, methods and applied technology of information sensing, acquisition and processing. The main funding areas include signal theory and signal processing, the processing of multidimensional signals and array signals, and processing of radar, sonar, remote sensing and voice signals; mathematical theory and methods in information acquisition and processing, and information acquisition mechanism and technology, weak signal detecting and processing, detection and imaging system in information detection and processing, image processing and interpretation, integration of multi-sensor signals, multimedia information processing and presentation, space and marine information acquisition and processing, and applied basic research in mobile network big data, etc.

In 2017, the Division received 2,343 proposals for General Program, and funded 500 projects. The success rate is 21.34% and the average direct cost funding intensity is 596,900 yuan per project.

In 2018, the Division will continue to support researches in areas of basic theory and key technologies that are significant to the national security in areas of new method of circuit and system design, millimeter wave antenna and system integration, acquisition of electromagnetic energy, micro wave photon radar, new sensor mechanism and design method, bio data analysis, medical image processing, space information network, mobile internet, optical communication, communication system security, underwater communication and sensor network, electromagnetic vortex communication, new principle and method of radar, detection and imaging, remote sensing image processing, multimedia

information processing, space information acquisition and processing, underwater information acquisition and processing. The innovative and cross-disciplinary research and exploratory studies with good prospects will be supported that may have some risk and are non-consensus, preferential funding will be given to the projects which have scored outstanding achievements in previous research. Preferential support will be given and encouraged to the projects which could open and share their research results, and research on the design of software and hardware on the opening data base; it is encouraged the combination of theory and practice to focus on innovation and to study and solve basic problems in important application areas, so as to improve China's research capabilities in this discipline.

Division II of Information Sciences

The Division mainly funds researches in areas of basic theories, basic methods and key techniques related to computer science and technology and relevant interdisciplinary areas.

Computer science and technology is one of the most active, fast-growing and widely influential areas in information sciences. A conspicuous trend of computer science and technology development is to obtain super speed, large storage, high performance, high reliability, easy interaction, intelligent, networking, universal and mobile applicability. Applicants are recommended to pay attention to these new features in this Division.

The Division emphasizes that proposals are encouraged to focus on key scientific issues and technologies in computer science, and original, fundamental and far-sighted research. We encourage researches on the theory of computer science, software theory and engineering, architecture and system software, parallel and distributed computation, new types of storage, imbedded system, computer graphs and virtual reality, image and audio video processing, bio data processing and analysis, man machine environment, information security, secure architecture and protocol, computer network, mobile and universal computation. The Division also stress on funding of studies on theoretical method of new computation models and algorithm, big data analysis and processing, new mechanism of information security, new types of searching, mixed reality, and man-machine coordinated computation, and information physical systems, etc.

The Division will continue to support collaborations with researchers in areas of life sciences, medical sciences, mathematics, physics, chemistry, geosciences, engineering, and management and economics and social sciences to make joint explorations on new ideas, new theories, new method and technology, developing prototype systems in interdisciplinary areas so as to promote the mutual development of computer science and other sciences. The Division especially encourages and support scientists to address those basic issues that are well known internationally for their complexity and significance and of strong exploratory nature, so as to increase the level and impact of computer science research in China.

In 2017, the Division received 2,643 proposals for General Program, and funded 576 projects (including 31 interdisciplinary projects with mathematics). The success rate is 21.79% and the average direct cost funding is 597,400 yuan per project

It should be noted that such problems as lack of basic science problems, lack of clear scientific topics, lack of originality in research ideas, lack of clear application background and lack of clear research goals and preparations still existed in proposals received in 2017. Applicants are suggested aiming at the national needs and research frontiers in the discipline, select fundamental, explorative and key scientific issues, and strive to make innovations and breakthroughs so as to make important achievements.

Division III of Information Sciences

The Division mainly funds basic research and far-sighted research for the national economy and national security in areas of control theory and engineering, systems science and system engineering, robotics and robot technology and artificial intelligence driven automation, etc.

Funding areas of control theory and engineering include control theory and technology, control system, navigation guidance and telemetry, sensor technology and sensor network, multi-information acquisition and fusion, etc.

Funding areas of systems science and system engineering include modeling theory and technology, system emulation and evaluation, intelligent manufacturing theory and technology, system reliability, dynamic optimization and management of engineering systems, analysis and regulation of bio systems, etc.

Funding areas of robotics and robot technology cover robot sensing and understanding of environment, robot autonomous control technology, robot bionic technology, coordination control technology of multi-robots, etc.

Funding areas of artificial intelligence-driven automation cover machine visual audio technology and systems, coordination theory and method for groups of intelligent autonomous moving bodies, intelligent modeling and control of complex industrial processes, and man machine interaction and systems, etc.

In 2017, the Division received 1,948 proposals for General Program and funded 416 projects. The success rate is 21.36% and the average direct cost funding intensity is 588,900 yuan per project. Some projects are related to interdisciplinary areas with mathematics.

Statistics of recent years show that the following areas are becoming hot spots in research: trouble shooting and error control, multi-intelligent system analysis and control, complex network theory and application, smart traffic systems, etc.

In addition, the Division gives due support to farsighted and interdisciplinary researches such as modeling analysis and control of micro-nano scale systems, modeling, analysis and control of hypersonic aircraft, optimization, decision and control of complex process, analysis of social network behavior, navigation and guidance and control in deep space and deep ocean exploration, new energy control, management and efficient use, smart medicine, smart city and agricultural information technologies. We encourage innovative research on knowledge automation system theory and application, industrial network security theory and application, quantum navigation theory and technology, bionic sensing and devices, bionic robot, micro nano robot, intelligent manufacture process theory and technology, and multi-mode man machine interaction systems, etc.

In 2018, the Division will continue to encourage and support interdisciplinary

research with mathematics, mechanics, mechanical engineering, semiconductors, optics, energy, environmental science, management, economics, biology, neuroscience and psychology, etc.

In 2018, **artificial intelligent (application code F06)** and **information science in interdisciplinary research (application code F07)** will be added to the Department's funding scope to support research in basic theory, method and key technology in these areas.

Artificial Intelligence (Application Code F06)

To promote basic research in artificial intelligent (AI) and development of AI theory and key technology, foster AI researchers, this application code will be used to receive applications in related areas.

This area will focus on key scientific issues and technology in AI research, encouraging original, fundamental, far-sighted and interdisciplinary research. Research on basics of AI, machine learning, machine sensing and pattern recognition, natural language processing, knowledge representation and processing, AI system and application, cognitive and neural science induced issues are encouraged.

The Department supports close cooperation between AI researchers and those in other disciplines and humanities and social sciences to explore new concepts, theory, method and technology. Researches to explore basic issues of great difficulties and great impacts are especially encouraged.

Information Science in Interdisciplinary Research (Application Code F07)

To promote interdisciplinary research in artificial intelligent and foster research team, we use this application code to receive applications in related areas.

Educational information science and technology (F0701)

Focusing on knowledge generation, cognition laws and learning development, and original, fundamental, far-sighted and interdisciplinary research, the Department encourages research on basic theory and method of AI-driven education, online and mobile learning environment, virtual and enhanced reality learning, visual representation of knowledge education cognition tools, education robot, education AI bodies, education big data analysis and application, learning analysis and evaluation and self-adaptive personalized learning assistance, etc. Researches explore new concept, theory, method and technology to solve education problems in China are encouraged.

Interdisciplinary problems in information and mathematics (F0702)

The Department supports research requiring integration of information and mathematics, such as theory and method in electronic communication and mathematics, computer and mathematics, automation and mathematics, AI and mathematics, semiconductor and mathematics, and optics and mathematics. Priority is given to explorative research, so as to promote development of intercrossing of information and mathematics.

Division IV of Information Sciences

The funding scope of the Division covers semiconductor science and information devices, and optics and photo-electronics.

The main scope of funding for semiconductor science and information devices includes semiconductor crystal and membrane material, design and test of integrated circuits, semiconductor photo electric devices, semiconductor devices, semiconductor physics, integrated circuit fabrication and packaging, semiconductor micro and nano mechanical and electrical devices and system, and new types of information devices including nano, molecular, super conducting, quantum functional information devices.

The main funding scope for optics and photo-electronics includes optical information acquisition and processing, photon and photoelectric devices, transmission and exchange photonics, inferred physics and technology (including terahertz), nonlinear optics and quantum optics, laser, spectrum technology, applied optics, optics and photoelectric materials, space optics, atmospheric and marine optics, biomedical photonics and optical problems in interdisciplinary studies.

In 2017, the Division received 1,933 proposals, and funded 420 projects with a success rate of 21.73% and an average direct cost funding intensity of 598,300 yuan per project.

In recent years, along with the development of information sciences, the above areas are now having more interactions with physics, chemistry, materials sciences and life sciences and medical sciences, and many new research directions are emerging. Among the major branch areas, applications remained the same in the following areas: semiconductor photoelectric devices, IC design and test, semiconductor crystals and membrane materials, photon and photoelectric devices, transmission and exchange photonics, optical information acquisition and processing, nonlinear optics and quantum optics, laser and applied optics, etc. Applications are increasing in such areas as semiconductor electronic devices, semiconductor micro nano mechanical electronic devices and system, IC manufacturing and packaging, semiconductor physics, inferred physics and technology, biomedical photonics, optics and photoelectric materials, spectroscopic technology, etc.

The Division will give priority to researches on high performance light source, low power consumption radio frequency chips and circuits, new types of sensor materials and devices and network technology, terahertz devices, micro and nano device and technology, new types of optical field control technology and devices, quantum optics and quantum devices, quantum communication and quantum computation, optical information processing and display technology, photon electronic devices and photonic integration, wide gap semiconductor materials and devices, semiconductor integrated circuit system, energy photonics, new types of laser technology and devices, biomedical optical imaging, and space optics, etc. In order to solve the bottleneck issues of devices in various fields in China, the Division will encourage studies to improve device performance (both yield and reliability) including scientific issues in device physics, structure and technology development.

Based on the trend of application in 2017, proposals that frequently change research directions have reduced. Researchers are advised to take concrete steps in their research by

making in-depth and persistent studies, and propose more creative research topics according to the international research trend and the national development needs.

Department of Management Sciences

Management is an interdisciplinary science which aims at revealing and applying the basic laws of various management activities. The research findings can be used to optimize the utilization of limited resources. The Department consists of three divisions, handling proposals of four disciplines, which are Management Science and Engineering, Business Administration, Economic Sciences, and Macro-Management and Policy.

During the 13th Five-Year Plan, the Department will further encourage innovative studies, give preference to proposals of discovering universal scientific issues based on Chinese management practices to explore these issues, and enrich the knowledge of human management sciences.

The Department emphasizes applying “scientific methods” to explore the objective laws of management sciences, and therefore ordinary management research will not be supported. The Department supports experimental research that observes and discovers the new management phenomena based on data obtained from experiments, observations, and measurements, etc. The Department also supports theoretical research that aims at addressing management issues by analyzing and explaining management phenomena through modeling, computation, induction and deduction. The Department will offer higher funding support than the average funding level for experimental research projects that do need long-term and large-scale data collection, data processing, and field investigation, and high performance computing and experiments.

The Department encourages and supports scientists from diverse academic backgrounds to take an active part in management science research and contribute to the development of management science, a comprehensive interdisciplinary science. However, applications focusing on social science and humanities, as well as those within the funding scope of other scientific departments of NSFC, will not be accepted by the Department. Applicants are advised to propose their research topics from the perspective of management science research.

General requirements for applications in 2018 are as follows:

1. No repetitive funding with the National Social Science Fund

To optimize the allocation of the National Natural Science Fund and to ensure that project leaders invest adequate time and energy in their on-going national projects, the Department will decline proposals by the following applicants in 2018:

Applicants who were supported by the National Social Science Fund as a project leader within the past 5 years (from Jan. 1, 2013), and have not yet got the project completion certificate awarded by the National Planning Office of Philosophy and Social Science until the deadline of this year’s fund application.

Note: if an applicant has gained the project completion certificate from the National Planning Office of Philosophy and Social Science, and is applying for an NSFC project with the application code starting with G in 2018, he/she must provide a copy of the certificate with an official signature and seal of his/her home institution.

2. Accuracy and integrity of information

Applicants are responsible for the accuracy, integrity, and reliability of the contents in their applications, and their home institutions are obligated to undertake serious check on the relevant information. The following requirements should be complied with when applicants prepare and submit the project proposals:

(1) Applicants are required to give a detailed description on their previous research work related to the proposed work, as well as the publications published in previous work. For publications that are accepted and waiting to be published, a copy of the acceptance notice should be provided in the proposal.

(2) The Department treats it unacceptable that applicants submit the same proposals to more than one science funding agency. Applicants who propose new research topics based on their previous NSFC projects are required to describe the progress of the previous NSFC project and clarify the relations and differences between the newly submitted proposals and the previous ones. For applicants who are undertaking projects funded by other agencies, such as MOST, NSSF or local science funding organizations, they are required to clarify the similarities and differences between their on-going projects and the new proposals submitted to NSFC.

3. Special requirements for project leaders starting NSFC projects in recent years

To ensure that project leaders invest adequate time and energy in their on-going projects, the applicants in 2018 who gained any kind of NSFC projects as a project leader in 2016 or 2017 will be reviewed and assessed through stricter procedures.

4. Consideration of the performance of accomplished projects

The Department conducts performance evaluation for all General Program projects, Young Scientists Fund projects, and Fund for Less Developed Regions projects one year after these projects were complete. The evaluation results will be released to the public on the NSFC website. Researchers with good performance evaluation results will be given priority for funding when they apply for new projects. However, researchers with poor performance evaluation results will undergo stricter review procedures when applying for new projects.

Funding for General Program Projects in Department of Management Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Average funding for direct costs	Success rate (%)	Projects	Average funding for direct costs	Success rate (%)
Division I	Management science and engineering	193	9,264	21.69	224	10,752	20.59
Division II	Business administration	209	10,032	20.31	196	9,408	19.20
Division III	Economic Sciences	138	6,662	18.23	153	7,344	17.09
	Macro-management and policy	180	8,602	18.00	182	8,736	17.04
Total		720	34,560	19.59	755	36,240	18.54
Direct cost per project		48.00			48.00		

In 2018, the average funding intensity for direct expenses of General Program projects will be 500,000 yuan per project, and the funding period is four years.

Division I of Management Sciences

The Division of Management Science and Engineering mainly supports research associated with theories, methods and techniques in the field of management science, which includes management theory and research method, operations management, decision-making theory and method, game theory and method, evaluation theory and method, forecast theory and method, management statistics theory and method, management psychology and behaviors, management system engineering, industrial engineering and management, logistics and supply chain management, service science and engineering, system reliability and management, information system and management, knowledge management, risk management, financial engineering, engineering management, and transportation management, etc.

The Division emphasizes basic theories and frontier areas, and innovative research on management theory and method integrated with China's management practices, management philosophy, and cultural characteristics. The Division encourages interdisciplinary research and international frontier research.

In 2017, the Division received a total of 1,088 applications for General Program and funded 224 projects. The success rate was 20.59%.

For the past few years, the discipline of management science and engineering has experienced rapid development in China. The quantity of academic papers in the fields of optimization and management, industrial engineering and management, logistics and supply chain management, information system, and transportation management is increasing significantly; in addition, the number of academic paper published in international top journals is also increasing steadily. However, compared to the international counterparts, the number of papers published by Chinese scholars in high-level international journals is still relatively small.

In 2018, the Division will continue to support proposals aiming at innovative fundamental scientific issues, and provide strong support for projects based on management practices. The Division encourages scientists to integrate theories and methods with practical issues to solve the issues generated from management practices in China, and to form the management theory and methods for China. The Division also encourages integrations of management sciences with mathematics, economics, behavior sciences, information sciences, as well as other disciplines, and supports studies of seeking breakthroughs of theory, methods, and practices though multi-interdisciplinary.

Division II of Management Sciences

The Division of Business Administration mainly supports fundamental research and applied fundamental research on management theories and new management techniques and

methodologies, taking micro-level organizations (all types of industries, enterprises, institutions, and nonprofit organizations) as research objects. The funding areas of the Division include 14 disciplines, which are strategic management, organization theory and organization behaviors, enterprise technology innovation and innovation management, human resource management, financial management, accounting and audit management, marketing, production and quality management, enterprise information management, e-commerce, operation management, project management, entrepreneurship management, international business and multi-culture management, etc.

In 2017, the Division received a total of 1,021 applications for General Program and funded 196 projects, with a success rate of 19.2%.

In 2017, the number of applications in the fields of financial management, marketing, accounting and audit management, enterprise technology innovation and innovation management, and operating management was relatively high, and correspondingly, the number of funded projects in these fields was larger than in other fields. On the other hand, the number of applications in the fields of project management, production and quality management, and international business and multi-culture management was small, and the number of funded projects in these fields was relatively low. In general, the proposals aiming at new methods and technologies have shown some innovation, and the number of applications focusing on new issues and China's practical needs was increasing. From a perspective of funding structure, a balanced distribution of funding areas has been formed.

In 2018, the Division will continue to support innovative and frontier research, encourage theory innovation and new knowledge discovery and creation, encourage scientific accumulation and discovery research by integrating empirical analysis, case studies, and observation experiments, encourage those focusing on scientific issues derived from China's management practices that have potential social application values, and those research with substantial international cooperation. The Division advocates scientific spirits, encourages exploration, and supports original fundamental research.

In order to promote the balance within the discipline, the Division will give priorities to fundamental research frontier in areas of strategic management, organization theory and organization behaviors, enterprise technology innovation, human resource management, financial management, accounting and audit management, marketing, enterprise information management, e-commerce, and operation management. Preference will be given to areas of international business and multi-culture management, project management, entrepreneurship management, service management, as well as e-commerce and business intelligence. Meantime, the Division will strengthen the support for theory innovation research based on Chinese management practice.

Division III of Management Sciences

The Division III of Management Sciences supports 2 fundamental research areas: Economic Sciences and Macro-Management and Policy.

Economic Sciences (G03)

The Economic Sciences discipline mainly supports the fundamental research of

revealing development rules of economic activities, explaining economic development phenomena, and discovering economic theories by using scientific research methods such as empirical study, quantitative study, and behavior study. The funding areas of the Economic Sciences discipline include quantitative economics theory and methods, experimental economy and behavioral economy, macro-economy management, financial management, industry economy and policy, spatial economics, fiscal and tax policy, game theory, agriculture and forestry economics management, international economy and trade theory, economy development, etc.

In 2017, the Economic Sciences discipline received a total of 895 applications for General Program, 15.3% higher than that in 2016 (776 applications, the economy-related areas in the previous Micro-Management and Policy discipline), and funded 153 projects. The success rate was 17.09%.

During the recent years, the number of applications in the fields of agriculture and forestry economics management, financial management, and macro economy management was relatively higher, while the number of applications in fiscal and tax management was rather low, which indicates the differences in scale of research teams and research capacity between various research areas. Many applicants concentrated on hot topics associated with China's economy development and growth, and submitted high-quality research proposals. Although the total number of application associated with game theory and information economy, experimental economy and behavioral economy, and quantitative economics and economic calculation were not very large, but the number of Young Scientist Fund applications in these areas is much more than that of the General Program applications, indicating the promising growth potential in these areas.

In 2018, the Economic Sciences discipline will pay more attention to research proposals aiming at macro-economic models based on China's actual situations, econometrics experimental economy theory and method, internet financial management, industry transformation and upgrading, and public finance. In particular, special preference will be given to the research areas focusing on China's economy development and growth, including economy structure adjustment, technology innovation and productivity, population and labor, resource and environment, and income distribution.

Macro-Management and Policy (G04)

The Macro-Management and Policy discipline is a cluster of disciplines that study the behaviors of all levels of governments and related public sectors in formulating macro policies and implementing comprehensive management policies, in order to achieve the social and economic development goals. It covers public administration, non-profit organization management, technology management and policy, innovation management, health management and policy, education management and policy, public security and crisis management, culture and leisure industry management, social welfare management, environment and ecology management, resource management and policy, regional development management, information resources management, etc.

In 2017, the Discipline received a total of 1,068 applications for General Program, 8.9% higher than that in 2016 (981 applications, all areas in the previous Micro-Management and Policy discipline excluding the economy-related areas), and funded 182 projects. The success rate was 17.04%.

During the recent years, applications focusing on the areas of resource and the environment management, and public health management and policy have seen more than other areas in number. The number of applications in the areas of public security and crisis management, public health management and policy, and resource management increased rapidly, and the number of applications focusing on urbanization and aging increased even more rapidly. Many applicants concentrated on hot topics associated with macro-management and policy practices in China, and submitted high-quality research proposals.

In 2018, the Macro-Management and Policy discipline will pay more attention to research proposals in the fields of public policy, Cyberspace governance, social governance patterns, health service management, urban and spatial management, and the aging society within the context of big data.

Through funding research projects, the Division aims to facilitate discipline development, promote academic innovation, and support talent scientists and research teams. In particular, the Division encourages researchers to provide scientific support and evidences for macro policy makers while developing theories and methods. The applications should take China's practical management issues as the main research objects, and bring up scientific theoretical issues from the research objects accurately. Special attention should be paid to the scientificity and normativeness of the research methods. Applicants are advised to differentiate between management science research and actual management work, and between an NSFC project and a humanity and social science project in terms of research methods. The scope of the research topic needs to be appropriate, the research goal should be concentrated, and the research content should be specific and concrete. The research method and technology roadmap, as well as how to address the key scientific issues, need to be clarified in the application.

Department of Health Sciences

In view of the fact that scientific research is both curiosity-driven and national needs-driven, the objective of the funding for General Program in the Department is to support basic research on issues concerned with disease prevention, disease control and disease treatment in China. For the purpose of improving the scientific research in medical science, this program mainly supports basic research (including clinical-related basic research) in the following areas: the structural, functional, developmental, genetic and immune abnormalities of human body, the occurrence, development, outcome, diagnosis, treatment and prevention of diseases.

The Department encourages research areas as follows:

Innovative theoretical and methodological research aimed at the scientific issues emerging from medical practices; systematic and indigenous study on key scientific issues emerging from medical disciplines; translational medicine through combination of basic research and clinical research; integrative medical research on the occurrence, development and regression of diseases at various levels from molecular, cellular, tissue to organ, individual and population level by using new multidisciplinary and comprehensive techniques or methods; in-depth systematic and innovative study based on existing accumulated researches; interdisciplinary medical research crosscutting with other scientific

fields; the development of new animal models of human diseases; substantive international joint research and exchange. The Department will give priority to basic research on major key diseases closely related to the national welfare, human livelihood, major emergency event of public health, and common or frequently encountered diseases that severely affect human health. Meanwhile, the Department will also highlight research on rare diseases based on existing accumulated research work and other weak research areas in an effort to keep the balance and coordinative development of various disciplines.

1. Specific instructions for applicants

(1) Applicants are encouraged to carry out in-depth basic research toward scientific issues, especially the original research. Applications with unique academic ideas or solid previously accumulated research work are encouraged to carry out further systematic research. Simply descriptive or observant applications and those tracking others' without innovative scientific ideas, or applications merely pursuing new high-technology rather than scientific novelty will not be in consideration for grant.

(2) Applicants are expected to elaborate the scientific values and potential clinical applications of the anticipated research results in detail. Applicants are suggested to propose a defined scientific issue or a specific hypothesis based on analysis of the relevant latest literatures and research progress in the field. Furthermore, elucidation of theoretical as well as applicable value of the research is needed.

(3) Applicants are expected to elaborate whether the proposed research will possibly solve the specific scientific problems or verify the hypothesis, and the proposed research is supposed to be specific, feasible and logical. Furthermore, applicants are expected to propose adequate research contents, detailed research design, clear research methods and reasonable budget.

(4) Applicants are expected to provide detailed information about relevant previous research. In case of extensive applications of previously funded project, the innovative ideas and further scientific problems of the research are expected to be elaborate in detail. Besides, all the relevant published papers are expected to be listed, and relevant unpublished results including experimental data, tables and graphics, etc., are suggested to be provided.

(5) Applicants are expected to provide true and accurate information in their applications, including the curriculum vitae and major participants (both education and working experience are expected to be included, in chronological order with exact months and years, keeping the timeline consistent), previous grant information and relevant publications. Patents and awards should also be listed according to the guideline. For publications, detailed information including the names of all authors (in the same order in which they appeared in the publication), the article and journal title, book title, volume number, page number, and year of publication (abstracts or meeting proceedings should be specified) are supposed to be included. The first authors and corresponding authors should be noted in accordance with the instructions and guidelines of application form. Accepted manuscripts should be listed along with an attached acceptance letter or online publication link, unaccepted submitted manuscripts or manuscripts in preparation should not be included.

(6) Applicants are expected to provide a signed written institutional certification or approval (the scanning copy should be attached to the electronic proposal) to meet the related ethical or informed consent requirement if applications involve special medical research objects such as human subjects.

(7) Applicants are expected to follow all appropriate guidelines for the use and handling of pathogenic microorganisms, including the guideline “Bio-safety Administrative Rules of Pathogenic Microorganism in Lab” released by the State Council of China and the ethical and bio-safety regulations by other governmental agencies. Additionally, a commitment letter to guarantee bio-safety should be provided by the research institutions when applications are involving highly pathogenic microorganisms.

(8) Applicants with good performance records in their previous grants will be given preference on equal conditions.

(9) Applicants are expected to notice that: in 2018 the Department will generally not give further funding to applicants who either have got high funding intensity in 2017 from NSFC (such as Key Program, Major Program, Major International and Regional Joint Research Program, etc.), or are applying for repetitive or similar research to their on-going national scientific projects funded by other agencies.

(10) Applicants are expected to provide PDF copies of no more than 5 representative papers (PI’s papers only) in their electronic applications.

(11) Applicants are expected to refer to the specific requirements for various programs via the website of the Department (<http://health.nsf.gov.cn>).

2. General overview of applications in the Department in recent years and instructions to research institutions

The number of applications has been increasing in the Department of Health Sciences ever since its establishment. In 2016, the number of applications was 48,646 (from 996 research institutions), accounting for 27.50% of the total applications in NSFC, including 20,318 of General Programs which account for 27.44% of the total applications of General Program in NSFC. In 2017, the number was 57,454 (from 1,039 research institutions), accounting for 28.45% of the total applications in NSFC, including 22,965 for General Program which account for 28.60% of the total applications for General Program in NSFC.

To enable the rapid and healthy development of both scientific fund and medical research in China, the research institutions are expected to further strengthen their management in the process of NSFC grant applications, and to make an effort to further improve the scientific quality of applications (rather than increase the number of applications) under the guidance of “Requirements of NSFC for Institutions to Improve Management of Scientific Projects”.

3. Specific explanations on application codes

Peer review activities of the applications in the Department are organized according to the application codes attached to this guide. The application codes of the Department are composed of 31 primary application codes (H01 to H31) and many relevant secondary codes. The basic characteristics of the application codes are as following: (i) the primary application codes, which are mainly arranged in the order of organs or systems, include research areas relevant to both basic and clinical research, in an effort to ensure that applications on similar scientific issues from different disciplines are reviewed in the same reviewing system; (ii) the secondary application codes, which are arranged in the order from basic to clinical research and from structural, functional and developmental abnormalities to diseases, cover both basic and clinical research relevant to the given organ or system.

The applicants are expected to carefully choose the primary application code and the relevant secondary one. For the details, please refer to the following contents in the *Guide*

to Programs of each division of the Department. **Special instructions for applicants are as follows:**

The application in hematological fields now includes all hematologic malignancies (H0818: lymphoma and other lympho-proliferative diseases; H0819: myeloma and other plasma cell diseases).

Application codes of proposals related to distinctiveness of tumor from specific systems/organs should be carefully chosen in corresponding to the specific systems/organs. Applicants should note that the proposals on tumor epidemiology should be submitted to the Division VIII of Health Sciences (H26); the proposals on oncological pharmacology should be submitted to anti-tumor pharmacology (H3105); the proposals on medical imaging and biomedical engineering of tumor should be submitted to the Division V of Health Sciences (H18); the proposals on radiation oncology should be submitted to Division VII (H16); in addition, the proposals on traditional Chinese medicine tumor research should be submitted to Traditional Chinese Medicine (H27), Chinese Materia Medica (H28), or Integrated Chinese and Western Medicine (H29).

The funding scope under Radiology (H22) is given to basic research in radiation damage and repair, radiation toxicology and pathology, radiological hygiene and protection, and radiological therapy for non-tumor disease. The Division of Radiology (H22) does not accept applications for cancer radiotherapy or radiodiagnosis, the latter of which should be submitted to Medical Imaging and Biomedical Engineering (H18).

The funding scope under Gerontology (H25) mainly covers studies focused on the pathophysiological mechanisms of aging and aging-related diseases. Applications that focus on age-associated diseases that do not involve pathophysiological mechanisms of aging should be submitted to other proper divisions.

Applications that focus on neonatal diseases should be submitted to Reproductive System/Perinatology/Neonatology (H04).

Applications that focus on sexually transmitted diseases should be submitted to Medical Pathogens and Infection (H19).

4. Special Projects under General Programs and relevant policies

(1) Animal models development

Animal models for mimicking human diseases are requisite to biomedical research, not only for understanding mechanism of diseases, and identifying new drug targets, but also for drug evaluation in clinical trial phases. The Department will give special support to applications for General Programs involving the development of animal models of human diseases. Basically, animal models for mimicking human diseases include both spontaneous animal models and inductive (laboratory) animal models, the latter may include gene modified animals (transgenic models, gene knock in/out models, the N-ethyl-N-nitrosourea (ENU)-induced inductive models and cloning models), surgical animal models and physical- or chemical-induced animal models.

The funding intensity of direct cost is averagely 0.8 million yuan, and the duration is four years. Research in the following areas are especially encouraged: (i) identification of spontaneous animal models of human diseases; (ii) the development and standardization of various new inductive animal models; (iii) studies on the impacts of various environments on animal models; (iv) comparative medical studies on various species of animal models of the same disease; (v) resource information and databases of animal models; (vi) technical improvements in developing animal models. New animal models for human diseases are

one of the fundamental works in experimental medical research, so the Department will give long-term continuous support in order to provide technical platforms and facilitate research progress in this area in China.

The applicants are expected to choose the proper secondary application codes attached to the primary application codes (H01 to H31) based on their proposed research, and “The development of animal models for human diseases” should be written in the annotated column of the application form. The similarity and differences in disease susceptibility and clinical symptoms between animal models and human diseases should be elaborated, and a detailed analysis of the available animal models of a given human disease is required to avoid repeated research. All the government requirements concerning animal welfare and ethical issues should be met. There is an “animal model” special column on the website of the Department (<http://health.nsf.gov.cn>), and the principal investigators are expected to submit the progress report of the project in time, and to contribute to the validation, spread, and application of the animal model.

(2) Etiology and prevention study of human rare diseases

In 2018, the Department will continuously give special support to research aimed at studying the development and prevention of human rare diseases. The rare diseases are defined by WHO as diseases accounting for 0.65‰ to 1‰ of the total population. Applicants are expected to take the advantage of rich genetic resources in China, and to carry out in-depth research on prevention, diagnosis, and drug development of rare diseases, making achievement with own proprietary intellectual properties, and high international impacts. Meanwhile, case studies of major key rare diseases are highlighted in an effort to advance the understanding of pathogenesis underlying the development of major key diseases, thus providing theoretical bases for their novel diagnostic and therapeutic strategies. The applicants are expected to choose the proper secondary application code attached to the primary application codes (H01 to H31), and to write “Mechanism underlying rare diseases (including case studies) and their prevention and treatment” on the annotation column of the application form.

(3) The development and function of lymphatic system

In 2018, the Department will also give special support to research aimed at the development and function of lymphatic system. Research aimed at the regulation mechanism underlying the generation, maturation and homeostasis of the lymphatic system, the relationship between lymph and blood, the roles of lymphatic system on lipid metabolism, the immune defense function of lymphatic system, and the pathogenesis of major key diseases related to lymphatic system, are all encouraged. The applicants are expected to choose the proper secondary application code attached to the primary application codes (H01 to H31), and to write “Mechanism underlying rare diseases (including case studies) and their prevention and treatment” on the annotation column of the application form.

Specific annotation of the above Special Projects should be specified in the annotated column of the application form. Otherwise, these applications would not be treated as Special Projects.

5. Funding plan and budget for General Program in 2018

The funding intensity of direct cost for each project of the General Program in the Department is expected to be averagely 600,000 yuan, roughly the same as that in 2017, and the duration will still be four years. Doubled funding will possibly be given to excellent

innovative research built upon previous strong background. Applicants are expected to request the adequate budget for their proposed work by filling out the budget form with detailed justification. The support research areas of each Division, and an overview of the award number, funding, and success rate of the General Program in 2016 and 2017 in the Department are listed in the table below.

Funding for General Program Projects in Department of Health Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Average funding for direct costs	Success rate++(%)	Projects	Average funding for direct costs	Success rate++(%)
Division I	Respiratory system, circulatory system, blood system	445+22*	25,720+550*	21.91	487+22*	27,204+550*	20.54
Division II	Digestive system, urinary system, endocrine system/metabolism and nutrition support, ophthalmology, otorhinolaryngology head and neck science, oral and craniomaxillo-facial Science	545+24*	31,432+600*	20.61	594+24*	33,188+600*	20.57
Division III	Neurological and psychiatric diseases, gerontology	356+13*	20,688+325*	21.50	382+13*	21,316+325*	20.65
Division IV	Reproductive system/perinatology/neonatology, medical immunology	228+12*	13,137+300*	24.84	229+11*	13,215+275*	24.92
Division V	Medical imaging and biomedical engineering, special medicine, forensic sciences	220+11*	12,565+275*	19.43	239+11*	13,234+275*	19.17
Division VI	Medical pathogenic microorganisms and infection, orthopedics and sports medicine, emergency and intensive care medicine/trauma/burns/laboratory medicine/plastic surgery/rehabilitation medicine	369+21*	21,208+525*	19.02	401+21*	22,223+525*	18.65
Division VII	Oncology (leukemia not included)	746+29*	42,784+725*	18.73	819+29*	45,562+725*	18.28
Division VIII	Skin and appendages, preventive medicine, epidemiology, occupational medicine, radiology	225+11*	12,917+275*	24.11	241+10*	13,341+250*	24.18
Division IX	Materia medica and pharmacology	237+11*	13,567+275*	21.74	262+11*	14,534+275*	21.28
Division X	Chinese medicine, Chinese materia medica, integrated Chinese and western medicine	550+27*	31,494+675*	17.76	599+28*	33,058+700*	16.22
Total		3,922+180*	225,590+4,500*	20.19	4,275+180*	237,640+4,500*	19.40
Direct cost per project		56.09 (57.52**)			54.35 (55.59**)		

Note: *One year program; ** One year program not included; ++ One year program included

Division I of Health Sciences

The division I of Health Sciences supports basic and clinical-related basic research on the diseases of respiratory, circulatory, and hematological systems.

Respiratory System (H01)

The division of respiratory discipline mainly funds the basic and clinical basic translational research that focus on lung, airway, pulmonary circulation, mediastinum, pleura, thoracic cage, and diaphragm. The funding areas cover the disease mechanisms, pathophysiological changes and treatment strategies involving the studies on lung and airway structure, function and developmental abnormalities; lung, airway immunity and transplantation; alveoli and blood-gas barrier; lung fluid transport and pulmonary edema; abnormalities in respiratory regulation; respiratory infections and host-pathogens interactions; lung injury, repair and remodeling; airway inflammation and asthma; chronic obstructive pulmonary diseases; pulmonary circulation and pulmonary vascular diseases; interstitial lung diseases; pulmonary nodules; granuloma; sarcoidosis; and sleep-related breathing disorder; pleural diseases; new methods, techniques and animal models of the respiratory system diseases.

In the recent years, public attentions have focused on the discussion of respiratory emerging infectious diseases and ambient particulate matter (e.g., haze, cigarette smoking etc.) on human health. Therefore, applicants are encouraged to carry out studies focusing on the basic and translational researches related to: (1) environmental pollution and/or pathogen-induced respiratory system damage and immune system dysfunction; (2) inflammatory microenvironment regulation, tissue damage repair and pulmonary fibrosis, which share scientific similarities; (3) bronchial or alveolar epithelial cell dysplasia and nodular lesions; (4) lung stem cells and lung regeneration studies; and (5) also encourage studies on the establishment of respiratory research platforms and new research models.

In present, the submitted and funded proposals in the respiratory system mainly focus on respiratory inflammation and infection, asthma, chronic obstructive pulmonary diseases, pulmonary circulation and pulmonary vascular diseases, interstitial lung diseases, lung injury, repair and reconstruction, sleep-related breathing disorder. The Department emphasizes studies in the areas of lung-blood barrier; respiratory infection, inflammation and defense responses; chronic cough; nodules and pleural diseases. The Department encourages studies in (1) cell therapy for respiratory diseases; (2) combine of latest developments in biomedical research; (3) genetic and epigenetic studies on respiratory diseases; and (4) seeking for new treatment approaches, and potential molecular markers and intervention targets for precise and personalized medication.

Circulatory System (H02)

The division mainly supports the basic researches in cardiac and vascular (including lymphatic vessels) diseases, as well as microcirculation and shock. In recent years, most proposals were focused on cardiac/vascular injury and protection, and followed on atherosclerosis, coronary heart diseases, arrhythmia, heart failure and hypertension, etc. Additionally, there were many applications in the fields of non-coded RNA and stem cells

(progenitor cells), but the innovation and its own characteristics were insufficient. Applicants are encouraged to carry out original and translational basic research, working together with clinicians, developmental biologists and genetic biologists, to study on the mechanisms of cardiovascular diseases development and the therapeutic strategy. In the cutting-edge fields of cardiovascular diseases, researchers are encouraged to establish international collaborations, to propose innovational hypothesis based on their own research data, and eventually gain achievements with independent intellectual properties. Researches on the biological and pathological effects of the biological active substances on the heart and vessels are encouraged, and further screening the potential biomarkers for diagnosis, therapeutic targets and innovative treatment technologies. Studies on the molecular etiology, regulation network and intervention targets of the metabolic disorder related cardiovascular diseases are encouraged, and the effects of other system diseases on the cardiovascular system are also encouraged. Applications of new techniques, new methods and new materials in the cardiovascular field are encouraged. Pericardial diseases, infective endocarditis, immune related circulatory system diseases and lymphatic circulatory diseases are still the relative weak fields in cardiovascular system, and the basic and applied basic research are encouraged. Applicants are encouraged to conduct the study on the cardiovascular diseases in children. The basic and applied basic applicants on important clinical issues in the circulatory device implantation and peri-operative period of cardio-vascular surgery are encouraged.

Hematological System (H08)

The division of Hematological discipline mainly supports original basic research in the areas of hematopoietic cell/organ development and formation, hematopoietic stem/progenitor cell and hematopoiesis regulation, erythrocyte and its related diseases, leukocyte and its related diseases, platelet and its related diseases, aplastic anemia and bone marrow failure, myelodysplastic syndromes, myeloproliferative diseases, blood infection and its treatment, bleeding, coagulation and thrombosis, leukemia, hematopoietic stem cell transplantation and its complications, mesenchymal stem cell and its related blood disease research, blood typing and blood transfusion, hereditary hematologic diseases, lymphoma, and lymphoproliferative diseases, myeloma, and plasma cell diseases, immuno-therapy for blood diseases, research related to new technologies and methods for diagnosis and treatment of hematological diseases.

Currently, most applications and funding are concentrated in the fields of leukemia, lymphoma, myeloma, stem cell transplantation and hematopoiesis regulation. Applications in other categories are relatively low in number, especially in the areas of red blood cell diseases, structure and function abnormality of blood related organs (liver/spleen/thymus), blood coagulation and thrombosis, immune therapy. Thus in 2018, the applicants are strongly encouraged to submit applications in the fields of hematopoietic microenvironment and hematologic disease development, clonal evolution in hematologic malignancies, heterogeneity of diseased cells, and precision medicine, blood immune-therapy. Applications are encouraged to initiate clinical-based basic research and propose basic research projects from clinical perspective, translational research fully utilizing clinical resource, research using the state-of-the-art technologies including hematological research platforms and innovative disease research models. Applications are also encouraged to

initiate biotherapy-related basic and translational research in hematological fields including HSC transplantation, MSC therapy, immunotherapy, gene therapy, etc. In addition, researchers are encouraged to submit applications in the following hematological fields that have solid progresses: hematopoiesis regulation and hematopoietic cell reprogramming; interaction between hematopoietic cells and leukemic cells and their microenvironment under the disease condition; clonal evolution of malignant hematologic diseases; drug resistance in treating malignant hematologic tumors; hematopoietic stem cell transplantation and its biological and immunological issues; hematological disease omics, hematologic biomarkers and their functional validation; the mechanism for leukemic stem cell maintenance and its clinical correlation; immune-therapies and molecular targeted therapies for hematological diseases; in vitro differentiation of stem cells to hemogenic cells; the interaction and mechanisms of platelets, blood vessel and coagulation factors.

As for the applications related to pulmonary circulation and pulmonary vasculature studies, applicants should choose the application codes of either respiratory system (H01) or circulatory system (H02), depending on their specific scientific questions. The application in hematological fields now includes all hematologic malignancies (H0818: lymphoma and other lympho-proliferative diseases; H0819: myeloma and other plasma cell diseases). The division VII for Medical Sciences (application code H16) will no longer accept applications related to hematologic malignancies. Please refer to General Description section in Medical Sciences for non-hematologic malignancies applications.

Division II of Health Sciences

Division II mainly supports basic researches on digestive system, urinary system, endocrine system/metabolism and nutrition support, ophthalmology, otorhinolaryngology, head and neck science, as well as oral and craniomaxillo-facial science.

Digestive System (H03)

The funding scope mainly covers basic research on various non-infectious and non-cancerous diseases of the digestive system. In 2017, the total number of application increased by 11.87% comparing to the year of 2016. The applications on liver diseases, such as liver fibrosis, cirrhosis and portal hypertension, are still the most dominant research areas in this division (accounts for 14.74% of all applications). Other research topics in hepatology include liver regeneration, hepato-protection, liver failure and artificial extracorporeal liver support (10.99%), metabolic liver disease (8.95%). In the field of GI diseases, applications on internal environment disturbance of GI tract, intestinal mucosal barrier impairment and related diseases (11.5%), mechanisms of immune-related diseases of gastrointestinal tract (8.4%), abnormal GI motility and GI functional disorders (4.6%) are among the primary focuses. Other applications include pancreatic exocrine dysfunction and pancreatitis (6.67%, similar to 2016) and digestive organ transplantation (5.09%). The number of applications on the structure and functional impairment of abdominal wall/peritoneum, endocrine and neuro-humoral regulation of digestive system, acid-related diseases and vascular circulation abnormalities of digestive system is relatively low, which warrants further attention.

Studies on hepatic diseases, particularly fatty liver diseases, hepatic fibrosis, cirrhosis, hepatic injury, regeneration and transplantation are still the “hot topics” in this field. However, drug-, toxin-, and alcohol-induced digestive diseases need further investigations. In the field of GI diseases, applications of abnormal GI motility and functional GI disorders show a significant increase in 2017, account for the second largest of group of applications in digestive diseases. Proposals on other topics, including the roles of immune-responses, mucosal microbiota homeostasis, and exosome in the initiation, progression, and therapy of digestive diseases received major attention. The researches focusing on these aforementioned important areas, and studies on the patho-physiology of pre-clinical phase of these diseases and the mechanisms of functional disorders, crosstalk among different digestive organs in the pathogenesis of digestive diseases are encouraged.

Urinary System (H05)

This section is to focus on the structural and functional disorders of the kidney, ureter, bladder, prostate and urethra, excepting tumor research. The number of the applications received in 2017 increased by 24.12% compared with that in 2016. Hot research areas are still on acute kidney injury and the prevention and treatment of chronic kidney diseases, under the code of H0503 (the injury and repair of the urinary system, 23.09%), followed by H0510 (the secondary renal diseases, 16.02%), H0511 (the renal failure, 10.41%), and H0509 (the primary kidney disease, 8.78%). The number of proposals related to kidney transplantation, urinary urolithiasis and urodynamics in 2017 is similar to that in 2016. More emphasis should be paid to urinary tract infection, dysfunction of renal substance transportation and renal endocrine. The NSFC will support the continuous and innovative researches in these fields.

Endocrine System, Metabolism, and Nutrition (H07)

The Division II mainly supports studies on endocrine organ structure and/or function under normal or pathological conditions and on non-tumor endocrine diseases. Supported areas include classical or non-classical endocrine tissue function and pathogenesis, metabolic disorders, clinical malnutrition, and therapeutic treatment for endocrine diseases. The total application number increases by 9.08% in 2017 relative to 2016, but the distributions of major research areas remain unchanged. The majority of the proposals (50.25%) focused on diabetes and diabetes-related diseases, followed by the projects investigating energy metabolism/obesity (19.53%) and thyroid diseases (6.26%). In contrast, there were few proposals on water/electrolyte metabolic disorders, acid-base imbalance, amino acid metabolic abnormality, aberrant adrenal gland development and/or structures, thyroid or parathyroid transplantations, or dysregulation of calcium-phosphorus metabolism. These minor areas will continue to be emphasized and considered preferentially or funding in the future. Similarly, research on clinical discoveries, new clinical questions, and innovative approaches/designs will be encouraged.

Ophthalmology (H12), Otorhinolaryngology Head and Neck Science (H13), Oral and Craniomaxillo-Facial Science (H14)

The Division mainly supports non-neoplasm diseases of related fields. Ophthalmology, mainly supports researches that focus on inflammatory, immune related,

hereditary, as well as degenerative and neo-vascularized eye diseases. Among the proposals received in 2017, fundus diseases remained the most concentrated area, accounting for 32.3% of all applications, followed by corneal diseases (16.0%), glaucoma, optic nerve and visual pathway related diseases (15.5%) and optometry diseases (9.6%). Diabetic retinopathy, retinal/choroidal neovascular diseases, refractive error and age related macular degeneration remained the hot topics of ophthalmic research. Most proposals granted in the field of Otorhinolaryngology Head and Neck Science focused on hearing abnormality, balance disorders (41.8%), diseases of the anterior skull base (27.17%), the olfactory system and the nose (9.77%) in 2017. Hearing related diseases and balance disorders as well as their therapeutic interventions will continue to be key issues in otology. These issues include genetic and molecular mechanisms underlying the pathogenesis for various types of deafness and the signal pathways related to hearing impairments. Pathogenesis of rhinitis and sinusitis, and its immunotherapy will be hotspots in the field of rhinology. Proposals focusing on parathria and functional repair will be encouraged. Proposals for throat diseases will be encouraged to focus on obstructive sleep apnea hypopnea syndrome (OSAHS). Pathogenesis and interventional treatments for tinnitus, hyperacusis and dizziness, and for immune-disturbance of nasal mucosa will be the important research directions, which will favorably be funded. In areas of oral and craniomaxillo-facial science, there were more proposals on the periodontal and oral mucosa diseases, accounted for 18.6% of total proposals in 2017, followed by dental pulp and periapical diseases (13.8%), as well as tooth defects, anodontia, repair and correction of dentognathic deformities (13.2%). The studies in osteogenesis, applications and mechanisms of odontogenic stem cells and exosomes, tissue biomechanics and biomaterials were hot fields. The Division will continue to support researches on most severe, common, complicated diseases or functional disorders in the above fields, support research on pathogenesis, diagnosis, novel treatment procedures and functional reconstruction, and areas related to general health of human body.

The Division does not support researches on drug design and pharmacology. Please submit the related proposals to Division IX of Health Sciences (H30, H31). Proposals on the male reproductive system and male sexual dysfunction are not included in code H05, so please submit related proposals to Division IV (H04). It is specially noted that the proposals on teeth repair and implant material should use code H1409, and the proposals on craniofacial bone, cartilage tissue in the field of oral medicine should use code H1402. Other proposals related with characters of oral orthodontic and repair should submit to code H1408. Division II does not support cancer research. All applications on cancer research in those areas please refer the general introduction of proposal guidance from Department of Health Science.

Division III of Health Sciences

Division III provides financial support primarily for basic research in the fields of neurological diseases, psychiatric disorders, and diseases associated with aging.

Neurological Diseases and Psychiatric Disorders (H09)

Under this code, Division III offers a wide range of funding opportunities that

provide support for both basic and applied research investigating the pathogenesis, mechanism, diagnosis, treatment, and prevention of most neurological diseases. We provide research funding for common neurological disorders (e.g., cerebrovascular diseases, epilepsy, injury and repair of brain and spinal cord, pain syndromes, and neurodegenerative disorders), as well as rare nervous system diseases. The Division supports for studies on inherited metabolic, inflammatory, and immunological diseases of the nervous system. In addition, we encourage and stimulate research examining the causes of comorbid neurological diseases and psychiatric disorders as well as clinical investigations that focus on neurological diseases and psychiatric disorders independently. The Division does not provide funding for research concerning nervous system tumors.

One of the defining characteristics in the spectrum of modern human disease is the rapidly increasing prevalence of psychological and psychiatric diseases. Therefore, the most urgent need in these fields is the development of studies that aim to: (1) identify and/or classify the biological bases associated with specific disorders, and (2) better understand the biomedical causes and mechanisms that can be used to promote early detection, objective diagnoses, and targeted treatments. Applications submitted within this scope are considered to be among the highest of funding priorities for our division. Compared with research funding requests from previous years, most of the applications for psychiatric disorders submitted in 2017 remained focused on depression disorders and schizophrenia, though there has been a mild increase in applications for studies of psychiatric disorders in children and adolescents, sleep disorders, psychological consultation, and crisis intervention. Yet, despite the growing need, the number of applications that focus on personality disturbance and psychological measurement remained very low. In an effort to reduce the growing burden of mental health in China, the Division also encourages the submission of research applications that aim to illustrate the effects of the environment on genetics and the impact of both factors on the development of psychiatric disorders.

In recent years, applications for research in neurological diseases were predominantly focused on stroke, injury and repair of brain and spinal cord, pain and analgesia, and cognitive impairment. 2017 saw a dramatic increase in applications for research of lncRNA, multimodal neuroimaging, and exosomes in neurological diseases; however, most of the proposed research focused on follow-up analyses and/or lacked originality. Our division will continue to fund studies on rare genetic diseases of the nervous system, particularly studies based on the molecular classification of individualized diagnoses and treatment. Studies using animal models such as non-human primates, *Drosophila*, and Zebrafish will be given priority.

Although the number of applications for clinical study of cerebrovascular diseases has increased, there is great need for consensus in defining the characteristics of these diseases, and for significant improvement in standardization of methods (e.g., trial design, data collection, etc.). A unified strategy for carrying out clinical trials and data collection is critically important for strengthening both basic studies and clinical trials for early intervention, revascularization, functional recovery, and precision medicine in acute stroke and neurotraumatic patients. Research on the mechanisms underlying pain, especially chronic pain, need to be strengthened through the collaboration of basic and clinical studies.

Research on mental disease and disorders of the nervous system in children has been an ongoing concern of Division III, but the research in this field in China is weak. In 2018, combined with defining the characteristics of the child's developing nervous system, two or

three general projects related to epilepsy in children and neurodevelopmental disorders will be generously funded to increase the pace of knowledge acquisition and encourage research in this vitally important field.

In summary, Division III will work to balance its support among applications from neurology, neurosurgery, and psychiatry, as well as related fields such as pediatrics and anesthesiology. Clinicians and researchers in basic neurosciences are encouraged to jointly apply for collaborative funding to carry out significant multifaceted investigations.

Gerontology (H25)

The funding scope under this code in the division mainly covers studies on the pathophysiological mechanisms of aging and aging-related diseases. Research on the effects of pathophysiological changes on organs and organ systems and common mechanisms of various diseases related to the aging process are also encouraged and supported. Of particular interest are studies examining the effects of factors such as genetics, metabolism, damage, stress, and inflammation on organ function and the development of aging-related diseases; molecular mechanisms of stem cell senescence and its association with organ function and maintenance; new techniques and methods in aging study; the anti-aging effect and mechanism of calorie restriction, exercise, health management, and other approaches to healthy aging. The division does not offer funding for age-associated diseases that do not involve pathophysiological mechanisms of aging. Such applications should be submitted to the appropriate Divisions of Health Sciences. Similarly, the division does not provide funding for research concerning tumors, which should be submitted to the Division VII of the Department.

Division IV of Health Sciences

Division IV mainly supports basic, translational, and clinical research in the areas of Reproductive System/Perinatal Medicine/Neonatal and Medical Immunology.

Reproductive System/Perinatal Medicine/Neonatology (H04)

Major supporting research projects include but are not limited to: Basic research on the structure/function/development abnormalities of the reproductive system, injury and repair, inflammation and infection, the endocrine abnormalities and related disease, hereditary reproductive diseases and other non-neoplastic reproductive system related diseases, germ cell occurrence and fertilization, embryo implantation and fetal development, prenatal diagnosis, placental structure/function and development abnormalities, pregnancy and pregnancy related diseases, neonatal related diseases, mammary gland structure/function and development abnormalities, contraceptive/birth control and termination of pregnancy, female infertility and assisted reproduction, reproductive engineering and the related research about developing new diagnosis/treatment technologies in the areas of reproductive system/perinatal medicine/neonatal related diseases.

Major focus areas of investigation for the research projects include but are not limited to: the studies about germ cell occurrence and fertilization, embryo implantation,

fetal development and abnormalities, placental development and regulation, the mechanism of pregnancy adaptive compensatory and it is abnormal-regulation related diseases; the environment in/out utero affect the pregnancy outcome and descendant health; the regulation of the organ's development of newborn and related diseases; the environmental/genetic/maternal nutrition factors affect endocrine and it is related diseases; the pathogenesis of endometriosis and adenomyosis, histopathologic changes, biological behavior of proliferation and invading of tumor-like cells; fertility preservation and rebuild, infertility, assisted reproduction technology and it is safety study; male infertility and sexual dysfunction study, etc. In the gynecology-related areas, it is recommended to focus on the physiology and pathogenesis of puberty, menopause and the prevention/treatment of related diseases, focus on the basic research of the diagnosis and treatment of endometriosis and adenomyosis, focus on the pathogenesis and treatment of cesarean section related diseases, uterine incision scar pregnancy and incisional uterine diverticulum, focus on the basic research about the common and high frequent gynecological diseases.

In the male reproduction-related areas, the study about low libido and ejaculation dysfunction such as premature ejaculation and no ejaculation are encouraged, it is recommended to focus on male reproductive system structure, function, and development defects (such as hypospadias and cryptorchidism) and hereditary diseases of male reproductive system (such as idiopathic non-obstructive azoospermia and congenital vas deferens deficiency); in the reproductive and perinatal medicine areas, it is recommended to focus on the study of the preimplantation embryo development and the regulation of embryonic stem cells, focus on the study of multi-factorial mechanistic and intervene of preeclampsia, focus on the interactions between environmental (maternal nutrition) and genetic factors on pregnancy outcomes and descendant health and the mechanism of maternal diseases affect the maternal/fetal health, focus on placental development and placenta-originated maternal/fetal diseases, focus on the mechanisms of parturition, preterm birth, intrapartum placenta and uterine contractions related postpartum hemorrhage, focus on the research about the affection of autoimmune diseases on pregnancy outcomes and the immunotherapy of related diseases, focus on the normal development of fetal organ systems and mechanisms of abnormal fetal organ defects as well as early diagnosis and treatment of congenital defects; in the neonatology related areas, it is encouraged to focus on the newborns circulatory system diseases, hereditary metabolism diseases, infectious diseases, newborns nutrition, neonatal critical care, neonatal chronic organ damage and repair, etc.; in the assisted reproduction and reproductive medical engineering related areas: it is recommended to focus on developing new assisted reproductive technologies and reproductive medical engineering methods such as in vitro sperm induced differentiation technology, testicular sperm retrieval techniques, technology for promoting spermatogenesis, focus on the oocyte induction/differentiation/maturation techniques in vitro, focus on the induction/differentiation and transplantation of stem cells, focus on building new animal models of human related diseases.

Priority supporting research areas: Establishing new characteristic research systems and multidisciplinary technology platform (i.e., targeted molecular therapies, in vivo tracking therapies and primate/other large animal models) to study the molecule and cell basic of human genetic and developmental diseases, focusing on gametogenesis and the regulation of reduction division, focusing on the regular rule and abnormalities of human sperm-ovum recognition and fertilization, the regular rule and abnormalities of embryonic

stem cells and early embryo development, the physiology regulation of pregnancy establishment/maintenance and the pathomechanism of related diseases, the rule and abnormalities of human organogenesis and early development, the basic mechanism and abnormalities of human reproductive system structure and function development, parturition and related diseases, the rule of human neonatal development and aberrant; the study on transgenerational inheritance of acquired character; the remodeling of germ cells, reproductive tissues, organs, including artificial gametes, uterus and placenta; exploring the new mechanisms of dysgenesis diseases; the study about pathogenesis and early diagnosis/treatment of congenital malformation, congenital metabolic diseases, single/poly gene genetic diseases and chromosomal disorders based on the superiority of Chinese genetic and disease resources; the research about contraception, birth control, assisted reproduction and related safety evaluations based on novel advances in biomedicine; the basic and applied basic research for treatment of reproductive system diseases using the novel techniques such as genome-editing technologies, stem cell cultivate and directional differentiation, and the novel advances in tissue materials engineering, etc.; the studies of gender difference affect human health and diseases based on the rare population resource in China; the basic/applied basic research on reproductive system/perinatal medicine/neonatology related areas using real-time imaging techniques, advanced sequencing and histology new technology, etc.; the innovative and translational clinical studies on reproductive system/ perinatal medicine/neonatology related areas with the cooperation of basic and clinical staff.

Reproductive system/Perinatal medicine/Neonatology (H04) does not support the tumor-related research project.

Medical Immunology (H10)

Major areas include but are not limited to: The new immune cells and their subgroups, the new immune molecules and their signal transduction pathways in association with diseases, stem cells and immunity, immune cells in vitro differentiation, epigenetic regulation and modification on immune cell differentiation and function; mutual regulations between metabolism and immunity, intestinal, reproductive microecology and immunity; regional immunity and disease, extracellular vesicles and immune-related diseases, immune cell differentiation and functional abnormalities and diseases, immune recognition-response-effect and disease; infectious diseases, inflammatory diseases, hypersensitivity diseases, autoimmune diseases, tissue damage and repair, primary and secondary immunodeficiency disorders, transplantation immunity and organ transplantation (e.g., the immunological status of the transplanted patients after long-term survival and immunosuppressant-related diseases) and other related basic and clinical research; mechanistic studies of new biological agents and carriers used for immunotherapy, and the role of vaccines and adjuvants.

In the field of basic immunology, it is recommended to focus on research of new immune molecules and immune cell subsets, development, differentiation, function of lymphatic system and its involvement in mechanism of immune-related diseases, the roles of sugar/lipid metabolism in the development of immune-related diseases.

In the field of inflammation/infection and immunity, applicants are advised to focus on Hippo pathway, metabolic pathway, neuroendocrine regulation, and to strengthen the

research of inflammation in tissue damage and repair (including the impact of inflammatory response and inflammatory factors in immune intervention, as well as in promotion of tissue repair and protection of tissue function).

In the field of organ transplantation and transplantation immunology, it is recommended to focus on the roles of innate immune cells, new immune cell subsets, antibodies, and complements in transplantation immunization, as well as the mechanisms of chronic rejection and its prevention and treatment.

In the field of hypersensitivity, applicants should focus on the new roles of IgE, the new molecules associated with hypersensitivity, and screening, component analysis, standardization and diagnostic methods of new allergens, as well as studies of type II, III and IV hypersensitivity.

In the field of autoimmune diseases, it is recommended to focus on the studies of animal models of autoimmune diseases, to extend the research with other disciplines by application of immunological bioinformatics, cytomics and genome editing technology in autoimmune diseases, and to pay particular attention to research on rare diseases.

In the field of vaccine research, the Division encourages applicants to focus on cross-studies of individualized vaccines and bioinformatics, vaccine discovery and rational design of new pathogens, biomimetic nano-adjuvants and delivery system, and the use of immune repertoire technology to carry out the discovery and research of vaccines, and pay particular attention to therapeutic vaccine for important diseases.

In the field of new technologies for diagnosis and treatment of immune-related diseases, it is recommended to focus on application of visualization and high-throughput technologies in immunology research, as well as to cross-studies of immunology and big data, animal models of immune-related diseases, interactions between tissue engineering materials and the immune microenvironment, microflora and immune system.

Priority research area: Studies of human immune-related diseases by establishing distinctive research systems and targeted technology platforms such as targeted molecular techniques, unique cell models and animal models, and so on; taking full advantage of disease resources and genetic resources in China to carry out immunological research; in-depth studies of disease related immunological bioinformatics, immunomics, immune repertoire, computational immunology and others in systems immunology; studies of medical immunology in clinical practice through a close cooperation between basic and clinical immunology researchers; studies of the immune system and processes of immune response using new technologies developed in recent years, such as high-resolution magnetic resonance imaging techniques, real-time dynamic imaging techniques, mass spectrometric cellular techniques, and single cell sequencing.

Division V of Health Sciences

Division V mainly supports basic research and basic clinical research in the fields of medical imaging, biomedical engineering, special medicine, and forensic medicine.

Medical Imaging and Biomedical Engineering (H18)

Medical Imaging and Biomedical Engineering are characterized by interdisciplinary

work between multiple subject areas, such as that between medicine and mathematics, physics, chemistry, information sciences, materials sciences, engineering, life sciences, and so forth. The Division supports research in the areas of medical imaging and biomedical engineering.

In the field of Medical Imaging, the Division mainly supports the research of medical imaging and its application to solve scientific problems related to medicine, including radiology (magnetic resonance imaging, X-ray imaging and computed tomography imaging), ultrasound in medicine, nuclear medicine, interventional medicine, and so forth. Meanwhile, explorative interdisciplinary studies in the scientific forefront of these fields, including the areas of multimodal imaging, molecular imaging, functional imaging, computer-aided diagnosis and artificial intelligence-based imaging, precision interventional medicine, theranostics, radiomics, and translational medicine are also encouraged. In addition, the research of new imaging technology which can be applied in early diagnosis/treatment, prognosis, and the therapeutic effect evaluation of various diseases are also supported.

In the field of biomedical engineering, the Division mainly funds research on medical engineering associated with disease prevention and early-warning, disease detection and diagnosis, disease treatment and rehabilitation, as well as the basic research related to regenerative medicine and nanomedicine, including processing/analysis of biomedical signals and images, biomedical sensors, biomedical photonics and magnetics, chips and micro-nano systems, biomedical system modeling/simulation, medical information system, physical therapy, rehabilitation engineering, neural engineering and brain-computer interface, treatment planning and navigation technology, robotics-assisted therapy, biomedical instruments and medical equipment, gene/drug delivery materials and transport systems, medical biomaterials, tissue engineering, regenerative medicine, artificial organ, and so on. Research on neural interface/regulation technology, bioMEMS, 3D-printing and tissue/organ construction, medical virtual reality and augmented reality, cell therapy, bioreactor, micro-tissue/organ construction and application, medical artificial intelligence and big data mining in healthcare are particularly encouraged.

Special Medicine (H21)

Special Medicine is aimed at the special health care needs from the population under different special circumstances, to solve various special medical problems, so as to provide theoretical and technological support for major national strategic needs. These studies will aim at understanding the physiological and pathological changes and related mechanisms, on the level of molecules, cells, tissues, organs and the entire human body. In this area, the Division mainly supports research on the analysis of pathophysiological phenomena and the prevention/cure of diseases under special circumstances, such as aeronautic, astronautic or space, nautical, submersible, plateau, polar region and other special or extreme conditions. The Division encourages the application in medicine, physics, chemistry, biology, and modern engineering technologies to perform thorough and systematic work on specific medical issues and explore new technologies and methods to maintain and enhance brain function and physical function of the body under special environmental conditions. Interdisciplinary work within special medicine, interdisciplinary work between special medicine and biomedical engineering or other natural sciences are also supported. The

Division funded one proposal with high-intensity funding in 2017, and will fund at least one proposal with high-intensity funding in 2018.

Forensic Medicine (H23)

In the field of Forensic Medicine, the Division mainly funds the research on resolving the medical problems in the judicial practice with the studies of human body and other relevant human biological samples. The funding fields mainly include the identification of cause of death, the estimation of postmortem interval; the pathophysiological changes caused by abuse of and dependence on drugs and poisons, in vivo metabolism of poisons, detection technologies for poisons and their metabolites; the forensic evidence associated with the mechanism of injury and damage, the evaluation of the degree of injury and damage, the estimation of wound age, the identification of the level of disability and loss of the working ability; the objective evaluation of the legal capacity of persons with mental disorders; the determination of individual characteristics (age, height, appearance, etc.), individual identification from difficult samples, paternity identification, identification of the tissue origin and ethnic origin; forensic translation from new technologies and new methods in biology and medicine. Systematic research in the above aspects using the theories and techniques of physics, chemistry, biology, medicine, legal science and informatics, and so forth, is strongly encouraged. Interdisciplinary work between forensic medicine and medical imaging, biomedical engineering, and other disciplines are also strongly supported. The Division will fund at least one proposal with high-intensity funding in 2018.

The development of medical imaging, biomedical engineering, special medicine and forensic medicine has been accelerated by multidisciplinary studies. In 2017 there were in total 1,304 applications in the areas of medical imaging, biomedical engineering, special medicine and forensic medicine, of which 250 applications including low-intensity funding were funded, the success rate is 19.17%. There was a significant increase in the number of applications in Medical Imaging, and there are slight increases in the number of applications in Biomedical Engineering and Forensic Medicine. However, the number of applications in Special Medicine decreased. To further promote the rapid development of medical imaging, biomedical engineering, special medicine and forensic medicine disciplines, the Division will continue to encourage multidisciplinary research and cooperation between scientists with different scientific backgrounds aiming at the above scientific frontiers. At the same time, preferential supports will be provided to young investigators.

The Division does not accept applications on radiation oncology or radiation prevention, which should be submitted to Division VII (H16) or Division VIII (H22) in the Department of Health Sciences, respectively. The applications on pharmacology and drug administration should be submitted to Division IX (H30, H31) in the Department of Health Sciences.

Division VI of Health Sciences

The funding scope of Division VI covers basic researches in fields of abnormalities and diseases of locomotor system, emergency and critical care medicine, trauma, burns,

frostbite, plastic surgery, rehabilitation medicine, laboratory medicine and biological characteristics and infection of bacteria, fungi, viruses, parasites and other pathogenic organisms.

Abnormalities and Diseases of Locomotor System (H06)

The Division mainly supports the research on the abnormalities in structure, function and development of the bone, joint, muscle and ligament, and the research in the etiology, pathogenesis, diagnosis, prevention and cure of the musculoskeletal diseases including the genetic diseases, the immune-related diseases, inflammation and infection, injury and repair, grafting and reconstruction, fatigue and recuperation, degenerative disorders, sports injury, deformity and correction, and non-neoplastic diseases. Meanwhile, the researches on the emerging scientific issues such as precise medicine and medical biomaterials development in musculoskeletal fields are highly encouraged. In 2017, the submitted proposals mainly focused on the research fields in the musculoskeletal damage and repair (H0605), and the degenerative diseases of bone, joint and soft tissue (H0609). Research projects on intervertebral disc degenerative disease, osteoarthritis and biomaterials have been hot spots in this field. In contrast, research applications in musculoskeletal fatigue and recuperation filed (H0608) were still at quite low volume. The research projects focusing on the biological mechanisms in the interaction between locomotor system and other organ systems based on the emerging medical phenomena and clinical problems are preferentially encouraged.

Emergency and Critical Care Medicine/Trauma/Burns/Plastic Surgery (H15)

Focus on scientific problems including the pathophysiology, pathogenesis, diagnosis, treatment and prevention in the field of emergency and critical care medicine, trauma, burns, and plastic surgery. Key funding areas of emergency and critical care medicine include early identification, diagnosis and treatment, as well as organ function support, protection and reconstruction. Key funding areas of trauma and burns include pathogenesis of injury, treatment and prevention of complication, tissue repair, as well as functional reconstruction. Key funding areas of plastic surgery include wound healing and scar management, repair, regeneration and reconstruction against malformation and defect of surface tissue and organ.

Rehabilitation Medicine (H17)

The Division mainly supports the researches on the mechanisms, clinical evaluation and therapy in the rehabilitation of dyskinesia and injuries caused by the diseases of locomotor system, nervous system or other relevant organ/systems. The projects focusing on the interdisciplinary research fields and the innovative research in the rehabilitation technology are preferentially encouraged.

Medical Pathogens and Infection (H19)

The Division mainly supports the research of medical microbiology and parasites, including etiology, pathogenic biology, pathogenic mechanism of pathogens, mechanism of drug resistance and host immune response, epidemic trend of nosocomial infection, discovery and biological characteristics of pathogenic vectors, and so on. The genetic

variation and evolutionary processes, drug resistance and the interaction with the host of the pathogen are the important scientific issues and research hotspots in pathogenic biology and infectious disease. The Division encourages innovative research on the above scientific issues, and encourages the development of biomedical research on various types of pathogenic organisms, especially new and neglected pathogens.

Laboratory Medicine (H20)

The Division mainly supports researches on new theory, new technology, new methods and new markers for prediction, diagnosis, monitoring and prognosis of all kinds of diseases. The key-funding fields include early, rapid and accurate detection technology, discovery and identification of new biomarkers, diagnosis of rare diseases and genetic diseases, etc. Interdisciplinary researches are encouraged.

The applications on therapeutic drugs and pharmacology should be submitted to Division IX (H30, H31) or Division X (H28). Pathogenic mechanism of molecules and temporal and spatial expression and regulation of genes should not be sent to laboratory medicine, please apply it in other appropriate Divisions. Researches on drug-resistant pathogens should choose the code of Variation of Pathogen and Drug-Resistance (H1908). Researches that are not involved in the mechanism, evaluation and therapy of rehabilitation should not submit to rehabilitation medicine, please apply it in other appropriate Divisions. As for the applications involving highly pathogenic microorganism and tumor, please see the general part of Department of Health Sciences.

Division VII of Health Sciences

The Division mainly funds basic research and translational research in oncology.

Oncology (H16)

The Division provides funding for cancer research involving common features of tumors in occurrence, development and progression, as well as the distinctiveness of tumors of various systems/organs in etiology, pathogenesis, diagnosis, treatment and prevention. The scopes of funding cover not only tumor etiology, tumor development, tumor genetics and epigenetics, tumor immunology, tumor prevention, tumor recurrence and metastasis, tumor stem cell, tumor diagnosis, chemotherapy, physical treatment, biological treatment, comprehensive treatment of the tumor, tumor rehabilitation including social and psychological rehabilitation, new techniques of tumor research, but also tumors of various systems/organs (excluding hematologic system) which include respiratory system, digestive system, nervous system (including special receptors), genitourinary system, breast and endocrine system, bone and soft tissue, head, neck and maxillofacial region, as well as skin, body surface and other parts of the human body.

The scientific goal of the Division is to emphasize the common features of tumors, which focuses on the molecular mechanism of tumor biology, such as proliferation, differentiation, metastasis, autophagy and apoptosis, thus to explore the mechanism and

regularity of tumor occurrence, development, metastasis and recurrence, laying the foundation for tumor diagnosis, treatment and prevention. Also, the Division highlights the distinctiveness of tumors of various systems and organs, and to promote the clinical practice in tumor diagnosis and treatment by carrying out translational research based upon clinical experiences and observation of specific systems/organs.

Proposals related to common scientific questions of tumor should select relevant application codes in tumor etiology, tumor development, tumor genetics and epigenetics, tumor immunology, tumor prevention, tumor recurrence and metastasis, tumor stem cell, tumor diagnosis, chemotherapy, physical treatment, biological treatment, comprehensive treatment, rehabilitation (including social and psychological rehabilitation) and new techniques of tumor research (application code: H1601 to H1614). Proposals related to distinctiveness of tumor of specific systems/organs should choose application codes of corresponding systems/organs (application code: H1615 to H1626). Application codes should be carefully selected in accordance with various scientific fields.

Oncology is one of the most active areas in medical sciences. With the rapid development and integration of cell biology, developmental biology, genetics and immunology, the trends of cancer research are steered towards tumor epigenetics, tumor stem cells, tumor immunology, and tumor systemic biology. Recently, research on cancer epigenetics has emerged as a rapid moving field, especially the studies of epigenetically regulated functional RNAs in tumorigenesis and tumor progression. Additionally, in the research field of tumor microenvironment, studies on the interaction between tumor cell and its microenvironment have gained increasing attention, for it emphasizes not only the regularity of microenvironment on tumor cell's biological property, but also the biological significance of tumor cell's effect on microenvironment. Moreover, the impact of cancer treatment on microenvironment has also been noted recently. On the other hand, aberrant cancer metabolism and its underlying mechanisms as well as its role in cancer biology have been appreciated, especially the reciprocal causality of metabolism and tumorigenesis and cancer development. Special interests have been aroused in the mechanisms of metabolic reprogramming of cancer cells and microenvironment, the association between specific metabolism of tumor cells and their biological behaviors, the roles of metabolites, metabolic enzymes, and metabolic-associated molecules in oncogenesis and tumor development,, the crosstalk among different signal pathways and its effects on tumor microenvironment and tumor immunity. The other proposals have stressed the translational values of metabolic factors in tumor biology. For example, studies exploring the efficacy and mechanisms of agents regulating the metabolisms of glucose, lipids and nuclear acids in tumor cells may provide experimental evidence for the application of traditional drugs for cancer treatment. Studies probing the biology of tumor stem cells are making tremendous progress, which include the molecular mechanisms involved in sustaining tumor stemness of tumor stem cells, abnormal metabolism of tumor stem cells, relationship between epithelial-mesenchymal transition (EMT) and tumor stem cells, formation and mechanisms of vascular mimicry, interactions between microenvironment and tumor stem cells, cancer cell dormancy, tumor heterogeneity, and resistance in therapy. Tumor chemoprevention attracts more and more interest. By screening natural or synthetic compounds, new targets for cancer prevention and treatment were identified, reducing the incidence of cancer and improving survival for cancer patients. Moreover, psychological impact on tumor development has aroused increasing attention. Mental stress may lead to immune and

neuroendocrine alteration, which thus may play a role in tumor metastasis and therapy resistance. It could also be an important etiological factor of tumorigenesis. The Division encourages the development of new techniques and methods for cancer research, including the establishment of the organoid model and the research of organoid related techniques.

In recent years, the quality of proposals in the field of oncology has been significantly improved, in terms of solid preliminary experimental data, scientific hypothesis based on sophisticated reasoning and complete and thorough studying items. Proposals derived merely through literature reviewing without preliminary experimental data, or descriptive and correlative studies are declining each year, and are lacking approval by reviewers.

Applicants are encouraged to conclude scientific questions from accumulated research findings or clinical practice, and to systemically investigate mechanisms for malignant tumors to improve cancer diagnosis, treatment, and clinical translation, as well as to develop new technology for cancer research. Integrated research proposals making the most of domestic clinical resources and focusing on common and high incidence tumors in the Chinese population are also encouraged.

Applicants should note that the proposals on tumor epidemiology should be submitted to the Division VIII of Health Sciences (application code: H26), and proposals of hematologic system tumor should be submitted to the Division I of Health Sciences (application code: H0818, H0819). Proposals related to distinctiveness of tumor from specific systems/organs should carefully choose application codes of corresponding systems/organs. Proposals submitted in wrong application codes would be objected.

Division VIII of Health Sciences

Division VIII of Health Sciences provides funding for basic researches in fields of skin and its appendages, radiology medicine, endemiology, occupational medicine, and preventive medicine.

Skin and its Appendages (H11)

The funding scope mainly covers the basic research in the structure, function and dysplasia of skin and its appendages, as well as hereditary, immune-mediated and inflammatory skin diseases.

Radiology (H22)

The funding supports basic research in radiation damage, radiation toxicology, radiological hygiene and protection, and radiological therapy for non-tumor diseases.

Endemiology (H2401)

This field provides funding to basic research regarding to the natural focal diseases, biogeochemical diseases and special diseases related to work or life style.

Occupational Medicine (H2402)

This filed provides funding to basic research concerning diseases due to exposure to occupational hazards.

Preventive Medicine (H26)

The funding scope covers the basic research in environmental health, occupational health, human nutrition, food hygiene, maternal and child health care, children and adolescent health, toxicology, hygienical analytical chemistry, epidemiology of infectious diseases, epidemiology of non-communicable diseases, epidemiological methods and medical statistics.

Funding for radiology, endemiology, occupational medicine and preventive medicine is mainly focused on research in discovering new theory and developing advanced technology and methods for disease prevention and control. Projects with important scientific value and original innovation are highly preferred. Investigators are recommended to focus on population-based studies according to the actual need of population health and disease prevention. During research, reasonable application of integrated advance technology is encouraged. A combined research in laboratory experiment and field trial is also encouraged. Applicants should pay more attention to the multidisciplinary method and new growing point. In order to reflect Chinese characteristics and prestigious international standing, it is prerequisite to seek a novel research direction and to make great efforts in prospective studies. Basic data accumulation and medical specimen collection will be encouraged for in-depth, systematic studies. The basic research in epidemiological cohort studies is highly encouraged. The studies investigating the association of environmental pollution with health should be intensively supported.

In the scope of skin and its appendages (H11), oncology-related researches are not accepted, which should be submitted to Division VII (H16). Researches on sexually transmitted disease are not supported as well, and applicants may refer to categories under Division VI (H19). Applications involved in cancer radiotherapy are not accepted in Radiology (H22), and may refer to categories under Division VII (H16); Applications for medical imaging and radiological diagnosis also are not included, and may refer to categories under Division V (H18). Applications of hereditary disease without geographical features are not accepted under the category of Endemiology (H2401). These applications are suggested to refer to corresponding category depending on the systems of human body. Food hygiene (H2604) does not support the study only involved in food processing, and relevant divisions of Life Science are recommended. Applications for studying gynecologic diseases and pediatric diseases are not accepted in the field of maternal and child health care (H2605), and children and adolescent health (H2606). The former may refer to categories under Division IV (H04), and the latter depends on the classification of body system. In addition, applications on drug toxicology are not supported by Toxicology (H2607), and applicants may refer to categories under Division IX (H31). Researches about clinical test are not included in the category of hygienical analytical chemistry (H2608). Applicants may refer to categories under Division VI (H20). Pharmaceutical analyses are also excluded from H2608 and applicants may refer to Division IX (H30). Applications only involved in laboratory research are not accepted under the category of epidemiology (H2609/H2610). Epidemiology of non-communicable disease (H2610)

and other issues in preventive medicine (H2612) do not accept applications for hygienical economics, hospital administration and health management. Applicants may refer to categories under Department of Management Science. Also, applications for pathogen biology, including its pathogeny, pathogenesis, diagnosis, treatment and prognosis are not supported by field of infectious disease epidemiology (H2609) and other issues in preventive medicine (H2612). Applicants may refer to categories under Division VI (H19).

Division IX of Health Sciences

The Division IX of Health Sciences mainly supports basic researches in the discipline of Materia Medica and Pharmacology.

Materia Medica (H30)

Funding scope of Materia Medica in the Division covers research areas or sub-disciplines including Synthetic Medicinal Chemistry, Medicinal Chemistry of Natural Products, Microbial Drugs, Biotechnological Drugs, Marine Drugs, Special Drugs, Drug Design and Drug Informatics, Pharmaceutics, Pharmaceutical Materials, Pharmaceutical Analysis, Drug Resources, etc.

The discipline of Materia Medica puts emphasis on interdisciplinary researches and basic researches of innovative drugs. Funding in Synthetic Medicinal Chemistry focuses on the research of active molecules based on new mechanisms or new structures, and generally does not support the simple optimization research of active compounds for known targets. Funding in Medicinal Chemistry of Natural Products and Microbial Drugs mainly provides to innovative theories, technologies and approaches for drug discovery from plants, animals and microorganisms. Funding in Biotechnological Drugs mainly supports researches on innovative biotechnologies or approaches to obtain biotechnological drugs including therapeutic antibodies, vaccines, proteins, nucleic acid and cells, etc.; meanwhile, exploratory researches on new types of expression systems and large scale cultural techniques will also be supported rationally. Funding in Marine Drugs mainly supports chemical, pharmaceutical and ecological researches of rare marine creature and marine microorganism from deep sea. Funding in Special Drugs supports drug researches involved in aeronautics, astronautics, deep sea, radiations, militaries, special environments, etc. Funding in Drug Design and Drug Informatics mainly supports researches on innovative theories or approaches for drug design and safety prediction, and meanwhile, on the discovery and structural optimization of completely new chemical structures of hit molecules by applying principles of drug design, computer-aided drug design, and pharmaceutical informatics. Funding in Pharmaceutics mainly supports researches on innovative theories, technologies and methods, which are associated with Physical Pharmacy, Biopharmaceutics, Molecular Pharmaceutics, Industrial Pharmaceutics, Novel Drug Delivery Systems and Pharmaceutical Dosage Forms. Funding in Pharmaceutical Materials mainly supports basic researches on establishment and safety evaluation of new pharmaceutical excipients and carriers, which should have owned prominent features in pharmaceutical functions and structures and can be distinguished from researches in the

area of pharmaceuticals. Funding in Pharmaceutical Analysis mainly supports basic researches on establishment and development of innovative approaches and techniques for analysis of the pharmaceutical molecules or biofunctional molecules, especially, the pharmaceutical macromolecules or in vivo effector molecules to solve key scientific problems in the fields of Materia Medica and Pharmacology. As for Drug Resources, the Division mainly supports researches on key scientific problems associated with discovery, exploration, sustainable utilization and protection of new pharmaceutical resources.

Pharmacology (H31)

Funding in the discipline of Pharmacology supports researches on drug action mechanism or drug resistance mechanism, target validation, Drug Metabolism and Pharmacokinetics, Clinical Pharmacology and Drug Toxicology, etc. The involved drugs should be therapeutic drugs or drug candidates or bioactive substances with some advantages in treatment of diseases.

The discipline of Pharmacology puts emphasis on in-depth study of action mechanism of drugs or bioactive products and their target, including exploring the basic rule of life and the pathologic mechanism of disease by using drug molecules as probes. In-depth and systematic studies should be strengthened in proposals related with research fields as below: discovery and validation of new target, disease-specific and sensitive biomarker, discovery of new pharmacological actions of drugs or bioactive compounds and elucidation of their action mechanism, strategies and methods to effectively overcome multi-drug resistance, new strategies of drug combination based on pharmacogenomics, epigenetics, systematic biology, etc. Basic research should be strengthened in proposals as below: molecular regulatory network of complex disease and mechanism of drug intervention, individualized drug therapy and new treatment approaches, translational medicine, innovative pharmacological models, techniques and approaches. In the sub-discipline of Drug Metabolism and Pharmacokinetics, new approaches and new models should be constructed and developed to strengthen the molecular mechanism researches on the drug-metabolizing enzymes and transporters that involved in the research areas of pharmacodynamics, toxicology, clinical medication and drug intervention. In the sub-discipline of Clinical Pharmacology, the research should focus on the exploratory research of individualized medication and the interaction between drugs and human body, and lay more emphasis on rational administration of special community such as children, pregnant women and the highest-risk population, etc. In the sub-discipline of Drug Toxicology, researches should be strengthened in the research fields as below: molecular mechanism, intervention strategy to drug toxicity, mechanism on metabolite toxicity, novel models and approaches for drug safety evaluation.

In recent years, a large proportion of proposals in Materia Medica were from the sub-disciplines of Pharmaceutics, Synthetic Medicinal Chemistry, and Medicinal Chemistry of Natural Products. Many proposals from sub-disciplines of Pharmaceutics and Synthetic Medicinal Chemistry were involved in antitumor drug researches. Even though the proportion of these proposals in General Program basically tended to be reasonable in 2017, it was still excessively large in Young Scientists Fund. Therefore, disease types and new ideas should be further expanded and interdisciplinary research between chemistry and biology should be further strengthened. The researches on the druggability of delivery

systems and new compounds should be emphasized. In the sub-discipline of Pharmaceutics, researches on multi-functional delivery systems should focus on evaluation of druggability and rationality of combinational design.

In the discipline of Pharmacology, most proposals have mainly focused on the action or the resistance mechanism of a certain sort of drug. Some featured projects based on long-term accumulation and an increasing proportion of the projects focusing on the new target discovery and new molecular mechanism could be found. Some proposals with good research idea failed to be approved due to inadequate data, insufficient evidences, oversized research plan, insufficient study in depth, ambiguous research objects and incomplete scientific logic, etc. A considerable number of proposals were not granted due to the lack of obvious innovation or over simple application that lacks depth and preliminary data.

Innovative fundamental research and continuous in-depth projects will be granted in priority. Because translational medicine is of far reaching significance in improving clinical application value of basic research, laboratory basic research on discoveries of new drug, clinical therapeutics and diagnostics will be strengthened to reveal new targets for drug therapy, new biomarkers for disease diagnostic in the course of exploring the mechanisms on occurrence and development of disease, furthermore, to lay theoretical and experimental foundation for developing innovative drugs and diagnostic reagents with independent intellectual property.

The scopes of funding at Division IX do not cover conventional researches for drug development for new drug approval such as pharmaceutical process and general pharmacology. To the innovative basic research with a great prospect for new drug development, the entire chemical structures or backbone of compounds should usually be provided in application, but the applicants should pay special attention to the protection of intellectual property and carefully handle the relationships between application and secrecy. Confidentially core contents or techniques, which are not suitable to illustrate or describe in proposals such as chemical structures, should be sent directly to the office of Division IX by confidential letters and explained in proposals. Applicant of young scholar should get the consent of the applicant's supervisor and Letter of Authorization signed by the supervisor should be attached with proposal, if research proposal is similar with or closely related to the supervisor's research work.

Division X of Health Sciences

The Division X of Health Sciences identifies its role as advancing the theories of Traditional Chinese Medicine (TCM) while highlighting advantages of the heritage. It provides funds to basic research and clinic-based research programs in TCM, Chinese Materia Medica (CMM) and Integrated Chinese and Western Medicine (IM).

Traditional Chinese Medicine (H27)

Funding areas: (i) Fundamental theories of TCM: Essence of Viscera, Qi-Blood-Body Fluid, Body Constitutions, etiology and pathogenesis, basis of TCM Syndromes, Therapeutic Principles and Methods, Prescriptions and Diagnostics in TCM; (ii)

Basic research in clinical medicine: Internal Medicine, Surgery, Orthopedics and Traumatology, Gynecology, Pediatrics, Ophthalmology, Otorhinolaryngology, Stomatology, Geriatrics, and Health Preservation and Rehabilitation in TCM; (iii) Acupuncture and moxibustion, Tuina and massage: Meridians, Collaterals, and acupoints, acupuncture, moxibustion and Tuina and massage; (iv) Other ethnomedicine.

Chinese Materia Medica (H28)

Funding areas: (i) Chinese Materia Medica: Resourceology, Identificology, pharmacodynamics substance, quality evaluation, processing, pharmaceutics of CMM, and theories in the properties of Chinese herbs; (ii) Pharmacology: Neuropsychopharmacology, cardiovascular and cerebrovascular pharmacology, anti-tumor pharmacology, endocrine and metabolic pharmacology, anti-inflammatory and immune pharmacology, antiviral and anti-infective pharmacology, respiratory pharmacology, digestive pharmacology, urinary and reproductive pharmacology, pharmacokinetics, and toxicology in CMM; (iii) Ethnopharmacology.

Integrated Chinese and Western Medicine (H29)

Funding areas: (i) Fundamental theories of IM; (ii) Basic clinical research of IM; (iii) Methodological or technical innovations in TCM research.

In recent years, the funded projects in the field of TCM, CMM, and IM have exhibited the following features: (1) based on TCM theories and clinical effects of TCM, and conducted from both macroscopic and microcosmic levels, the projects explored the holistic rules of human life and the integrating regulatory effects of TCM; (2) through introducing cutting-edge theories, methods and techniques exerted in the modern medical science and other sciences, incessant innovation of research thoughts and methods, dynamic integration of TCM and new emerging disciplines, the projects have particularly been promoting the TCM development; (3) these projects have also paid more attention to the clinic-based research of functional disorders, age-associated diseases, metabolic diseases, immunological disorders, and viral infectious diseases treated by TCM and/or Ethnomedicine and to identify underlying mechanisms.

The Division's top priority is to support the best projects in basic research, continuous in-depth projects and research projects that discover the inner-connections between TCM or Ethnomedicine theories and biomedical sciences. The Division will continue to encourage the integration of different disciplines, focus on matters of science in this field and particularly emphasize interdisciplinary research using multidisciplinary concepts, methods, techniques and approaches under the guidance of TCM or Ethnomedicine theories and thus promote the inheritance, development, and innovation of TCM fundamental theories.

In light of the current TCM research, the Division in 2017 will continue to value and support researches on the followings: Visceral Manifestation Theory, etiology and pathogenesis, TCM syndromes, therapeutic principles and methods, Detoxification and compatibility in classical formulas, relationship between classical formulas and TCM syndromes, mechanisms for therapeutic effects of TCM on preponderant diseases and the preventive effects on major and refractory diseases, methodology in clinical therapeutic evaluation of TCM, mechanisms underlying the therapeutic and preventive effects of

acupuncture on diseases and the theories of meridians and acupoints, theoretical and clinical basis for integrated TCM and western medicine, innovative techniques and methods in TCM research, CMM resources; CMM identification, CMM processing and preparation, CMM properties, material basis for effects, physiological disposition and the related regulation, pharmacological effects and mechanism of CMM, CMM toxicity, correlation between toxicology and toxicity-effect, ethnomedicine, and so on.

The Division will not support any proposal which is not associated with TCM and Ethnomedicine. Any pharmaceutical proposal without the guidance of TCM theories or Ethnomedicine theories should be submitted to pharmaceuticals (H30) or pharmacology divisions (H31). Medical proposals without the guidance of TCM or Ethnomedicine theories should be submitted to other medical divisions (H01 to H26). Any proposal containing TCM or acupoints formulas which cannot be shown openly should be sent to the Division directly by confidential mails, and specifically explained in the proposal, or it will be unacceptable.

Key Program

The Key Program supports researchers to conduct in-depth, systematic and innovative research in directions with sound research basis or where new growth points of scientific disciplines might emerge, so as to promote disciplinary development and breakthroughs in important areas or scientific frontiers.

Key Program projects should follow the principle of limited objectives, limited research scope and focused goals, pay attention to intercrossing disciplines, make effective use of existing major scientific research bases at national and ministerial levels, and conduct substantive international cooperation and exchange.

Applicants should have the following qualifications:

- (1) Experience of undertaking basic research projects;
- (2) Senior academic position (title).

Post-doctors, postgraduate students and the people with no host institution or whose institutions are not registered in NSFC are not qualified for application. Key Program projects set research areas or directions and announce in the *Guide to Programs*. Applicants should follow the guidelines to prepare proposals, be concise and specific in content within the research fields and directions, choose project title according to research content, and avoid using research area as project title.

In general, one Key Program project is conducted by only one research institution. If necessary, two institutions at maximum are allowed to work as collaborators. The funding period of a Key Program project is 5 years.

Special reminder to the applicants: In 2018, for Key Programs, pilot paperless applications are carried out. In process of the submission, the supporting institution shall only confirm the online application and the attachments, without having to submit a paper form application. Once approved, the signature and seal page (A4) of the application form should be submitted at the time of submitting the project plan. The signature and seal information should be consistent with that of the electronic application.

In 2017, NSFC funded 667 projects under the Key Program, with a total funding of 1.987 billion yuan, and the average funding for direct costs is 2.979

million yuan per project.

Funding of the Key Program Projects in 2017

Unit: 10,000 yuan

Department	No. of applications	Awards				Success rate (%)
		No. of awards	Funding for direct costs	Average funding for direct costs	Share of NSFC total funding for direct costs (%)	
Mathematical and physical sciences	281	76	23,850	313.82	12.00	27.05
Chemical sciences	239	62	18,600	300.00	9.36	25.94
Life sciences	537	112	33,500	299.11	16.86	20.86
Earth sciences	481	89	28,080	315.51	14.13	18.50
Engineering and materials sciences	457	99	29,700	300.00	14.95	21.66
Information sciences	267	89	25,500	286.52	12.83	33.33
Management sciences	108	28	6,720	240.00	3.38	25.93
Health sciences	642	112	32,750	292.41	16.48	17.45
Total	3,012	667	198,700	297.90	100.00	22.14

Please refer to the respective sections in each department for research areas and orientations of the Key Program projects.

Department of Mathematical and Physical Sciences

In 2017, the Department of Mathematical and Physical Sciences announced 97 areas for Key Programs, and received 281 applications. 76 projects were funded with direct cost funding of 238.5 million yuan and about 3.1382 million yuan per project. The success rate was 27.05%.

In 2018, the Department plans to fund about 82 Key Program projects. The average direct cost funding will be more than 2.6 million yuan per project for mathematics, and 3.4 million yuan for mechanics, astronomy, physics I and physics II. Please choose the proper application code when applying.

To ensure the high quality of projects, applicants are required to have the experience of holding national projects, with relatively large research teams.

Please give the title of the proposed research directions in the note section of the application form, otherwise the application will not be accepted. Please provide with the specific application code when applying.

In 2018, the main research directions are as follows:

- 1. Finite group theory and its applications**
- 2. Representation theory and categorization method**
- 3. Mode space theory and its application**
- 4. Finsler geometry**
- 5. Convex geometry and integration geometry**
- 6. Conformal geometry and invariant theory**
- 7. Geometry and topology on 3D manifold**
- 8. Non-Archimedes dynamical systems**
- 9. Harmonic analysis and differential operator in functional space**
- 10. Limited hypothesis and its application in PDE**
- 11. Attractor of infinite dimensional dynamic systems**
- 12. Non-smooth variation theory and allocation**
- 13. Geometry and classification theory in operator algebra**
- 14. Non-agreement hyperbolic dynamical systems**
- 15. Complexity and ergodicity of dynamical systems**
- 16. Mathematical theory of fluid dynamic equations**
- 17. Nonlinear wave equation**
- 18. Nonlinear elliptical equation**
- 19. Gromov-Witten invariant theory**
- 20. Mathematical theory of quantum field equation**
- 21. Stochastic PDE and ergodicity theory**
- 22. Merging, characterization and analysis of multi-source data**
- 23. Statistic induction of super high dimensional data**
- 24. Statistic theory and method of functional data**
- 25. Analytical method nonlinear combination optimization**
- 26. Theory and application of multi-stage stochastic optimization**

27. Big data driven optimal modeling and efficient algorithm
28. Control theory and numerical method of stochastic system
29. Modeling and theoretical analysis of fluid coupling and multi-phase flow interactions
30. Mathematical basis, method and application in deep learning
31. Stochastic analysis method and theory in financial studies
32. Mathematical modeling and analysis of bio behaviors in complex environment
33. Stochastic dynamical method in bio data
34. Analytical theory and method on bifurcation sets
35. Graph covering and classification
36. Maximum combination theory and applications
37. Stochastic method in network theory
38. High order algorithm and application of fraction order differential equation
39. New algorithm and theoretical analysis of electromagnetic computation
40. Modeling and computation of target detection based on spreading process
41. Theory and method of physical mechanics
42. Theory and experiments of high dimensional non-smooth nonlinear system dynamics
43. Modeling, analysis and control of complex system dynamics
44. Nonlinear dynamic response and design of complex structures
45. Deformation and damage mechanism of materials and structures
46. Strength theory and structure reliability
47. Mechanical response and multifunctional optimal design of new materials and structures
48. Mechanical behaviors of material and structure in multi-field conditions
49. Unsteady complex flow mechanism and control
50. Hydro dynamics of marine vessels and structures
51. Aerodynamics of aircraft
52. Bionic fluid dynamics and bionic propulsion
53. Biomechanical problems in human health, sport and medicine
54. multi-scale multi-field coupled mechanical bio problems
55. Mechanical behavior of materials and structures in large dynamic loading conditions
56. Mechanism of energy release and damage in energy containing material explosion
57. Computation methods for complex mechanical problems
58. New methods and technology in experimental mechanics
59. Key mechanical problems in environmental evolution and catastrophe
60. Key mechanical problems in high-end equipment and advanced manufacturing
61. Key mechanical problems in extreme conditions
62. Key mechanical problems in new energy and resources areas
63. Theory and method of fluid solid coupling mechanics
64. Nature of dark matter and dark energy and physical process in early period of cosmos

(1) Dark matter and dark energy and physical process in early period of cosmos

(2) Large scale cosmic structures

65. Galaxy evolution and impact of surrounding environment

(1) Detection of medium high red shift celestial bodies and formation and evolution of galaxies

(2) Galaxies and relations with surrounding dark matter and interstellar media

66. Structure, formation and evolution of large mass black holes and active galaxies

(1) Structure and radiation of active galaxy cores

(2) Formation and evolution of large mass black holes and mutual evolution with the galaxies

67. Structure, composition, integration and evolution of the Galaxy

(1) Galaxy structure, distribution dynamics and long term evolution of star groups

(2) Basic parameters and matter distribution (including dark matter) of the Galaxy

68. Formation of molecular cloud and stars, internal structure and evolution of stars and high energy process of dense celestial bodies

(1) Formation of stars, molecular cloud, interstellar matter circulation

(2) Internal structure and evolution of stars and star systems

(3) Birth, explosion and high energy process of dense celestial bodies

(4) Discovery, time measurement and radiation mechanism of pulsars

69. Planet system exploration and dynamics

(1) Exploration of solar system and outer planets, and dynamics of planetary system

(2) Atmospheric property and internal dynamics of planets

(3) Formation and original star disk and planetary system

70. Solar atmosphere, magnetic field and activities

(1) Structure and dynamics of solar atmosphere, fine structure of solar magnetic field, origin and evolution of solar magnetic field

(2) Solar eruption and its origin and evolution, forecast of solar activities

71. High precision astronomical frame and time frequency

(1) Micro angular second frame celestial sphere, high precision earth reference frame and astronomical earth dynamics

(2) Precision time generation and transmission

72. Solar system dynamics and stability

(1) Stability of solar system and orbit diffusion

(2) Discovery of small celestial bodies in solar system and its origin dynamics

(3) Physical and chemical properties of small celestial bodies in solar system

73. Measurement, determination of precise orbit and dynamics of fast moving celestial bodies

(1) Design and measurement of deep space probes and precision satellite navigation and positioning

(2) Monitor and dynamics of fast moving celestial bodies

74. Optical and inferred key technology

(1) Key technologies for extremely large optical and inferred telescopes

(2) High resolution, high contrast imaging technology

(3) Large view, high resolution imaging and spectrum detection technology

75. Key technology of radio astronomy

- (1) Low noise, super wide band, array receiver
- (2) Digital signal processing
- (3) Single array interference imaging and VLBI technology

76. Key technology for space astronomy

- (1) Key technologies of X-ray, ultra violet and inferred space telescopes
- (2) Key technologies for high resolution cosmic ray, X-ray, inferred and ultra violet space detectors

77. Physics of new forms of energy

78. Solid quantum information and quantum computation

79. Physics of advanced functional materials and devices

80. Surface and interface physics

81. Physics of small quantum systems

82. Strong correlated quantum system and superconductivity

83. Physics of soft matter and related to life phenomenon

84. Computation and simulation of matter structures and properties

85. Topological quantum state and related physics

86. Magnetism and multi-field regulation in dense matters

87. Structure and fine spectroscopy of atoms and molecules

88. Atomic and molecular impact dynamics

89. Physics of cold atoms and molecules

90. Ultra-fast, ultra-strong light physics

91. Optical field regulation and interference control

92. Regulation and interference control of optical field

93. New physical and new mechanism in optical electric conversion process

94. Meso scale optics

95. Optical physics in complex media

96. New physics and mechanisms in acoustic energy converter and its arrays

97. Acoustic physics in complex media

98. Key problems in acoustic and biomedical and information sciences

99. Frontier problems in basic theory of quantum physics

100. Frontier problems in basic theory of statistical physics and physical systems

101. Frontier problems in theory of gravitation, cosmology and dark matter

102. Precision verification of standard models and new physics

103. High precision computation and measurement in partical physics

104. Studies on the internal structure of hadron and strong interactions

105. Quantum chromo dynamics and quark gluon plasma

106. Novel structure, isotopic related decay spectroscopy of nuclei in drip line

107. Studies on reaction of non-steady nuclei, nuclear astrophysics and laser nuclear physics

108. New techniques of neutron physics, reactors and scattering

109. Applied basic research in the application of nuclear technology in new materials and energy

110. Basic research on nuclear technology and applications in life and environmental sciences

111. Studies on key problems in radiation physics and radiation protection

- 112. Accelerator physics and its advanced technology
- 113. Mechanism, method and technology of radiation detection (including radiation energy spectrum)
- 114. Particle detection mechanism and method based on large facilities
- 115. Technology and method of nuclear electronics
- 116. Frontier problems of strong laser plasma and inertia confined fusion physics
- 117. Magnetic confined fusion plasma physics and advanced experimental and diagnosis technology
- 118. Basic research on low temperature plasma physics and advanced technology and new methods
- 119. Studies on advanced technologies and experimental methods of synchrotron radiation and free electron laser

Department of Chemical Sciences

In 2017, the Department of Chemical Sciences funded 62 Key Program projects with 186 million yuan and 3 million yuan of average funding intensity per project (direct cost). The duration of each project is 5 years. In 2018, the Department announces guidelines for Key Program projects and accepts proposals in 73 research areas, and the average direct funding intensity will vary from 2.5 to 3.5 million yuan for each project. In order to further improve the quality of projects, proposals from those groups and teams with excellent research resources and innovative ideas are preferred, and proposals for interdisciplinary cooperative research carried out by teams which have strong background are encouraged.

In 2018, the Department will have a comprehensive readjustment for disciplines to conduct classified funding and management based on the main research orientations of chemistry and chemical engineering. This will be helpful for better adaption to the trend of international chemical development and will promote the transformation development of research in chemistry and chemical engineering in China. The applicants should read the instructions of all research areas carefully (refer to the General Program Projects) and select the proper application code.

The new research orientations funded by the Department of Chemical Sciences are listed as follows: (1) Synthetic chemistry; (2) Catalysis and surface/interface chemistry; (3) Chemical theory and mechanism; (4) Chemical metrology; (5) Materials chemistry and energy chemistry; (6) Environmental chemistry; (7) Chemical biology; (8) Chemical engineering and industrial chemistry.

When filling in the application form, the applicants must indicate the selected research area in “the column of note”, and select the proper application code marked in brackets of the research area.

In 2018, the research areas for Key Program projects funded by the Department of Chemical Sciences are listed as follows:

1. Inorganic solid state synthetic chemistry (B01)
2. Cluster compounds preparation and structural chemistry (B01)
3. Metal coordinative compounds and coordinative polymers (B01)

4. Synthesis and properties of metallic/element-organic compounds (B01)
5. New reaction and new reagent in synthesis (B01)
6. Photochemical reaction/free radical chemical reaction (B01)
7. Asymmetric catalytic reaction (B01)
8. Total synthesis of natural products (B01)
9. Self-assembly and supramolecular catalysis (B01)
10. Synthetic methodology of photoelectrical functional molecular (B01)
11. Controlled synthesis of biomimetic polymers (B01)
12. Green synthesis methods of high performance polymers (B01)
13. Accurate synthesis and functionalization of biological macromolecules based on multi-component reaction (B01)
14. New methods and new concepts for the construction of specific structural and functional catalytic materials (B02)
15. High efficiency catalytic process and its dynamic characterization (B02)
16. New theories, methods and applications of colloid and interface chemistry (B02)
17. Controllable construction and function regulation of electrocatalytic system (B02)
18. In-situ dynamic method and process research of complex interfacial electrochemical system (B02)
19. Nature and mechanism research of photoelectrochemical process (B02)
20. Reaction mechanism and computational chemistry (B03)
21. Experimental research of function-oriented structural chemistry (B03)
22. New methods of chemical spectroscopy (B03)
23. New methods in theoretical and computational chemistry of complex systems (B03)
24. Application of theoretical and computational chemistry (B03)
25. Excited state molecular reaction dynamics (B03)
26. Theory and method of chemical thermodynamics in complex systems (B03)
27. Photochemical and photophysical processes of functional materials (B03)
28. Physicochemical mechanisms at the nano/microscale (B03)
29. Theoretical calculation and simulation of non-equilibrium polymer system (B03)
30. Separation and analysis of complex systems (B04)
31. New electroanalytical chemical methods (B04)
32. New spectroscopic analytical methods (B04)
33. New mass spectrometric analytical methods (B04)
34. New chemical imaging methods (B04)
35. Single molecule, single particle and single cell analysis (B04)
36. In-situ, online and in-vivo analysis (B04)
37. Molecule functional materials (B05)
38. Chemistry of multi-scale and hole structure materials (B05)
39. Nanomaterial chemistry (B05)
40. Chemistry of biomimetic material (B05)
41. Optical-electric functional polymers (B05)
42. Stimulating response of polymer hydrogels and their biomimetic function

(B05)

43. Rational design and precision synthesis of polymer liquid crystal photoelectrical materials (B05)

44. Interaction between biomedical polymers and biofilms (B05)

45. Micro-interface process and transformation mechanism of radioactive material or typical pollutants (B06)

46. Environmental characteristics, spread mechanism and health effects for antibiotics and antibiotics resistant genes (B06)

47. Fundamental chemistry of new functional materials in environmental pollutant remediation (B06)

48. Chemical principle in soil contamination control or solid waste treatment (B06)

49. New chemical principles and methods in wastewater treatment (B06)

50. The methodology in environmental exposure, toxicity mechanisms and combined effects of pollutants (B06)

51. Chemical biology of trace elements and metals (B07)

52. Discovery and activity of natural products (B07)

53. Molecular design and mechanism of ecological pesticide (B07)

54. Small molecule regulation on biomacromolecule functions (B07)

55. Discovery and function of new targets based on in vivo active probes (B07)

56. Assembly, function and regulation of bioactive molecules (B07)

57. In vivo identification, localization and interaction of important bioactive molecules (B07)

58. Chemical engineering basis of synthetic biotechnology and bio-conversion processes (B08)

59. Chemical engineering basis of biorefinery processes (B08)

60. Chemical engineering foundation for the high effective and clean utilization of fossil energy (B08)

61. Chemical engineering basis and key technologies of new type energy system (B08)

62. Scientific foundation in preparation and property regulation of new materials for chemical engineering (B08)

63. Chemical engineering basis related to the high effective utilization of mineral resources (B08)

64. Chemical engineering basis and key technologies of high effective utilization of biomass (B08)

65. Scientific and engineering basis of chemical reaction and reactor (B08)

66. Scientific foundation for systematic engineering and safety of chemical engineering (B08)

67. New methods and new technologies for chemical separation (B08)

68. New theory of chemical transfer under unconventional conditions (B08)

69. Green chemical engineering process and key technologies of environmental protection in chemical engineering (B08)

70. Design and property research of critical electrode materials for rapid transfer of Na(K) alkali metal ions(B0X)

71. Photoelectrical dynamics of non-lead perovskite materials (B0X)

72. Mechanism of ionic liquids in mass separation and analysis of plasma membrane proteins (B0X)

73. Theoretical and computational chemistry frontiers (B0X)

The main research topics for the group of key projects include:

- (1) New methods of strongly correlated electronic system;
- (2) Theoretical method of electronically excited state;
- (3) Low scaling and efficient algorithm for dynamic structure and interaction of biological macromolecules;
- (4) Research on artificial intelligence algorithm and software for material simulation based on supercomputer cluster.

The items from 70th to 73th listed above are the Key Program projects/Key Program project group driven by the disciplinary frontier. The applicant may organize the collaborative research teams to apply for one of them accordingly. When filling in the application form, the applicants should select the corresponding code based on the research contents (for code B0X, please select code from B01 to B08). The General Office of the Department will accept and handle the proposals.

Department of Life Sciences

The Department of Life Sciences accepts two types of applications for the Key Program. One of them, the majority of total applications, is guided by designated areas (ADA for short) and the other, complementary to ADA, is to freely select research areas (ANA for short). In 2017, the Department of Life Sciences received 537 applications, among which, 479 applications were for ADA and 449 were accepted, of which 101 projects were funded at a success rate of 21.09%. The rest 58 applications were for ANA, with 50 projects accepted and 11 of them funded at a success rate of 18.97% (counting by accepted applications).

In the fiscal year 2018, the Department will continue to accept applications for ANA. It is strongly suggested that applicants should read this type of requirements carefully in each discipline described in the Guide. The five disciplines accepting the projects in both types (both ADA and ANA) are the following: microbiology; biophysics, biochemistry and molecular biology; biomechanics and tissue engineering; physiology and integrative biology and cell biology. The other sixteen disciplines, which will only accept ADA projects (application for ANA will be rejected), include botany; ecology; forest science; immunology; neuroscience; cognitive science and psychology; genetics and bioinformatics; developmental biology and reproductive biology; basic agriculture and crops; food sciences and plant protection; horticulture and plant nutrition; animal husbandry and grassland science; aquaculture; veterinary medicine and zoology. In order to apply for the Key Program, applicants should read the application requirements, special notes, and the funding plan of the department in this chapter carefully. Moreover, since the research areas in the Department of Life Sciences cover a broad spectrum from fundamental biological sciences and basic medicine to agricultural science, the designated areas of Key Program in each discipline is closely correlated with the funding areas of the discipline. Please note that applicants should correctly apply for the Key Program according to the funding areas.

Those categories, which are not within funding areas as described in the General Program part of this Guide, are not applicable to Key Program.

The requirements for application to the Key Program projects of the Department are as follows:

(1) Applications to the Key Program projects in designated areas (ADA). For designated areas, applicants should propose research topics and compose every parts of the proposal following the guidelines of designated areas issued by the Department in 2017. In the column of Annotations on the basic information table of the application form, applicant should fill in the applied research area; with the corresponding application code lined out in each discipline's designated areas correctly. Please note that the designation of application codes for the Key Program projects is set for efficient project management, whereas the application codes appointed may not include all the research contents of the designated areas. Therefore applicants should not be restricted by the application codes appointed in ascertaining their research themes according to the relevant contents of designated areas.

(2) Requirements for applications to Key Program projects for free application of non-designated areas (ANA). Applicants for this category are required to specify with "Application for Free Areas" in the column of "Annotations". The ANA grant is set for applicants who have recently achieved major progress, in an eager need of support for further investigation, while their research areas are not included in the ADA of the Department, or for cutting-edge studies in the fields, or studies that are shedding lights to new orientations of the area, but are not yet covered in ADA of the year. For either case, applicants should have profound basis of research work in the field, and urgently require intensive financial support in order to further their investigations. Therefore, a statement with about 800 Chinese characters on the important innovative progresses already achieved is required in addition to the routine application text for ANA. In the statement, applicants are expected to elaborate the rationale for ANA, as well as emphasize the important innovative progress closely related to the new application, relevant research basis and publications in international major academic journals, etc. Research articles representing the "significant progress achieved" in the application should be published within three years, with applicants sitting as the first author or corresponding author.

(3) Applicants for the Key Program (including both ADA and ANA) of the Department are required to attach the first pages of five representative research articles closely related to the proposal.

In 2018, based on the overall arrangement for the Key Program of NSFC, the Department of Life Sciences will arrange a total direct cost budget of 335 million yuan, to support 112 Key Program projects. The funding intensity is roughly the same as that in 2017. Applicants should put forward reasonable budget according to the actual financial needs of their research. The duration of the Key Program project is 5 years.

The designated areas of each Division in the Department of Life Sciences in 2018 are as follows:

- 1. The relationship between terrestrial microorganism and environment (C0105)**
- 2. Pathogenic mechanism and resistance mechanism of microorganism (C0106)**
- 3. Molecular mechanism of adaptive evolution of plants (C0203)**
- 4. Plant cell structure and function (C0201)**
- 5. The molecular mechanism of plant metabolic pathways and regulation**

(C0204)

6. Mechanisms for restoration and reconstruction of degraded or contaminated ecosystems (C0312)

7. Effects of global change on biodiversity and ecosystems (C0308)

8. Species co evolution and community construction (C0305)

9. Theory and method of high precision monitoring and evaluation of forest resources (C1602)

10. Forest degradation and recovery mechanism (C1607)

11. The basic research on the cultivation of plantation (C1607)

12. Function and mechanism of protein and nucleic acid modification (C0502)

13. Novel techniques and new methodology for the study of biological macromolecules (C0508)

14. Immune rejection and tolerance mechanism (C0804)

15. The microenvironmental immunological characteristics of tissues (C0803)

16. Immune cell recognition, activation and memory formation (C0802)

17. The basic research on bionic manufacturing of important organizations (C1003)

18. Implant material surface interface construction and body interaction (C1002)

19. Novel technique and new methodology for the study of brain functional connectivity (C0916)

20. The function and plasticity of glial cells (C0902)

21. Regulation of ion channel function and its mechanism in nerve system (C0901)

22. Molecular mechanism of metabolic remodeling and function of the body (cell, tissue, organ, etc.) (C1105)

23. Material transport regulation and body homeostasis (C1103)

24. The psychological and brain mechanisms of human cognitive processing (C2101)

25. The psychological and brain mechanisms of human emotion and social cognition (C2117)

26. Mechanisms of psychological disease (C2103)

27. Dynamic regulation of chromatin and biological function (C0606)

28. Molecular mechanism and regularity of genomic stability and genetic variation (C0605)

29. The epigenetic regulation network of complex characters (C0607)

30. The regulation mechanism of cell metabolism (C0711)

31. The molecular mechanism of aging and cell death (C0706)

32. Regulating mechanism of gamete and embryo development (C1202)

33. Regulation mechanism of organ development and steady state maintenance (C1201)

34. The regulatory mechanism of stem cell fate determination and trans-differentiation (C1201)

35. Crop germplasm resources and important genes mining and utilization (C1304)

36. Study on the regulation mechanism of cultivation measures on crop yield or

quality (C1303)

37. Basic research on the molecular design and breeding of crops (C1306)
38. New technology study on trace, accurate and rapid detection of food hazardous substances (C2007)
39. Biological basic study on the storage and preservation of food (C2006)
40. Basic research in the process of food fermentation and brewing (C2003)
41. The immune regulation mechanism of crops to the disease origin (C1401)
42. The interaction mechanisms of parasitic natural enemies and insect pests (C1402)
43. Molecular mechanisms of insecticide resistance of crops and insects (C1405)
44. Mechanism and regulation of organ development or quality formation of horticultural crop products (C1501)
45. Response mechanism and regulation of horticultural crops to abiotic stress (C1502)
46. Mechanism of high efficiency utilization of plant nutrient elements and high yield and quality of crops (C1507)
47. Mechanisms of animal evolution and adaptation (C0402)
48. Animal population diffusion and migration law (C0404)
49. Animal behavior and its biological basis (C0403)
50. Genetic mechanism of excellent germplasm resources of livestock and poultry and the basic theory of high efficient reproduction (C1701)
51. Basic research on comprehensive utilization and conservation of pasture and grassland (C1702)
52. Physiological and genetic basis of excellent characteristics of special economic animals, such as bees and silkworms (C1703 or C1704)
53. Important pathogens of livestock and poultry, invasion, replication and interaction with their hosts (C1805)
54. Mechanisms of resistance to important pathogens of livestock and poultry (C1807)
55. New/reproduced pathogenic biological studies of important blight of livestock and poultry (C1805)
56. Genetic basis of the excellent characters of important aquatic animals (C1902)
57. Interaction mechanism between pathogen and host of important aquatic animals (C1906)
58. Nutrient metabolism mechanism of important aquatic animals (C1904)

Moreover, considering common problems in the past years, the Department of Life Sciences particularly reminds applicants of avoiding the following mistakes. Otherwise, proposals may be rejected during the preliminary checking procedure:

- (1) Applications for ADA do not specify the title of designated research areas in the column of “Annotations” on the basic information table in main body of the application text;
- (2) Applications for ADA do not fill in the corresponding application code specified by this guide;
- (3) Applicants applying for ANA to certain disciplines, which however, do not accept ANA applications;

(4) Applications for ANA do not specify “ANA” in the column of “Annotations” on the basic information table in the main body of application text;

(5) Applications for ANA do not provide a description about 800 Chinese characters on the major innovative progress already achieved claimed by this guide;

(6) Applications to key projects, without submitting the 5 representative publications within 5 years (since 2013) as first author or corresponding author;

(7) Applicants for Key Program projects (including both ADA and ANA) do not attach the first pages of five representative research articles to the application documents as requested;

(8) Similar to or overlapping with projects already funded by the National Basic Research Program of China (namely “973” Project), the National High-Tech R&D Program of China (namely “863” Project), etc., and the National Science Fund for Distinguished Young Scholars;

(9) Applications indicate the designated areas in the “Annotation” column, but the actual research contents do not match the scope of funding;

(10) Applications submitted by applicants who are still holding a full time position abroad, or who cannot ensure necessary time and efforts for implementing the proposed research in China.

For other issues to be noted for proposal preparation, please refer to the guide to the General Program projects of the Department of Life Sciences.

Department of Earth Sciences

As one branch of fundamental sciences, the research object of earth sciences is the complex planet of the Earth. The challenges emerging from the research in the past, present and future of the earth system and its habitability have gone well beyond the capability of any single traditional discipline. Interdisciplinary research has become the fertilizer for innovative ideas and original innovation. It is expected that scientists from various disciplines of earth sciences and scientists from other research areas such as mathematics, physics, chemistry, biology, materials and engineering sciences, information sciences and management sciences jointly submit proposals for the Key Program in the Department of Earth Sciences. The application codes for interdisciplinary study should be filled in the application form.

For applicants, previous experience related to the proposed work must be stated in detail in the proposals. In the part of CVs, working experience, education, former NSFC grants (and results) and publications of all the PIs and co-PIs must be listed in detail. In the publication list, papers published and in press must be listed separately. For the published papers, all of the authors, paper titles, issue numbers of the journals and pages must be presented. All the publications must be classified as books, journal papers, conference papers, etc.

The relevance and academic contribution to the specific priority area must be stated in the proposals. To avoid duplication in funding, applicants shall state clearly the relations and differences between the research and related projects funded by other national agencies.

The application codes for key project proposal should be filled in the application

form upon the applicant's selection.

In 2017, the Department of Earth Sciences received 481 proposals for the Key Program, and 89 were funded with a total of 280.80 million yuan as direct cost. The success rate was 18.50% and the average grant was 3.1551 million yuan. In 2018, 89 projects will be funded, with a preferred range of 3 to 3.5 million yuan for each project. The required research period of a Key Program project is 5 years.

Special notes for applicants: in 2018, titles of 12 themes to accept proposals for the Key Program in the Department of Earth Sciences are as follows:

(1) New theories, techniques and methods of earth observation and information extraction;

(2) Deep earth processes and dynamics;

(3) Environmental evolution and biological processes on the planet earth;

(4) Formation mechanism and the application of detection methods for mineral resources and fossil energy;

(5) Ocean processes and their impacts on resource, environment and climate;

(6) Change processes and effects of terrestrial surface environment;

(7) Evolution and sustainable utilization of water and soil resources;

(8) Process and function of the critical zone;

(9) Process, change and mechanism of weather, climate and atmospheric environment;

(10) Sun-Earth space environment and space weather;

(11) Global environmental change and interactions among different spheres of the Earth;

(12) Impacts of human activity on environment and disaster.

In regard to the problems emerged when applying for Key Program projects, applicants must fill in "Annotations" in the proposal sheet with ONE of the above TWELVE titles of the themes. Proposals with incorrect "Annotations" or without "Annotations" will not be accepted.

The applicants can decide the title, content, and research plan for their own proposals according to the key issues listed in the research themes based on the previous research work and new scientific problems, as well as new research approaches.

1. New theories, techniques and methods of earth observation and information extraction

Scientific objectives: Earth science is based on mathematics, physics, chemistry theory and its observation, exploration methods and experimental research. The application of new theories, new technologies and new methods has led to great changes in earth science research methods and ways of thinking, which has promoted the progress of earth science and is the core of the earth science in the future. The scientific goal in this field is to develop new theories, new techniques and new methods for the basic theory, experimental simulation, observation and related information extraction of earth science research for the frontiers of earth sciences, and to provide theory and means of research for a breakthrough and deep-going development for earth science in China and such major issues as resources, energy, disaster prevention and mitigation and environmental protection that are facing the national economy construction and sustainable development.

Key scientific issues: Experimental technologies of physical and chemical properties and processes of the Earth's matter; theory and technology of deep earth

exploration and surface observation; trace, micro-area and high-precision and high sensitivity experimental analysis technology; theory and technology of earth system basic information collection and application; deep space, deep land, deep time, deep sea exploration theory and method; geography big data assimilation, fusion, sharing and analysis technology; remote sensing quantitative research of earth system science system; observation system and multi-source data fusion; earth system science numerical computation and simulation techniques.

Preferred research themes in 2018:

- (1) Theoretical and experimental studies of the earth's mass and dynamics processes;
- (2) High temperature and high pressure experimental theory and technology;
- (3) New methods and technologies for isotope dating and tracing;
- (4) Micro-area, trace high-resolution component analysis technology;
- (5) High precision, high sensitivity and new experimental analysis technology;
- (6) Geophysical methods of detecting the deep structure of the earth;
- (7) High resolution stratum profiling technology;
- (8) Joint inversion technique of gravity, magnetism, electricity and earthquake;
- (9) New principles and new methods of earth observation;
- (10) High-precision, high-resolution integrated detection and analysis of different circles;
- (11) New technologies for the detection of fluxes (energy, momentum and composition) of land-sea, land-sea and sea-air interfaces;
- (12) New theories and methods of quantitative remote sensing modeling and parameter inversion;
- (13) Multi-source data fusion and data assimilation theory and method;
- (14) Earth system numerical methods and simulation techniques;
- (15) Global observation information vectorization theory and spatial and temporal intelligent methods.

About 6 to 8 projects will be funded.

2. Deep earth processes and dynamics

Scientific objectives: To decipher how the solid Earth operates, to characterize the interactions among multiple spheres of the Earth, to disclose the coupling relationship between the deep Earth and the surficial processes, and to provide theoretical support for natural hazard mitigation and mineral resource exploration. To promote development and innovation in Solid Earth science, the researches of this field should dedicate to accurate description of tempo-spatial trajectory of continental materials, characterization and comparison of lithospheric structure, tectonics and dynamics of typical regions that include overseas key regions, construction of architecture and evolution of continents in a global scale, elucidation of origin and evolution of the Earth and their impacts on natural sources, geohazard and environment.

Key scientific issues: Structure, composition and status of the crust and mantle; origin, rejuvenation and evolution of continental lithosphere; plate convergence and orogenic dynamics; deep Earth fluids and volatiles; processes of plate interface and subduction zone; coupling of deep and surficial Earth processes; tectonic scheme and composition of the early Earth; seismogenic processes and mechanisms for hazard generation; mechanisms for continental volcanic activities and their geohazard and environmental impacts.

Preferred research themes in 2018:

- (1) Early Earth evolution and the formation, growth and reconstruction of continents;
- (2) The distribution, breaking and converging of global continents;
- (3) The structure of mantle plumes and their interactions with lithosphere;
- (4) 3D structure of seismic velocity discontinuities and Earth's deep layer interaction;
- (5) Crustal and upper-mantle anisotropies and deep-Earth dynamics;
- (6) Convergence of plates, compound continent orogenic processes and dynamics;
- (7) Basin and range system evolution and basin dynamics;
- (8) Oceanic plates and continental margin (and marginal sea) processes and ocean-continent transition zone;
- (9) Coupling of deep and surficial Earth processes;
- (10) Magmatic activities, metamorphic process and their mechanisms;
- (11) Volcano and geothermal activities and their deep processes;
- (12) Deep Earth fluids and water-rock interaction;
- (13) Rheological properties of continents and their effects on continental deformation;
- (14) Cenozoic tectonic deformation, seismogenic process and geohazard;
- (15) Correlation and interaction between the Earth and terrestrial planets;
- (16) Other important fundamental innovative researches related to this field.

About 6 to 8 projects will be funded.

3. Environmental evolution and biological processes on planet Earth

Scientific objectives: As the only known habitable planet, Earth is a complex interactive system, comprising the lithosphere, hydrosphere, atmosphere and biosphere. China has a very complete rock and fossil archive, which plays a very important role in this research field. Establishing a high resolution stratigraphic framework will enable interdisciplinary research to be carried out between palaeontology, anthropology, archaeology, stratigraphy, sedimentology, mineralogy, structural geology, geochemistry, geobiology and evolutionary biology, which together will elucidate our understanding of the co-evolution between the physical environment and life. This multidisciplinary cooperation aims to make new scientific findings, strengthen traditionally advantageous research directions and gradually gain a globally leading role in some directions in these fields towards achieving significant scientific breakthroughs and theoretical innovations.

Key scientific issues: Systematic paleontology of major fossil groups and reconstruction of the tree of life; evolutionary principles that underpin deep-time biodiversity; early Earth evolution and the origin of life; high-resolution integrated stratigraphy towards establishing a precise global timescale; geomicrobiological processes and environmental evolution; biological processes in extreme environments; major environmental events and their causal mechanisms; human origins and their relationship with environmental change; origin and evolution of the terrestrial planets.

Preferred research themes in 2018:

- (1) Origin and evolution of major groups of organisms, and their environmental context;
- (2) Evolution of biodiversity and major co-evolutionary (life/environment) events in deep time;
- (3) Evolution of terrestrial ecosystems in deep time;

- (4) Evolution of marine ecosystems in deep time;
 - (5) Origin and evolution of humans, and their environmental context;
 - (6) Early history of agriculture;
 - (7) Origin and evolution of civilization, its impact on, or response to climate change;
 - (8) High-resolution chronostratigraphy and geochronology;
 - (9) Geomicrobiological processes and environmental evolution;
 - (10) Biogeochemical processes, mechanisms and environmental evolution;
 - (11) Evolution of sedimentary systems and relevance for natural resources and environment;
 - (12) Biological and mineralogical interactions and their environmental effects.
- About 6 to 8 projects will be funded.

4. Formation mechanism and the application of detection methods for mineral resources and fossil energy

Scientific objectives: To reveal the coupling between the mineralization and the geodynamic system evolution, and constraints of the structure deep and process on the mineralization of the important metallogenic belt; to establish genesis model of ore deposit, ore deposit model, theory of ore genesis; to explore the dynamics of large basin and the law of oil and gas accumulation, the accumulation conditions and distribution law of deep oil-gas reservoirs, and mechanism of formation and evolution of unconventional oil and gas reservoirs; to improve oil and gas geological system theory which is suitable to the complex geological conditions in China; to establish and improve the geophysical and geochemical exploration methods and theories of concealed ore deposits, deep oil-gas reservoirs and unconventional oil and gas reservoirs; to improve the speed, precision and depth of exploration; to reveal the formation and evolution mechanism of groundwater dynamic field and chemical field in different geographical units and in different geological media under the effects of humankind activities and natural factors.

Key scientific issues: The occurrence and exploration of resources and energy in the deep earth; plate convergence, lithospheric reconstruction and mineralization; enrichment and mineralization of special elements; the dynamics of sedimentary basins and hydrocarbon accumulation; formation conditions and distribution of dense oil and gas and exploration; groundwater circulation and sustainable utilization; metallogenic models, metallogenic system and mineralization mechanisms.

Preferred research themes in 2018:

- (1) The enrichment mechanism of the massive ore-forming materials in sedimentary basin and magma systems;
- (2) Mineralization and metallogenic regularity of unique metallogenic units;
- (3) Mineralization in different continental geo-dynamic setting;
- (4) Regional fluid system tracing and metallogenic system evolution in areas where large ore bodies are concentrated;
- (5) The characteristics, structural model and exploration indicators of different types of metallogenic system;
- (6) Formation mechanism and metallogeny of special or shortage nonmetal mineral resources;
- (7) Regional geo-dynamics evolution and hydrocarbon accumulation of large basin;
- (8) Accumulation conditions and distribution regularities of oil and gas in deep, ultra-deep oil-gas reservoirs as well as ancient formations;

(9) Systematic evolution of the Earth and the sedimentary environment of hydrocarbon reservoirs in basins;

(10) The principle and method of ore bearing information detection and extraction of large, deep ore deposits;

(11) The formation, evolution mechanism of non-conventional oil-gas reservoirs and geophysical exploration theory & method;

(12) Ore forming mechanism of metals and fossil energy in ocean;

(13) The groundwater flow system in regional scale and the space distribution law of groundwater;

(14) Groundwater hydrological process and its evolution in different geographical units;

(15) Genesis and detection of geothermal resources in large geothermal fields, high temperature geothermal systems and oil areas.

About 6 to 8 projects will be funded.

5. Ocean processes and their impacts on resource, environment and climate

Scientific objectives: Applications should be focused on the scientific problems closely related to the key national demands and international research frontiers. The marginal sea along the Asia continent as well as the adjacent open ocean should be the key regions to be studied. By studying the oceanic physical, chemical, geological and biological processes as well as the interactions among them on different timescales and spatial scales, the researches should enhance the understanding on the oceanic processes and mechanisms, promote the fundamental research on oceanology in China and extend ocean researches in China from marginal seas to deep oceans.

Key scientific issues: Multi-scale ocean processes and their effects on climate system; oceanic ecosystem and biological diversity; ocean biogeochemical process and eco-environment; formation and evolution of marginal seas in East Asia and island arc and mid-ocean ridge system; ocean-continent transitional zone: structure, tectonics and their interactions; environmental change and related oceanic process in the polar regions; process and mechanism of multi-spherical interaction in the ocean.

Preferred research themes in 2018:

(1) Ocean turbulence and mixing;

(2) Ocean dynamics and its climate effect;

(3) Geodynamics and tectonic evolution of oceanic lithosphere;

(4) Marine geological processes and mineral resources;

(5) Oceanic ecology and biogeochemical cycle;

(6) Marine sedimentation and paleoenvironment evolution;

(7) Ocean-continent interaction and its environmental effects;

(8) Ocean acidification and its effect on ecosystem;

(9) Interface process in marine environment and matter cycling;

(10) Marine biological diversity;

(11) Change of ocean, ice sheet and ecosystem in the Polar Regions.

About 6 to 8 projects will be funded.

6. Change processes and effects of terrestrial surface environment

Scientific objectives: This field mainly focuses on the interaction and interfacial processes of key components of the terrestrial surface and the relationship with human activities, and primarily analyzes the typical processes and the typical regions on the

terrestrial surface. The scientific objectives are to reveal formation characteristics and mechanisms of surface environment, to elucidate change processes and effects of surface environment, to develop the methods of change-monitoring and effect-evaluating in terrestrial surface system, to expand theory and methodology of system science for terrestrial surface study, and finally to provide the scientific basis for the application of spatial administration and human-nature coordinated development under the background of global change and globalization.

Key scientific issues: Processes of terrestrial surface system, response mechanism and feedback of surface processes on environmental change, soil processes and its biogeochemical cycle, comprehensive study on surface processes in typical regions.

Preferred research themes in 2018:

(1) Interaction mechanisms between patterns and processes of terrestrial surface system;

(2) Biogeochemical cycles and their spatial differentiation in typical regions;

(3) Interactions between climate, hydrology and landform, and their environmental and disaster effects;

(4) Processes and effects of cryosphere;

(5) Interactions between soil and vegetation, and their spatial heterogeneity;

(6) Mechanisms of ecosystem degradation and restoration strategies;

(7) Ecosystem processes and services;

(8) Evolution of rural regional systems and its resources and environmental effects;

(9) Surface processes and eco-environmental effects of city and urban agglomeration;

(10) Surface environmental changes and the effect evaluation on public health;

(11) Effects and responses of human processes on the evolution of terrestrial surface system;

(12) Spatial evolution processes and its simulation of human-nature compound system;

(13) Uncertainty of spatial information and spatial analysis;

(13) Uncertainty of geography spatial information and its process and analysis;

(14) Expression, analysis and visualization of terrestrial surface features;

(15) Synthetical integration and simulation of terrestrial surface system processes;

(16) Spatial governance path based on human-land coupling.

About 6 to 8 projects will be funded.

7. Evolution and sustainable utilization of water and soil resources

Scientific objectives: This field mainly focuses on the formation, evolution and the ecological and environmental effects of soil and water driven by natural and human activities, and primarily analyzes the coupling mechanisms and processes of soil and water in the different scales. The scientific objectives are to elucidate the evolution processes of water and soil and their coupling mechanisms, to reveal the principles of formation and evolution of water and soil resources, and to propose the approaches to rational exploitation, scientific allocation, efficient utilization and integrated management of water and soil resources.

Key scientific issues: Soil processes and evolution, soil quality and resource effect, watershed hydrological processes and their ecological effects, formation mechanisms of regional water cycle and water resources, coupling of regional water and soil resources and

their sustainable utilization, ecological function and environmental effect of soil biology, and eco-hydrological processes and ecosystem services.

Preferred research themes in 2018:

- (1) Tempo-spatial variation of soil properties and informatization of soil and water elements;
- (2) Soil biodiversity and its function;
- (3) Interaction mechanisms and effects of soil processes;
- (4) Nutrient elements cycle, soil quality and environmental effect of farming ecosystem;
- (5) Mechanisms of soil degradation and soil remediation;
- (6) Soil and water quality, and safety of agricultural products;
- (7) Regional soil erosion and soil and water conservation;
- (8) Effects of climate change on soil-water processes and the countermeasures;
- (9) Formation, transformation mechanism and safety of regional water resources;
- (10) Evaluation of soil-water resources on regional carrying capacity and ecological compensation.

About 6 to 8 projects will be funded.

8. Process and function of the earth critical zone

Scientific objectives: Critical zone is a complex system of the thin layer of the Earth's surface and near-surface terrestrial environment, where strongest interactions occur among rock, soil, air, water, life, and anthropogenic force. The critical zone is the nexus of the mass and energy cycle not only connecting the deep Earth, surficial processes and the climate system, but also controlling the ecological environment and sustaining the inhabitability of life on the Earth. With the application of geology, geochemistry, pedology, hydrology and ecology, as well as other interdisciplinary approaches, the characteristics, process and evolution, with relations to social sustainable development, will be explored. The research work will dedicate to the development of transformative research approach and theory on the critical zone, construction of model for the critical zone system processes, prediction of evolution of the ecosystem and environment on multiple tempo-spatial scales, as well as the service to the societal sustainable development.

Key scientific issues: Structure, formation and evolution of the critical zone; mass transformation and interactions of the critical zone; service function and sustainable development of the critical zone; modeling and systematical simulation of the critical zone. Critical zone science is the system science based on the multidisciplinary and integrated research on the near-surface Earth system. From this rationality, multiple-disciplinary and systematic observation, experiments and theoretical modeling based on long term observation and research platforms are especially encourage.

Preferred research themes in 2018:

- (1) New theory, technology and methodology of the critical zone observatory network;
- (2) Multiscale modeling and simulation of the structure, process and function evolution of the critical zone at profile, catchment, regional and global scales;
- (3) Controlling mechanism of geological, climatic, hydrological and biological factors for the formation and evolution of the critical zone;
- (4) Biogeochemical processes, mechanisms and ecological functions of mass and element cycles in the critical zone;

(5) The characteristics, processes and regulation mechanism of energy cycle in the critical zone;

(6) The mechanism of pollutant migration, transformation and purification in the critical zone;

(7) Prediction and controlling mechanism of global change and anthropogenic disturbance on the structure and processes of the main critical zones in China;

(8) Co-evolution and regulation mechanism of rock weathering and pedosphere formation in the critical zone;

(9) Evolution and prediction of structure, processes and ecosystem functioning of the critical zone;

(10) Capacity and resilience of the critical zone to the environmental and catastrophic events.

About 6 to 8 projects will be funded.

9. Process, change and mechanism of weather, climate and atmospheric environment

Scientific objectives: To investigate various physical, chemical and biological processes of weather, climate and atmospheric environment, to understand their spatial and temporal characteristics, mutual relations and interactions mechanisms, to develop and improve the theory of modeling and prediction for weather, climate system and atmospheric environment, to provide a scientific foundation for the requirement of the high resolution, timing, fix point, and quantitative forecast of disastrous weather and atmospheric environment, as well as the improvement of the seasonal and interannual predication.

Key scientific issues: Dynamical mechanism and predictability of the weather and climate change; predication of the climatic interdecadal variability; processes of atmospheric physics and atmospheric chemistry, as well as the mechanism of their mutual influences; interactions among weather variations, climate change and atmospheric environment in Asia; exchange and cycling between substance and energy in climate system; frequency and amplitude of the extreme climate events.

Preferred research themes in 2018:

(1) Interactions among aerosols, clouds and precipitation as well as radiation;

(2) Interaction among atmospheric boundary layer, atmospheric pollution and climate system;

(3) Variations of the middle and upper atmosphere and interactions with troposphere;

(4) Coupling mechanism of the atmospheric physical and chemical processes, as well as related simulation;

(5) Development of high resolution weather forecast model and cloud model;

(6) Integrated sounding technology of dynamics-micro physics-electric processes in thunderstorm and weather modification;

(7) Occurrence, development and evolution of the disastrous weather and climate events, as well as theories and methods of the refined weather prediction;

(8) Dynamical mechanisms of climate and climate change;

(9) Causes and predictability of atmospheric sub-seasonal (10 to 90 days) variations;

(10) Prediction of atmospheric seasonal, interannual and interdecadal variations;

(11) Exchange and cycling between substance and energy in climate system;

(12) Interactions among regional extreme weather, climate, environment and global climate;

(13) Implementation and application of the new theories and methods in critical atmospheric variables detection;

(14) Data assimilation for coupled model;

(15) Land-air and air-sea interactions.

About 6 to 8 projects will be funded.

10. Sun-Earth space environment and space weather

Scientific objectives: To form a theoretical frame of the global cause-effect chain of space weather processes so to achieve new original knowledge based on the study of space weather processes among the different layers of the solar-terrestrial system; to establish the cause-effect chain model of the space events and develop the integrated method for prediction based on physics to provide basic data for the safety of astronautic activities and the space-to-earth survey; to conduct the interdisciplinary research with mathematics, physics, information, material and life sciences on the exploration of the mechanism of space weather effects on human activities for providing scientific basis in the policy making of administrations; to develop new concept and method in space explorations and new schemes of space weather satellite series for a new era of space weather study; to encourage fundamental research on space weather combined with national key projects; to encourage analysis, theoretical and simulation study based on the newest space borne or ground-based data from both home and abroad; to encourage studies on the space weather by using data from the Meridian Project observations; to encourage the related basic researches on space geodesy; to encourage the interdisciplinary study between space weather and space geodesy especially.

Key scientific issues: Frontiers of basic physical processes in space weather science; the coupling processes among solar-terrestrial space; space weather modeling and integrated modeling method; the mechanism and countermeasure of space weather on human activities; the influence of solar activity on space weather; the theory, method and technology of space and ocean geodesy, and its application in geosciences.

Preferred research themes in 2018:

(1) Solar driving source of space weather, related physical mechanisms and activities during the solar cycle;

(2) Fundamental physical process in space weather and Sun-Earth connection;

(3) Multi-scaled spatial and temporal structures in solar wind, magnetosphere, ionosphere and upper atmosphere; their evolution and couplings;

(4) Space weather of the solar system and planet;

(5) Prediction model and method in space weather, early warning of hazardous space weather;

(6) Effects of space weather on astronautics, telecommunication, navigation, materials and human health;

(7) New concept, principle, method and technique in space weather exploration, project pre-research in space exploration;

(8) New theory for space geodetic observation;

(9) Theory of geodetic survey, and the process and mechanism of mass transport of the earth theory of multi-source geodetic data fusion and its applications;

(10) New theory and methodology for time-variable geodesy and theory of geodetic inversion;

(11) Scientific issues of deep space exploration and Planetary Science;

(12) Deep-sea geodesy;

(13) Scientific studies in the disaster mitigation and prevention based on geodetic method and technology;

About 4 to 6 projects will be funded.

11. Global environmental change and interactions among different spheres of the Earth

Scientific objectives: Against the background of global environmental change, this field aims to improve the understanding of global warming and its changing trends in the future through the investigation of key scientific issues in the ocean-atmosphere interactions, in particular for the Asian climate change, and to provide scientific and technical supports for addressing the enormous environmental stresses and challenges faced by human society.

Key scientific issues: Processes and mechanisms of global warming hiatus; ocean-atmosphere interactions and the Asian climate change; global climate change and hydrologic cycle; biogeochemical cycle and climate change; past global warming and its effects during the Cenozoic era; interactions among different spheres and Earth system simulations.

Preferred research themes in 2018:

(1) Regional hydrologic cycle and its linkage to climate change;

(2) Changes in marine environment and their role in the climate system;

(3) Global change and key processes of the biosphere;

(4) Biogeochemical cycle and climate change;

(5) Short-term prediction and long-term projection of the global climate change;

(6) Interaction of multi-scale oceanic processes and the development of global model;

(7) Mechanisms of multi-scale ocean-atmosphere interactions;

(8) Detection and attribution of the regional climate change;

(9) Evolution and mechanism on multi-scale monsoon and atmospheric circulation;

(10) Response and feedback of polar processes to the global change.

About 6 to 8 projects will be funded.

12. Impacts of human activity on environment and disaster

Scientific objectives: This field follows the scientific development concept, which will devote to maintaining harmonious relationship between human and nature. It will focus on the development phase and needs of economy and society in China, and consider the actual condition and advantage of resources and environment and its change, and continue to support multidisciplinary and interdisciplinary researches between natural science, engineering technology, and social science. And it will attempt to reveal interaction effects, mechanism and process during the industrial and agricultural production activities, engineering construction of major infrastructures, exploitation of resources and energy, urbanization and other human activities, and investigate threatening impact of human activities on the earth's environment and disaster mechanism, and understand the mechanism of action due to the human activities and its possibly negative effects and disastrous consequences of the human activities on the earth system during the earth's environment and regional environmental evolution. This will be helpful to provide scientific basis to protect regional environment, reduce disaster risk, adjust and control the adverse environmental evolution, realize harmony relationship between human and nature, and promote sustainable economic and social development.

Key scientific issues: Characteristics, interaction and security disposal of industrial and urban solid waste; impact of large-scale human engineering activities on environment and its hazard mechanism; ecological and environment effects caused by mineral resources utilization; evolution process, influencing factor and mechanism of geological disasters (such as landslide and debris flow); impact of human activities on forming process of combined atmospheric pollutions; impact of human activities on regional and global environment; regional environmental process and control; regional sustainable development; multi-medium interface process, effect and control of environmental pollutants; coupling interaction between regional human activity and resources & environment; effects of urbanization and environment & resources.

Preferred research themes in 2018:

- (1) Security disposal of radioactive waste and unhandy industrial waste;
- (2) Mine environment and tailing disposal;
- (3) Pollution treatment of e-waste;
- (4) Pollution process and environmental restoration of groundwater;
- (5) Multi-medium interface process of environmental pollutants;
- (6) Regional development and spatial restructure;
- (7) Urbanization and rural sustainable development;
- (8) Early identification and warning of geological hazard;
- (9) Impact of large-scale human engineering activities on environment and its disaster mechanism;
- (10) Prediction and prevention of geological disasters involved in significant engineering;
- (11) Impact of human activities on forming process of combined atmospheric pollutions.

About 6 to 8 projects will be funded.

Department of Engineering and Materials Sciences

In 2017, the Department of Engineering and Materials Sciences received 457 proposals for the Key Program, and among them, 99 proposals were funded in 84 fields with a success rate of 21.66%. The total direct cost was 297 million yuan and the average direct cost was 3 million yuan per project for five years.

In 2018 about 100 projects will be supported in 91 fields with an average direct cost of 3 million yuan per project for five years. The 91 fields are as follows:

- 1. Key issues in the design, manufacture, processing and application of ferrous metals (E0101, E0109, E0113)**
- 2. Key issues in the design, manufacture, processing and application of non-ferrous metals (E0101, E0109, E0113)**
- 3. High temperature alloys, intermetallic compounds and metal matrix composite materials (E0101, E0102)**

4. Metastable and nano-structured metallic materials (E0103, E0104, E0105)
5. Energy and catalytic metallic materials (E0105)
6. Biomedical, intelligent and biomimetic metallic materials (E0105)
7. Magnetic and information metallic materials (E0105)
8. New phases, new functions in metals and new materials with metallic properties (E0104, E0105, E0106, E0114)
9. Characterization of structure, surface and interface of metallic materials (E0107, E0110)
10. Mechanical properties and service behavior of metallic materials (E0108, E0111, E0112)
11. Theory and property of ferroic glass (including strain glass, cluster spin glass and relaxor ferroelectrics) (3–4 projects) (E0105)
12. Exploration of new systems of inorganic non-metallic materials (E02)
13. New characterization techniques and methods for inorganic materials (E02)
14. Key issues in science and technology for green and sustainable development of inorganic non-metallic materials (E02)
15. Fabrication fundamentals and new techniques of inorganic non-metallic materials (E02)
16. Structure/property directed chemistry of polymeric materials (E03)
17. Manipulation of the aggregation structure of polymeric materials and its influence on properties (E0314)
18. New theories and methods for the processing (including micro-nano processing and additive manufacturing) of polymeric materials (E0315)
19. Basic issues on biomedical polymeric materials (E0310)
20. Basic issues on optoelectronic organic polymeric materials and devices with high performance (E0309)
21. Basic research on polymeric materials related to energy, ecological environment and resources (E0313)
22. Basic research on structure/function design, preparation and properties of polymer composites (E0307)
23. Basic research on the major problems & challenges existing in the fields of polymer materials those fulfill the requirements for the national strategical objective (E03)
24. Fundamentals of digital mine and intelligent mining (E0401, E0402)
25. Basic theories of comprehensive utilization of abandoned mine lands (E0401, E0402)
26. New EOR (Enhanced Oil Recovery) methods (E0403)
27. Disaster prevention and control of flammable and explosive chemicals (E0410)
28. Fundamentals on green disposal technology of metal mine tailings (E0411)
29. Big data in metallurgy and key data acquisition of metallurgical thermodynamics (E0412)
30. New principles and processes of metallurgical reactor (E0413)
31. New hydrometallurgical theory and new method of energy saving and emission reduction (E0415)
32. Scientific basis for green preparation technologies of titanium alloys

(E041503, E0416)

33. Fundamentals on powder material processing (E0417)
34. New theories and novel methods for the preparation of metals and alloys (E0418)
35. Basic theory and key technology of resource recycles (E0419)
36. Remediation and control technologies of heavy metal contamination (E0420)
37. Innovative principles and design methodologies for functionality and performance in mechanisms/machines (E0501)
38. New principles and methodologies for precision drive/transmission systems (E0502)
39. Mechanical system dynamics and vibration control for service safety (E0503)
40. Failure mechanisms and life design of the components, structures, or mechanisms for mechanical equipment (E0504)
41. Functional design and performance regulation of mechanical surfaces and interfaces (E0505)
42. Design theories and methodologies for complex electromechanical systems (E0506)
43. New principles and methods for bio and bionic design and manufacturing (E0507)
44. Novel principles and methods for integrated manufacturing with precisely formed and high-performance complex components (E0508)
45. Theories, technologies, and methods for high-efficiency and ultraprecision machining (E0509)
46. Novel principles and methods for high-energy-density beam and nontraditional energy-field-based manufacturing (E0508, E0509)
47. New principles, operation modes, systems, and equipment for intelligent manufacturing (E0510)
48. Measurement and testing theories, methods, and technologies for mechanical dynamic parameters (E0511)
49. New principles and methods for the design and manufacturing of MEMS/NEMS (E0512)
50. Thermodynamic system analysis, control and optimization for energy conservation and environmental protection (E0601)
51. Turbulent flow mechanism and flow control in fluid machinery (E0602)
52. Fundamentals on mass and heat transfer in energy conversion and utilization (E0603)
53. Combustion theory and combustion new technique of gas and liquid fuel (E0604)
54. Mechanism of combustion, pollution and emission reduction of solid fuel (E0604)
55. Fundamentals on multi-phase flow in power systems (E0605)
56. New principles and methods of measurement for complex thermo-physical quantity and field (E0606)
57. Key thermo-physical issues on the utilization of renewable energy (E0607)
58. Interdisciplinary research of thermo-physical area with mechanics,

materials, environment and life science, etc. (E0608)

59. Theory and technology on the high efficiency high quality electric machine system and its control (E0707)

60. Theory and technology on the new energy system based on electric power (E0704, E0706)

61. Theory and technology for advanced electrical material, equipment manufacturing and its operation (E0702, E0703, E0705, E0711)

62. Key issues on power electronic devices, equipment and its system (E0706)

63. Theory and technology on electromagnetic-biological interaction and medical application (E0712)

64. Key technology on the pulse power and discharge plasma (generation and application) (E0708, E0709)

65. Key technology on high efficiency, low cost and large scale storage of electric energy (E0702, E0713)

66. Theory and technology on the advanced electric-magnetic energy conversion and transmission (E0701, E0706)

67. The spatial planning theories and methods of city centers based on big data (E0801, E0802)

68. Fundamentals and design method of indoor environment for buildings in future urban area (E0803)

69. The planning theories and methods of urban green space under Low Impact Development (E0802)

70. The theory and methods of building climate zoning and the implementation (E0803)

71. Research on key fundamental scientific issues of urban wastewater reclamation and ecological storage (E0804)

72. Novel methods and technological principles for regulation of high-risk substances in industrial drainage (E0804)

73. Fundamentals on key technologies for pollution control and resource utilization of wastewater and solid waste in rural areas in the future (E0804)

74. Theoretical and technical foundation of quality assurance and risk control for drinking water (E0804)

75. New theory for disaster prevention of fabricated structures (E0808)

76. Key issues on theory of wind-resistance/seismic design of structures (E0805, E0808)

77. Hazard mechanism of artificial slopes under climate environmental action (E0806)

78. New structure system and design theory of durable asphalt pavement (E0807)

79. Performance of structural vibration control system based on monitoring data (E0805)

80. Design theory and control technique of transportation system under condition of cooperative vehicle and infrastructure system (E0807)

81. The stability and optimization of regional integrated water-agriculture-ecosystem (E0902, E0901, E0903)

82. River processes and integrated river management (E0904, E0903, E0901)

83. **Advanced material application and structural safety assessment for hydraulic equipment (E0906, E0908)**
84. **Unsteady flow in hydraulic equipment and flow-induced vibration (E0906, E0910)**
85. **Mechanism, simulation, monitoring and warning of catastrophe in deep major rock mass engineering (E0907)**
86. **Fundamental theories and dam construction techniques of low-heat cement or concrete (E0908)**
87. **Morphodynamic process of coral reef coast under the anthropogenic impact (E0909, E0904, E0907)**
88. **Engineering safety and ecological protection in exploitation and utilization of island reefs (E0909, E0907, E0903)**
89. **Key scientific issues in the fault control and safety design of deepwater submersible (E0910)**
90. **Key scientific issues in the installation and vibration control of large-scale ship propulsion shafting (E0910)**
91. **Key scientific issues in the development and operation of subsea production systems (E0910)**

Department of Information Sciences

In 2017, the Department of Information Sciences announced 75 areas and 3 priority funding areas for the application of Key Programs, and received 267 applications, of which, 89 projects were funded with total direct cost funding of 255 million yuan, and average direct cost funding intensity of 2.8652 million yuan per project. The success rate of funding is 33.33%. Some Key Program projects with potential application received a large amount of funding.

In 2018, the Department will publish 95 areas for Key Program projects, including 1 priority area.

In 2018, the Department will fund 85 Key Program projects with average direct cost of about 3 million yuan per project for 5 years. Applicant should follow the guidelines for research directions in relevant areas, in accordance with the trend of development in the research area and basis of their research team and the actual research object or process, propose key scientific problems and conduct systematic and in-depth theoretical studies or experimental verifications. Apart from high level papers, research results should be verified in experimental system or in practical applications. Projects of priority funding will be managed according to the management regulation of Major Program projects.

In 2018, the Department will accept free application for Key Program project on a trial basis in areas of AI, big data, mobile communication, cyber space security and new types of optical fiber communication technology. In 2018, we plan to fund about 15 such Key Program projects, with funding of 3 million yuan per project for 5 years.

Please provide proper application code in the application form. Please refer to NSFC's website (<http://www.nsf.gov.cn/>) for details.

The deadline for proposing areas of Key Program for 2019 is April 30, 2018; please

refer to the department website (<http://www.nsf.gov.cn/cen/oo/kxb/xx/tztg.htm>).

Key priority funding areas of the Department:

Basic theory and method of acquisition and identification of audio signals in complex scenarios

Picking up signals in strong noise and multi-source environment from long distance, and effectively processing, identifying text information is a basis and difficult problem in audio signal processing.

This Key Program project group aims at supporting research in basic theory and method of acquisition and identification of audio signals in complex scenarios. Applicant must have good research background and research results are required to be verified in typical application environment. The Department plans to fund 3 Key Program projects in the following 3 directions:

- (1) Acquisition and reconstructing of multi-channel audio signals;
- (2) Sensing and identification of moving sound sources;
- (3) Identification of emotions from voices in continuous state.

Key areas funded by Department are as follows:

- 1. Cloud wireless access for intelligent services**
- 2. Outdoor millimeter wave large scale multi-antenna wireless communications in limit hardware conditions**
- 3. Theory and key technology for space information transmission for moon landing mission**
- 4. Satellite sensing network theory and transmission technology**
- 5. Basic theory and method of telemetry network for underwater sound**
- 6. Mobile submerging video processing and transmission**
- 7. Theory and technology of secure optical communication**
- 8. Coordinated detection of target by onboard distributive high frequency radar**
- 9. Precision positioning of multi-station based shortwave radiation source**
- 10. Imaging by wide field of view chromatography computation**
- 11. Multimedia processing system for the vision disabled**
- 12. Mechanism and application of surface enhancement by graphene Plasmon sub radiation**
- 13. Design theory and technology of millimeter wave hetero IC**
- 14. Terahertz magnetic microstructure and unidirectional transmission devices**
- 15. Integration method and key technology of micro nano strong flux vacuum electro optical system**
- 16. Method and applied research on microwave devices based on new type of functional electromagnetic materials**
- 17. Sensing mechanism and devices of organic fluorescent sensitive materials**
- 18. Key gas transducers for fuel cell cars**
- 19. Basic theory of large scale graph information and computation**
- 20. Theory and efficient algorithm for big data analysis and computation**
- 21. Time space integrated modeling, precision and verification for ubiquitous connection**
- 22. Software and theory of quantum computer**
- 23. Real-time interactive analysis of big data**
- 24. New type of data management system**

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25. Mechanism and key technology of sustained integration and evolution of software services
 26. Theory of services in big data environment
 27. Mechanism and structure of storage computation merging
 28. Architecture and key technology for efficient processing of big data
 29. Embedded secure chip architecture
 30. Large scale solid storage architecture defined by software
 31. New types of distributive reliable storage system
 32. Real time 3D reproduction of scenario using multi-mode data
 33. Video media synthesis and evaluation based on vision cognition
 34. Social media big data
 35. Basic theory and algorithm of high flux proteomic computation
 36. Public key and complexity theory in new computational environment
 37. Security and privacy technology for big data sharing
 38. Space land information integration network theory and key technology defined by software
 39. Non-sensor scenario sensing theory and key technology
 40. Cloud end merging and boundary computation
 41. Man-machine skill sharing and cooperation for flexible manufacturing
 42. Mixed intelligent control theory and key technology for wearable robot
 43. Agile sensing and control of two arm robot for metallurgical process
 44. Reconstruction and efficiency optimal control of combustion field in furnace
 45. Quantum measurement and control system integration
 46. Metabolic estimation and intelligent optimal control of micro organism growth
 47. Modeling and coordinated control of network based micro spacecraft system
 48. Control, fault tolerance control and verification of hypersonic aircraft
 49. New sensing mechanism and micro nano system based on nano optical field enhancing effect
 50. Basic theory and key technology of man machine interactive system in cockpit
 51. Self spin quantum sensing of solid atoms and precision measurement theory
 52. Theory and key technology of energy mass flow coordinated operation for energy saving manufacturing process
 53. Key technology and application of autonomous reliable multi-unmanned aircraft system for environmental monitor
 54. Coordination and control of manufacturing process driven by knowledge and data
 55. Risk analysis of high speed train operation
 56. All solid gas transducer array for safety protection in closed environment
 57. Distributive optimization theory and method for network system
 58. Critical state prediction for complex bio process based on high dimensional data
 59. Information and physical security and active defense technology for industrial infrastructure

- 60. Key technology of high precision radar transducer chips
- 61. Key technology of optical signal frequency regulation for high speed high order modulation
- 62. Mechanism and key technology of 2D material wide band optical detectors
- 63. Key technology of dynamic reconstructing chip
- 64. Key technology of kilometer level low loss photon crystal optical fiber
- 65. New type of ultraviolet nonlinear optical crystal and laser performance
- 66. Electromagnetic resonance materials and devices for cancer diagnosis and identification
- 67. Key generation and distribution by classical information theory for large capacity optical communication
- 68. Quantity and effect relation of cells in invasive optical treatment in injury restorations
- 69. Structural material growth and physical mechanism of large power green light laser
- 70. Silicon based sub wave length optical devices for light connection on chips
- 71. Key technology of real time optical interference imaging of micro blood vessels
- 72. Basic research on silicon based optical electro integrated high speed quantum communication chips
- 73. High speed narrow single chip integrated adjustable laser
- 74. Remote atmospheric detection by ultra-short pulse laser
- 75. Physical mechanism and key technology of miniature terahertz radiation sources
- 76. Key technology of VLW inferred detector
- 77. Precision quantum measurement based on super cooling Rydberg atom
- 78. Basic theory and design method for approximate computation of IC
- 79. Key technology and application of high performance computation imaging
- 80. New principle and key technology of laser detection of underwater targets
- 81. Integrated energy acquisition and power management on self-energy supplied wireless sensing nodes
- 82. Key technology of super high speed optical parallel processing chips
- 83. Weak quantum measurement for 2D atomic crystals
- 84. Integration of new types of neural devices and chips
- 85. Modeling and online processing of self-learning of visual target
- 86. Multi-vision 3D target indexing theory and method
- 87. Deep neural network construction based on brain machine merging mechanism
- 88. Cross media deep knowledge network construction for video conferencing
- 89. Knowledge atlas construction for domain big data
- 90. Machine learning and cognition for small target
- 91. New models of brain-like learning and applications
- 92. New types of machine gaming algorithm and application
- 93. Machine learning and coordination of software and hardware in limited computing resources
- 94. Brain machine sharing and rehabilitation with online evaluation function

Department of Management Sciences

In 2017, the Department of Management Sciences received a total of 108 Key Program applications, and funded 28 projects. The average funding for direct cost was 2.4 million yuan per project.

During the 13th Five-Year Plan period, the Department of Management Sciences will release funding fields of key programs annually, and release funding fields of key program clusters and database construction timely. The Key Programs focus on (1) scientific frontier issues that can promote discipline development, obtain great innovative achievement, and generate international impacts; (2) important theoretical and application issues regarding economy construction, society development, reform and opening-up, and the improvement of China's comprehensive competitiveness, which need to be addressed immediately, and are possible to be addressed; (3) systematic and in-depth innovative research, which explores management theories and laws for China and has sound research background or good potential for discipline development.

The funding priority areas listed below outline the main contents, scopes and basic requirement of research work. Applicants are required to possess solid research experiences and abilities in the areas that they are applying for. Applicants are encouraged to exploit their full advantages, present deep academic thoughts in their applications, make the research goals clear and concrete, focus on one or several key points of the research and actually address them (it is not required to include all aspects of the research content in the Guideline), and have theoretical breakthroughs. In addition, applications are required to apply theories to practice, discover key scientific issues from important practical management issues from a perspective of China's situations and conduct in-depth research, and try to provide new approaches to address practical management issues. Applicants should focus on scientific methodologies, emphasize on the application of scientific approaches, take real data and actual cases as the fundamental information of their research, and make sure not to be subjective. Please note that the title of application is not required to be exactly the same as the area titles of the following listed Key Programs.

Note that the requirements given in the general description section of the General Program of the Department of Management Sciences in this *Guide to Programs* are also applicable to the Key Programs, please read those items carefully.

Key Priority Areas of Key Programs

In 2018, the Department of Management Sciences proposes 28 priority areas for Key Programs (including one Key Program Cluster), and plans to fund approximate 28 projects. The average funding for direct expenses will be 2.2 to 2.8 million yuan per project, and the implementation period of the Key Program projects will be 5 years.

1. Management optimization of green harbors and shipping network operation (G0102)

Key scientific issues: (1) dynamic evaluation and resource scheduling optimization of harbor operation based on emission classification; (2) decision optimization of shipping network operation within the context of the emission control policies; (3) decision optimization theory and methods of harbor investment, ship fleet allocation, and technology

upgrading, based on emission classification and control policies; (4) how to design emission classification and control policies, as well as other subsidy policies to lower the overall emission levels of shipping activities around harbors.

2. Complex data statistics learning theory and methods towards economic management (G0107)

This research area is focused on economic management and to address the following key scientific issues: (1) statistics deduction theory of complex data; (2) unsupervised statistical learning methods of complex data; (3) supervised nonparametric statistical learning methods of complex data; (4) supervised semi-parametric statistical learning methods of complex data.

3. Operation management theory and methods of bicycle sharing (G0102, G0112)

This research area is focused on operation management issues of sustainable development of bicycle sharing, and aim to develop operation management theory, methods, and technologies of sharing economics based on China's bicycle sharing practices. The key scientific issues include: (1) service capacity distribution and dynamic optimization such as bicycle sharing parking spot design and bicycle circulating strategies; (2) business modes and profit model innovation based on service pricing and associated services; (3) ecological construction method and operation management of bicycle sharing green service that includes platform operation, management of relationship between suppliers and clients, service quality, and product recycling; (4) influences of externality of client behaviors caused by the separation of the right to use and ownership, and the associated policies of sustainability.

4. On-line advertising modes and pricing strategy optimization (G0102, G0114)

Key scientific issues: (1) theory and methods of various on-line advertising applied in commercial activities; (2) acceptance of users for various on-line advertising and evaluation from consumers; (3) models and methods of advertising placement and selection; (4) differences between on-line advertising and conventional advertising from the view of advertisers of on-line advertising; (5) influence factors, pricing strategies, and strategy optimization of on-line advertising.

5. Optimization theory and methods of supply chain network design (G0111)

The research aims at the new characteristics of production and service supply chain network design under the internet circumstances, and the following key issues need to be addressed: (1) high performance calculation of supply chain network design with general cost functions; (2) large-scale distribution supply chain network design of multi-level stock management for differential service; (3) multi-sources distribution and supply chain network optimization design; (4) service supply chain network optimization algorithm for large-scale free trade areas.

6. Intelligent logistics optimization theory and methods under the big data environment (G0111, G0114)

The research will focus on process industrial enterprises or dispersing manufacturing enterprises or platform-based enterprises, and address the following key issues: (1) theory and methods of logistics demand forecasting under the big data environment; (2) active logistics and distribution methods based on customer or client behaviors; (3) theory and methods of warehouse decision based on online learning; (4) real-time data-driven online transportation capacity allocation and path optimization.

7. Internet of Things (IOT) service development and design optimization (G0102, G0112)

The research will aim at the high-efficient service in IOT, and address the following key issues: (1) service modes and processing innovation mechanism of various IOT environments; (2) service process design and optimization method under the IOT environment; (3) service modular design and service combination optimization towards the IOT platform; (4) customized service outsourcing design and pricing strategies for large-scale personalized requirement in the context of IOT; (5) service quality design, evaluation methods, and continuous improvement mechanism driven by IOT big data.

8. O2O mode, real-time delivery service operation and management theory and method (G0112)

The research will focus on small and medium-sized O2O platform enterprises, and address the following key issues regarding instance delivery service operation and management in O2O mode: (1) data-driven prediction of customer demand; (2) service quality design of instance delivery services; (3) capacity distribution and planning of service resources; (4) operation optimization and scheduling of service processes; (5) data-driven business and service mode strategy selection and case studies.

9. Information product design optimization theory and methods based on social media (G0114, G0110)

Information products are a kind of information transmission carrier and human-computer information exchange interface. Focusing on the social media environment, the key issues that this project is going to address include (1) consumption behavior and demand analysis of information products and services; (2) index system of information product design; (3) characteristics analysis, optimization models, and algorithm of information product design; (4) integrated optimization methods of information product update and multi-function information products, as well as the technologies to control negative impacts of information products; (5) information product pricing strategies and competitive business mode design, and information product design and the impact of operation modes on social welfare.

10. Enterprise strategy management theory in the intelligent manufacturing era (G0201)

Focusing on the deep integration of intelligent manufacturing and the internet, aiming at the key scientific issues of pathways, selections, organization modes that the strategic management practices are facing, this project will discuss how Chinese enterprises accelerate transformation, promote industrial innovation, and become more competitive in the new pattern of the Belt and Road and globalization by improving their strategic management capabilities. The key scientific issues include the reconstruction of enterprise value network in intelligent manufacturing conditions; structures and construction mechanisms of enterprise competitiveness in the era of intelligent manufacturing; ecosystem characteristics, so-opetition strategies, governance mechanisms that support the strategic upgrading of Chinese manufacturing enterprises, and associated impacts on enterprise competitive advantage; strategy upgrading paths and mode section for manufacturing enterprises of different property types, especially for state-owned enterprises.

11. Business intelligence system construction based on big data fusion (G0209, G0210)

By integrating big data of the market, enterprises and users, this project will establish enterprise information systems and core competitiveness based on the new business intelligence through addressing the following key scientific issues: business intelligence analysis method based on big data fusion, key technology and business knowledge expression model based on business big data, business model design of new business intelligence, and operational and management transformation required by business intelligence systems.

12. Chinese enterprises internationalization and institutional evolution mechanism and strategy research (G0214)

Against the background of the Belt and Road initiative, this research will aim at the business system environment built by the dual forces of China's "government and market", establish a new analysis framework and theoretical system for the internationalization of China's unique enterprises, and propose new energy and new paths that can effectively cultivate the internationalization of Chinese enterprises. The key scientific issues include (1) the motivation, driving forces, and performance guarantee of the internationalization of China's enterprises under the institutional environment driven by the dual forces of China's "government and market"; (2) the role orientation, the mechanism of action, and the synergistic effect of the government's will and market mechanism in the internationalization of Chinese enterprises. The goal of this project is to clarify the interaction mechanism between the internationalization of Chinese enterprises and the system evolution, as well as the new motivation and new path for the internationalization of Chinese enterprises.

13. Theories, methods and applications of big data-driven business-user interaction innovation under the internet environment (G0203)

The research area will focus on the enterprise interaction innovation theory, methods and applications under the internet business environment, including the following key scientific issues: (1) methodology for users' participation in enterprise innovation under the internet environment; (2) behavior characteristics of users in the innovation process, as well as their methods to extract knowledge; (3) creation of standard processes for interactive innovation, study of supporting tools for interactive innovation, and establishment of big data platforms for interactive innovation. This project is going to prepare a theoretical foundation for China's enterprises to develop product innovation.

14. Enterprise operation and resource allocation theory under the sharing economic environment (G0211)

By combining with the new features of enterprise operation and resource/energy allocation under the sharing economic environment, this project will take China's typical industries and service enterprises as study objects, to examine the operation management, resource/energy allocation, supply chain management, as well as coordination and optimization theory and methods under the sharing economic environment. This project needs to address the following key scientific issues: (1) enterprise internal operation modes, resources allocation behavior characteristics, and the coping mechanism under the sharing economic environment; (2) the growth mechanism and operation rules of platform enterprises under the sharing economic environment; (3) enterprise right and interest protection and trading mechanism design based on the separation of resource and energy ownership and usage; (4) supply chain structure design and optimization research based on the sharing economic environment; (5) supply chain coordination and improvement of Pareto mechanism design under sharing economic environment.

15. New methods and theoretical innovation of experimental research on economic policy evaluation (G0302)

Key scientific issues: (1) how economic institutions affect economic efficiencies and social norms through controlled incentive experiments; (2) measurement and analysis of individual choices and economic results, as well as how preferences, decision-making quality, and cooperative behaviors evolve and develop, especially the roles of information dissemination playing in these processes; (3) development of a series of methods including data collection, experimental design, statistical analysis, and theoretical research for a large-size tested object library, and establishment of individual and group behavior models that can effectively measure and analyze the achievements of China's economic development. This project is required to be conducted by combining with related fields such as financial development, urbanization, environmental challenges and poverty issues.

16. Innovative research on semi-parametric econometrics theory and methods (G0303)

Applicants are expected to study frontier theories and methods of semi-parametric econometrics and their innovative applications in China's economy and finance, including semi-parametric models, semi-parametric constrained variable instrumental variable models, semi-parametric spatial econometric models, semi parametric local stationary and non-stationary time series models, average method of econometric models, etc. This project is required to be conducted by combining the practical cases in China's economy and provide corresponding policy recommendations.

17. Historical metrics and empirical studies based on China's economic development and theoretical evolution (G0304)

The research is going to (1) analyze the historical process of China's economic development, as well as the economic thought of China and foreign countries, then conduct historical quantitative research on the path-dependent mechanism of economic development modes during different periods; (2) examine the important historical facts and the relevant economic hypotheses using empirical methods, analyze the economic thoughts and institutional arrangements during the major transformation in Chinese history, reveal the inherent logic of economic changes, and explore the internal interaction between economic variables; (3) conduct a quantitative empirical study for the clan network, cultural system and the historical dependence; (4) innovate historical quantitative research methods and establish associated historical databases, to provide historical coordinates and development logic for China's economic theory innovation.

18. Research on financial system of public service supply from the perspective of national governance (G0305)

From the perspective of national governance, this research needs to address the following scientific issues: (1) the role and position of public service supply mechanism in national governance; (2) the quantity and quality decision-making mechanism of public service supply in line with the existing financial capacity and the government performance; (3) differences in characteristics of public services between regions, and power arrangement and transfer payment system that realize multi-level governmental cooperative supply; (4) building of a big data platform and feedback mechanism for evaluating and validating public service supply based on micro-data of social residents satisfaction, and proposal of financial systems and reform paths to innovate and rebuild the supply of public services.

19. Poverty alleviation development theory and policy research in the new era

(G0307)

The research is going to (1) summarize the international theory of anti-poverty and explore the mechanism and causes of China's poverty alleviation; (2) identify the key factors that affect the effectiveness of poverty alleviation by examining the regional target and population target characteristics of China's poverty alleviation in the new era; (3) conduct empirical studies to understand the influences of industrial structure upgrading, labor mobility, and urbanization on poverty alleviation; (4) study the characteristics and dynamic evolution of poor families in China, to explore effective ways to prevent intergenerational transmission of poverty; (5) analyze resource allocation and implementation measures for poverty alleviation, and evaluate the effects and mechanisms of different types of poverty alleviation work; and (6) propose poverty alleviation development strategy adjustment and policy design direction during the transformation phase of economic and social development.

20. Agricultural market cultivation and westward opening in the Northwest drought region (G030802)

The research is going to (1) build the theoretical system of agricultural market reform, explore the theoretical principles, basic routes, and typical patterns of agricultural market reform and westward development; (2) innovate agricultural market efficiency analysis theory system, design the evaluation methods for agricultural markets effectiveness, and analyze the institutional barriers, institutional barriers, and policy defects that constrain the agricultural market cultivation and westward opening in the Northwest drought region; and (3) focus on China's strategic needs in the Silk Road Economic Belt, and propose a solution for cultivating agricultural markets in the Northwest drought region and westward opening, and conduct empirical tests.

21. Policy effect of governmental function transformation (G0401)

The research is going to (1) study the scientific connotation, dynamic characteristics, and identification indexes of policy effects of government function transformation, and make comprehensive measurement and evaluation of the policy effects of China's current government function transformation; (2) study the generation environment and obstruction factors of policy effects of government function transformation, summarize and simulate the issues of constraining the policy effects governmental function transformation; (3) study the motivation, mechanism, modes, and rules of the generation and spread of policy effects of governmental function transformation, construct theoretical models for policy effects of governmental function transformation under the background of internet and marketization, and; (4) study local cases and governance experiences regarding governmental function transformation, and propose sustainable development strategies for governmental function transformation.

22. China's core information technology innovation and industrial innovation ecological cultivation (G0405)

The research is going to (1) deeply analyze the connotation characteristics of IT innovation and related industry evolution mechanism in the context of global competition, and systematically study the law of core information technology innovation, and improve the relevant theoretical foundation to fulfill the major needs of China's future economic and social development, and then provide the core information technology independent innovation system and framework towards network power country construction; (2) conduct research in the development mechanism of new information technology industrialization,

and the industrial innovational ecological cultivation paths in the background of the internet big data; (3) explore the mechanisms and paths for technological breakthrough in key areas, and the mechanisms and paths of leading digital innovation and entrepreneurship development in the future, and propose systematic policy design and suggestions.

23. Public health risk prevention and health resources distribution in China under the Belt and Road Initiative (G0406)

The research is going to (1) analyze the major public health risks that the globalization may cause to China in the context of the Belt and Road, and explore the existing resources of China's health system in dealing with all kinds of new health risks and challenges; (2) study China's public health and safety challenges in the future and their evolution trends, explore and construct new modes for public health and safety risk assessment, capacity diagnosis, training and construction through analyzing the significant acute and chronic diseases, major health threats and the allocation of health resources of the Belt and Road neighboring countries and regions, and provide evidences for national health and safety strategies and resource allocation strategies.

24. Education reform and innovation management in the Era of "Internet +" (G0407)

The research is going to (1) study the motivation, connotation and characteristics of "Internet + Education", and analyze their influences on future educational resources, teaching forms, school forms and social forms; (2) study the integration of curriculum openness, teaching methods, learning methods, evaluation modes of "Internet + Education", and explore the adaptive evolution of basic education principles under "Internet + Education"; (3) study the educational management reform and school organization management innovation in the era of "Internet +"; (4) examine the deep application of big data in education management decision-making through practical cases and empirical studies, propose policy measures for promoting the educational reform and management innovation in the era of "Internet +".

25. The Driving mechanism and pathways choices of renewable energy development (G0412)

The research is going to: (1) analyze impact factors and evolution paths of typical renewable energy development, and study the impact mechanism on the paths of policies, the market and technologies; (2) analyze the rules and effects of the preference of renewable energy development in China; (3) study the role of each participant and the structural relationship and associated impact mechanism of renewable energy development processes; (4) examine the behaviors of the participant's choice and their impacts on renewable energy development and social welfare under different types of incentive policies; (5) analyze comprehensively the cost, profit, and environmental impacts under various renewable energy development scenarios in China, and propose renewable energy development paths and policies for China.

26. Transformation and governance of China's small towns (G0413)

The research is going to (1) analyze the process of transformation and development of small towns in China and foreign countries, and study the position and roles of small towns in national development strategies, regional urban agglomeration development, and the urban and rural area coordinating development; (2) study the status quo, opportunities and challenges of small towns in China, and explore the development strategies and mechanisms of small towns towards health, coordination, and sustainability; (3) analyze the

evolution and characteristics of small towns' environmental factors or elements, including economy, society, ecology, and space, build a theoretical system for sustainable development of small towns; (4) examine the governance pattern and management strategy of sustainable development of China's small towns, and propose policy proposals that can further promote development and transformation of small towns towards China's new urbanization.

27. China's blue economy spatial expansion strategy (G0413)

The research is going to (1) study the strategic decision methods of blue economy spatial expansion under the strategic background of maritime power; (2) compare and analyze the international maritime spatial planning of the international maritime powers, and generate the strategy for space expansion of blue economy; (3) systematically integrate the strategic decision methods for blue economy spatial expansion, and construct a strategic decision support system; (4) apply the strategic decision support system on China's blue economy spatial expansion by combining the international norms, the practices of international marine powers to expand space, as well as taking into account China's national conditions, and then conduct empirical analysis and propose policy suggestions for relevant regional cases.

28. Organizational behaviors and human resource management based on Chinese practices (Disciplinary Key Program Cluster)

As the implementation of the five core development concepts of "innovation, coordination, greenness, openness and sharing" in the Outline of the 13th Five-Year Plan, human resource power is once again promoted up to the national strategic level. It is important to understand the organizational changes and the human resources management environment changes, to stimulate the vitality of human resources innovation, and to explore new issues and theories that organizations and human resources management are facing, which are also a common concern of governments, industries, and the scientific society. This key program cluster will focus on the organization and human resources management issues that serve the national innovation-driven development strategy, and the key scientific issues include changes in organizational structure, organizational behavior modes, cross-border cooperation, and human resources management innovation based on China's practices, in order to derive and improve the organization and human resource management theories with local characteristics, and to provide theoretical support for the practice of enterprises.

(1) Enterprise human resource management modes based on innovation orientation (G0204)

This research is going to discuss the changes and evolution rules of organizational characteristics in different stages, analyze the environment, human resource management characteristics, and matching logics of different innovation orientations, explore the type, evolution and effects of employee-organization relationship, and examine the characteristics, effects, and mechanism of different types of innovative entities using big data, in order to reveal the connotation, construction, and operation mechanism of innovation-oriented human resource management mode.

(2) Construction of multiple employment theory based on sharing ideas (G0204)

This research is going to discuss the organizational and cultural factors that restrict the effect of multiple employment in Chinese enterprises in the sharing era, study the theories of organizational structure, virtual leadership and borderless human management

based on sharing ideas, explore the innovation of employment modes, examine the motivation, characteristics, modes, and effects of multiple employment, study new theory systems of multiple employment, and explore the theory and practice of borderless management of human resources in China, in order to derive employment management theories featured by present era and China's local characteristics.

(3) Organizational changes and organizational learning in a transforming environment (G0202)

This research is going to explore the relationship between characteristics as well as modes of organizational learning of Chinese enterprises and the competitiveness promotion of enterprises in the context of transformation, study network construction, embedding, diffusion, and the modes and innovations of organizational learning, study interactive, imitative, cross-border organizational learning mechanism from a perspective of competitive interaction and environmental interaction, based on which a enterprise organizational learning theory and methodology system under the transforming environment could be established.

(4) Organizational competition and innovation mechanism based on cross-border sharing (G0202)

This research is going to compare the essential differences between cross-border sharing and intra-border sharing, reveal the connotation of cross-border sharing in the era of sharing economy, study the existing forms of competition and cooperation under resource constraints, discuss the mechanism of cross-border sharing on organizational competition release or co-opetition, and explore the cultural and organizational behavioral factors that affect the enterprise cross-border sharing and co-opetition and breakthrough innovations, and delivery local co-opetitive theory.

29. Major theoretical and practical issues of marketing under the economic transition background (G0207)

(1) Impacts of economic transition and consumption upgrading on consumer happiness and benefit;

(2) Big data-based customer insights: consumer behaviors, decision making processes, and social impacts;

(3) Omni-channel marketing research in the era of mobile internet;

(4) Theoretical innovation of brand building under economic transition and internationalization;

(5) New product development strategy and business model innovation in the mobile internet era.

The applicants should make the following notation in the Appendix of the application: "Major theoretical and practical issues of marketing under the economic transition background Key Program Cluster".

Department of Health Sciences

Applications for Key Program in the Department of Health Sciences are accepted only if they are in response to the solicited thematic areas listed in the *Guide to Programs*. Applicants are expected to give their own specific project titles, research contents and

research plans according to the listed areas.

In 2017, 642 applications for the Key Program in 39 thematic areas were accepted, 112 of them were funded, with a total funding of 292.41 million yuan (direct cost) and an average funding of 3.275 million yuan (direct cost as well) per project.

In 2018, approximately 110 applications for the Key Program will be awarded by the Department; the funding intensity of direct cost is expected to be 3 million yuan per project, and the duration is 5 years.

Detailed requirements for applications for the Key Program are described in the general requirement for the Key Program of NSFC in this *Guide to Programs*. Special attention should be given to the following requirements:

(1) Applicants are expected to refer to the requirement for General Program in the Department of Health Sciences in this Guide, and to pay special attention to the following: the Department in 2018 will generally not give further funding to applicants who either have got intensive funding in 2017 from NSFC (such as Key Program, Major Program, Major International and Regional Joint Research Program, etc.), or are applying for repetitive or similar research to their ongoing national scientific projects funded by other governmental agencies.

(2) Applicants are expected to choose the relevant application code corresponding to the given thematic area and to fill in the application form. Besides, the title of the selected thematic area should be written in the “annotated column” of the application form.

(3) Applicants are expected to attach PDF copies of 5 relevant representative papers of the principal investigator to the electronic proposals.

(4) Applicants are expected to fill in the budget form with detailed justification.

It will be unacceptable if applicants fail to follow the above requirements.

The thematic areas for solicited Key Program in the Department of Health Sciences in 2018 are listed as follows:

1. The disease mechanism and treatment of chronic airway diseases (H01)

The priority research area will focus on the pathogenesis of chronic airway diseases (e.g., chronic obstructive pulmonary disease, bronchial asthma and obstructive sleep apnea and other diseases), including the effects of genetic factors, environmental factors, airway inflammation, respiratory central regulation in the development of the diseases; determination of the effects of changes in airway structure and function on the functions of respiratory system (pulmonary function) and other organs; seeking for new targets for intervention, and exploration of new methods of treatment.

2. The key role and regulation mechanism of the protein translation modification in the process of vascular injury repair (H02)

The priority research areas will focus on the key role and regulation mechanism of the translation modification of key protein molecules such as transcription factors in vascular function and injury repair, and regulation of the key protein molecule translation modification was as the cut-in point to elucidate the pathogenesis and prevention of important vascular diseases.

3. The myocardial metabolic imbalance in the pathological remodeling of myocardium (H02)

The priority research areas will focus on the metabolic characteristics of cardiac myocytes in the pathological remodeling of myocardium to elucidate the mechanism of metabolic pathway changes and its functional significance, probe into the effects of tissue

and cell interactions on myocardial cell metabolism, and discover metabolic markers and new targets for intervention in cardiac pathological remodeling.

4. Effects of intestinal mucosal damage/repair on digestive diseases (H03)

The research is to investigate the roles of intestinal barrier function injury, immune dysfunction, intestinal flora imbalance, and change of nutritional and metabolic status in the development of digestive diseases. Furthermore, to investigate the interactions between the intestinal microflora and host in diseased bowel, as well as the clinical efficacy and mechanism of interventions on digestive diseases.

5. Placentogenesis, placental development and the relevant diseases (H04)

The research focuses on physiological and pathological mechanism underlying placentogenesis and placental development, pathogenesis of placental mediated diseases, the role of placenta in the maternal-fetus interaction, and the mechanism of placental origin influence on the offspring health.

6. Pathogenesis and intervention of chronic pelvic pain (H04)

The research focuses on pathogenesis of chronic pelvic pain induced by the organic or functional diseases (such as endometriosis, adenomyosis, pelvic inflammatory disease, pelvic congestion syndrome, etc.), with an emphasis on the regulatory mechanism of key molecules in the process of disease development, the effective biomarkers, the threshold value of pelvic pain, as well as the application of new techniques such as neuroimaging in the diagnosis and intervention of these diseases.

7. Investigation of the genetic and epigenetic mechanisms of immune-mediated kidney diseases (H05)

The research direction is focused on the genetic, epigenetic, and molecular network mechanisms contributing to the immune-mediated kidney diseases, which will greatly improve the understanding of the pathogenesis of immune-mediated kidney diseases and kidney injury/repair process and will provide the novel targets for the development of new therapeutic drugs.

8. Aging, injury and repair and rehabilitation of the organs in locomotor system (H06)

Focus on investigating the molecular mechanism of degenerative diseases in the locomotor system during its occurrence and development; seeking the key regulator for delaying or reversing the degeneration progress in the locomotor system and elucidating its associated regulatory mechanism; studying the injury mechanism of the locomotor system and exploring preventive and therapeutic method.

9. The function and mechanism of trans-differentiation and crosstalk among islet cells in blood glucose homeostasis (H07)

Focus on the trans-differentiation among islet cells, differentiation and dedifferentiation of β -cell, and regeneration of islet cells and their functions in blood glucose homeostasis and explore metabolite regulation, signaling pathway and epigenetics of trans-differentiation and regeneration which will reveal the molecular mechanism of islet dysfunction during the metabolic stress, and provide therapeutic evidence for diabetes.

10. Immuno-therapy and mechanism research for hematologic malignancies (H08)

The applications should focus on the key scientific questions of immuno-therapy for hematologic malignancies including new targets for immuno-therapy, new technologies and means, combination method for immuno-therapy, efficacy, drug-resistance and intervention,

immuno-therapy prediction and evaluation system, and complications of immuno-therapy and the related treatments.

11. Mechanism for blood cell malignant transformation and its intervention (H08)

The applications should focus on the key questions in the fields such as earlier malignant transformation of blood cells, the complexity of stemness of transformed cells, the clonal origin and transformation of malignant cells, the interaction of malignant cells and microenvironment. Applicants are encouraged to use new strategies/methods such as functional omics, system biology, and single cell sequencing, to elucidate the transformation mechanism of malignancy and to provide key theoretic support for clinical intervention or decision.

12. Biological basis of physical stimulation in treating psychiatric disorders and neurologic diseases (H09)

The research will identify and fund research applications that apply noninvasive and minimally invasive electrical, acoustic, light, magnetic stimulation to modulate cellular function, and specifically focus on cellular and molecular biology, and neural network mechanism of psychiatric disorders (e.g., severe obsessive-compulsive disorder) and neurological diseases (e.g., Parkinson's disease), combined with nonhuman primate animal models, to explore the accurate treatment regimens based on intelligence computation.

13. Mechanisms of neurologic damage induced by functional changes of glial cells (H09)

The research highlights the heterogeneity of glial cells in central nervous system diseases. Priority will be given to studies that identify the molecular modulation and functional network of different glial cell subgroups, decode the key mechanism of neurologic damage, and explore new targets and clues aiming at modulating glial cell functions, using clinical samples combined with animal models.

14. Immune responses to stress and their effects on relevant diseases (H10)

The research is to investigate effects of various stress (such as trauma, pressure, infection, hypoxia, etc.) on immune system and immune regulatory responses, with a special emphasis on the key signal pathways and molecules involved in the immune-stress interaction and their effects on the progression of relevant diseases.

15. New diagnostic and treatment targets for autoimmune diseases and their underlying mechanism (H10)

The research is to investigate molecular mechanism underlying pathogenesis of autoimmune diseases (such as systematic erythematosus, rheumatoid arthritis, ankylosing spondylitis, multiple sclerosis, Graves diseases, etc.), new targets for immune regulation and immune tolerance, and the specific new therapeutic strategies for these diseases.

16. Regulation of immune molecules and intervention study in Immuno-inflammatory skin diseases (H1103)

Studies should focus on the molecular mechanism underlying cellular activation, differentiation and homing on the incidence, development and transformation of Immuno-inflammatory skin diseases. The aim is to investigate the key molecular regulation and its intervention for the disease-related Immuno-inflammatory response.

17. Mechanism studies on the interaction between genetic and environmental factors in eye diseases (H12)

Applicants are advised to explore the mechanism of gene-environment interaction in

major non-tumor eye diseases such as age-related macular degeneration, high myopia, and cataract. Analyze the genetic, epigenetic and environmental factors, combined with further functional studies using in vitro/ vivo models, elucidate their roles in pathogenesis of the diseases.

18. The mechanism and intervention of the neuropathy and central processing disorders of auditory vestibular system (H13)

Applicants are advised to focus on the pathogenesis, pathological fundament, gene therapy and intervention of the neuropathy and central processing disorders related to the dysplasia, damage and aging of auditory vestibular system (such as auditory neuropathy, vestibular migraine, noise induced hearing loss and presbycusis).

19. Study on the pathogenesis of oral maxillofacial genetic or development disorders (H14)

Applicants are advised to focus on the studies of pathogenesis of oral maxillofacial inherited and development disorders such as cleft lip and palate, enamel/dentin dysplasia, hypodontia, etc. Illustrate the pathogenetic mechanism by the combing of the genetic, epigenetic, and developmental biology and the effects of environmental factors as well as the translational potential via models in vitro/vivo.

20. Repair and functional reconstruction in severe tissue injury including trauma and burns (H15)

The research is to study the pathogenesis of tissue repair induced by severe trauma and burns, the new methods for the prevention of persistent tissue injury, as well as the acceleration of repair and regeneration against injured tissue, and the new approaches for the induction of tissue functional reconstruction.

21. The emergence of new antigen caused by tumor gene mutations and the strategy for vaccine research (H16)

This subject is focused on the discovery and identification of tumor specific new antigens caused by tumor gene mutations, exploring the effects and mechanisms of these new antigens on immune response, and developing strategies for tumor vaccines against the new antigens.

22. Inflammatory response induced by DNA damage and tumorigenesis (H16)

This topic is focused on the cellular inflammation induced by DNA damage and its role in tumorigenesis, including the activation of inflammatory response and the release of inflammatory mediators induced by DNA damage, and the mechanisms of these inflammatory signaling molecules and mediators in tumorigenesis.

23. RNA splicing and RNA modification in tumorigenesis and development (H16)

This topic is to study RNA alternative splicing and RNA modification in tumorigenesis and development, to discover and identify the RNA abnormal splicing and RNA modification products, and to study the effects and mechanisms of these RNA regulations on biological function of tumor cells.

24. Synergistic lethal effect and targeted therapy of tumor (H16)

This topic is focused on the discovery of the genes correlated with synergistic lethal effects and their mechanisms, including the synergistic lethal effect and mechanism between gene mutation and epigenetics regulation, as well as between gene mutation and tumor microenvironment.

25. New technologies and methods for intelligent imaging and diagnosis (H18)

The research should be focused on using digital information technology to implement medical image recognition and interpretation, especially using new technologies such as data mining, mathematical statistic calculation, neural network, deep learning in image data processing, building intelligent image recognition platform or intelligent image radiomics-aided diagnostic systems, or building standardized diagnostic module connected seamlessly with the picture archiving and communication system (PACS), in order to improve the sensitivity and specificity of intelligent screening, accurate diagnosis and prognosis prediction of diseases.

26. The regulation effect of carrier materials on the transplanted cells and tissue microenvironment and their in vivo biological behaviors (H18)

The research should be focused on: the in vivo metabolism and degradation of carrier materials, and how they influence the microenvironment of the transplanted cells and improve the integration of transplanted cells with the body; how the carrier materials and their components regulate the adhesion, proliferation, differentiation, migration and secretion of the transplanted cells in order to improve the survival rate of the transplanted cells, tissue regeneration and immune therapy; how to realize the real-time, in vivo and dynamic tracking of the transplanted cells by using molecular imaging materials, and evaluate the function and mechanism of the transplanted cells.

27. Functional investigations on micro tissue/organ and organ-on-a-chip (H18)

The research should be focused on: the development of seed cells, the relationship of cells and the microenvironment, and the interaction between cells and materials; the regulation of cell adhesion and proliferation; the three-dimensional cultivation of micro tissue/organ, construction of microvascular networks, and key regulatory factors of the function of microorgans, as well as the medical applications of micro tissue/organ and organ-on-a-chip in the exploration of mechanisms of major diseases, and drug discovery/screening.

28. Basic research on non-viral human pathogen and its infection (H19)

The study should focus on the interaction between non-viral pathogens and the host, such as pathogenic bacteria, fungi, parasites, etc. The research content includes the structure, function, physiology, biochemistry and metabolism, genetic variation and evolution of pathogens, pathogenicity, drug resistance and transmission mechanism of pathogens, functional gene discovery, immunogenicity, genetic susceptibility to infection of pathogens, and so on.

29. Laboratory medicine research on key cellular and molecular markers of complicated diseases (H20)

The study should focus on the cellular and molecular bases of individual differences in the different stages of occurrence, development and outcome of complicated diseases, and precise diagnostic methods based on evidence-based medicine and omics data, such as disease prediction, early diagnosis, treatment and prognosis.

30. The mechanism of body injury and adaptation in extreme environment (H21)

Main focus is on the mechanisms of body injury and adaptation under conditions such as aeronautic or astronautic, nautical or submersible, plateau, polar region and other special or extreme environments. In particular, the mechanisms in pathophysiology and molecular biology of the interconversion between body injury and adaptation under the ever changing conditions such as hypoxia associated with high altitude, temperature, pressure,

gravity and circadian rhythm will be mainly funded. Further research will be the intervention of anti-injury and promoting adaptation on the above basis.

31. Geochemical environmental exposure and incidence, development and evaluation of chronic diseases (H2401)

Studies should focus on geochemical environmental exposure with local and general characteristics such as fluorine, arsenic, iodine and selenium and the incidence, development and evaluation of chronic diseases. The association of exposure factors mentioned above with incidence and development of chronic diseases and its application in this population should be investigated.

32. New epidemic characteristics of acute intestinal/respiratory infectious diseases and its early detection and prevention (H2609)

The research should be on infection source, transmission route, susceptible population and influencing factors at present changed the epidemic characteristics of incidence and distribution of infectious diseases. Studies should focus on investigating new epidemic characteristics (or regularity) of acute intestinal/respiratory infectious disease and establishing new methods of early detection (or marker screening) for infectious disease (pathogen). The aim is to provide theoretical basis and technical support for decreasing the morbidity and mortality and improving the ability of comprehensive prevention in infectious diseases.

33. Statistical theory and methods for causal inference in medicine (H2611)

Studies should focus on statistical theory and methods for causal inference based on population cohort and cross-omics data. This includes rapid screening of biomarkers, interactive analysis, identification of biological pathways and estimation of causal effects. The aim is to provide the strategies and methods of systematic epidemiology for etiological inference, individualized prevention, diagnosis and treatment.

34. Relationship between Traditional Chinese medicine (TCM) damp-heat syndrome and intestinal microecology (H27)

Based on the combination of diseases and TCM syndromes, and syndrome differentiation followed by treatment procedures, researchers should employ the combined metagenomics, metatranscriptomics with metabolomics, and mucosal immunology to study intestinal flora and thus elucidate the relationship between TCM damp-heat syndrome and intestinal microecology. The interaction of the changed intestinal microecology and effect of TCM formulas will also be further explored.

35. Methodology on the evaluation of clinical curative effect of Traditional Chinese medicine (TCM) under evidence-based medicine (H27)

Based on the evidence-based medicine and guided by the characteristic of syndrome differentiation, diagnosis and treatment in TCM, researchers will focus on the critical technology and standardization system with high adaptability and strict trial design principles for evaluation of clinical curative effect of TCM, including intervention setting, control selection, evaluation of treatment outcome, regulation of bias, database development, critical skills for data analysis, etc.

36. Discovery and Validation of Quality Control Markers of Chinese Materia Medica (H28)

Based upon the theory of traditional Chinese medicine, the biological properties and the expression characteristics of effectiveness, and the transmissibility and traceability of Chinese Materia Medica, investigators should integrate multidisciplinary technical methods,

select representative Chinese Materia Medica and conduct demonstrative and innovative projects focusing on the discovery and validation of quality control markers of Chinese Materia Medica, and markers for the needs of quality control in the entire process of pharmaceutical production of Chinese medicine.

37. Study on the mechanism of prevention and treatment for glycolipid metabolic diseases by integration of Traditional Chinese and Western Medicine (H29)

On the basis of certain clinical effectiveness and research results achieved by integrating TCM and Western medicine in the prevention and treatment of glycolipid metabolic diseases, projects that focus on the mechanism in preventing and treating hyperlipidemia, diabetes, fatty liver and atherosclerosis by integration of TCM and Western medicine are strongly encouraged.

38. Novel techniques and methods for discovery of drug related biomarkers or drug targets (H30)

Applicants are expected to focus on the creation and development of novel detection techniques and methods, such as modern instruments, molecular imaging, isotope technologies, multi-omics analysis and multi-methods combination; systematical validation of their selectivity, sensitivity and practicability; and application to discover the drug related biomarkers or drug targets.

39. New mechanisms of drug resistance and new strategies for drug discovery and therapy (H31)

Applicants are expected to focus on investigation of the new molecular mechanisms of drug resistance in pathogens or cancers, elucidate the structures and functions of the new key biological molecules involved in drug resistance, and explore new strategies to overcome drug resistance, application of the screening models based on the new mechanisms for anti-drug resistant molecules to discover the lead compounds and develop the drug candidates for overcoming drug resistance.

40. Relation between the key factors affecting drug disposition in vivo and prevention and treatment of diseases (H31)

Applicants are expected to focus on studying the interaction and the molecular regulation mechanism between the key factors affecting drug disposition in vivo (e.g., drug metabolism enzymes and transporters, gut microbiotas, etc.) and occurrence and development of diseases and drug intervention process, discovering new drug targets or biomarkers and developing novel therapeutic strategies, and evaluating the functions in vitro and in vivo.

Major Program

Major program serves the major needs of the scientific frontiers, national economic, social and S&T development and national security, deploys in advance, conducts multidisciplinary research, and plays the supporting and guiding role of improving the capability of indigenous innovation in China's basic research.

Major Program projects will be implemented by unified planning and research projects will be supported in batches. Research areas and guidance for Major Program will be determined on the basis of the development plan, priority areas, evaluation reports on funding and opinions from the expert consulting committees of NSFC's scientific departments.

NSFC only accepts integrated applications for each Major Program, which should include both the overall application for the Program and proposals for research projects. Proposals involving only part of the research areas or one of the research projects indicated in the Guide of Major Program will not be accepted.

Each Major Program application can contain no more than 5 projects. The applicant for the program must also be the PI for one of the projects. Each project application should have no more than 2 collaborative research institutions. The total number of Host Institute and Collaborative units may not exceed 5 for one overall application. (For those programs with special research design and number on Collaborative units, please refer to the *Guide* on Major Programs.)

Applicants should have the following qualifications:

- (1) Have experience of undertaking basic research projects;
- (2) Have senior academic position (title).

Post-docs, graduate students and those without home institutions are not qualified to apply.

Applicants should have excellent academic accomplishments, with considerable influence and team ability.

The duration for Major Program is 5 years. When writing the proposal, the applicant should type in: from Jan. 1, 2018 to Dec. 31, 2022, in the column for duration.

The Major Program applicant should first fill in the overall application form in the submission system and authorize all the project applicants. Unauthorized applicants cannot submit in NSFC's information system.

Applicants should compose the application based on the Major Program Composition Outline, select "Major Program" in the funding category, "Overall application" or "Project application" in the subclass introduction, select the relevant major program title in "annotation" and select the correct application code according to the research content (for those with specific requirements on application codes, please do as required by the guidance).

Overall application and project application should be submitted through the host institutions. The project application must be submitted prior to the overall application, which should be submitted after all project applications are successfully submitted and then the produced overall budget forms are confirmed.

In 2018, *the Second Group of Two Major Program Guide for the 13th Five-Year Plan* is released. Applicants should follow the guidelines when writing proposals, focus on key scientific issues with strategic and fundamental significance, put forward clear, concentrated and interdisciplinary scientific targets, and pay attention to coordination and links with other national S&T programs. The research team should have good accumulation of research work, sufficient research conditions, the ability to do innovative work and a number of high level academic leaders.

The Third Group of Major Program Guide for the 13th Five-Year Plan will be released online on the NSFC website.

Porous Complexes for Energy Related Small Molecule Activation/Conversion

This major program supports research directed towards development of efficient and green new catalytic systems emphasizing new concepts, new strategies, and new porous complexes through integration of theories and methods of chemistry, material science and nanoscience. It aims to achieve the activation and conversion of energy related small molecules such as methane and carbon dioxide, and promote the innovation and development of precision chemistry to meet the needs of sustainable development.

I. Scientific Objective

In this program, porous complex materials with high activity, selectivity and stability will be created. Some new routes and new methods will be developed for the activation and conversion of energy related small molecules such as methane and carbon dioxide. A number of representative achievements with independent intellectual property rights are expected to be obtained. Efforts will be made to achieve industrial applications of one to two efficient catalytic systems, so as to the development of this area in the world.

II. Research Content

1. Porous complexes for CH₄ catalysis and conversion

Design and synthesize new type of porous complexes and hybrid materials between nanoparticle and porous complex; solve the problem of activation in inert C-H bond and construct new C-C/C-O bonds by coordinating super-molecule interaction within confined space and configuration of catalytic sites with high activities; achieve precise control the direct conversion of CH₄.

2. Porous complexes for CO₂ catalysis and conversion

Taking the advantage of porous complexes with the super ability to recognize and capture CO₂, construct multi-functional catalysts able to capture, enrichment and catalytic activity, and optimize and increase the binding energy between CO₂ and adsorption sites to solve the problems of low absorption and catalytic efficiency under the condition of industrial humidity; achieve direct conversion of CO₂ into chemical raw materials. Develop novel tandem reactions based on CO₂ conversion; synthesize chemical products of high value-added and low-carbon.

3. Porous complexes for electrochemical oxygen reduction and overall water splitting

Design and synthesize porous complexes with multi-catalytic sites and their derivatives; develop new catalysts to replace precious metals; reveal the energy and electron transfer pathway in the process of H-O bond breakage and H-H/O-O bond activation; achieve efficient oxygen reduction and overall water electrolysis in fuel cell.

III. Notices of Application

1. The illustration of annotations about the application is "Porous complexes for

energy related small molecule activation/conversion”.

2. The direct funding budget of application from applicants should not exceed 17 million yuan per project (including 17).

3. This project is accepted by the Department of Chemical Sciences.

Basic Theory and Key Technology for Characterization of Electromagnetic Properties and Reconfiguration of Complex Dynamic Spatial Multi-Targets

Characterization of electromagnetic properties and reconfiguration of complex dynamic spatial multi-targets is a common and basic scientific problem in radar identification and counter identification technology, and research in ground laboratory conditions is one of the hotspots in current research. It is also difficult and expensive to do the research in real flight conditions, not to mention small samples and not repeatable in real flight experiment. It is expected to make some breakthrough in basic theory and key technology in understanding, acquisition and verification of characterization of electromagnetic properties of complex dynamic spatial multi-targets, propose multi-parametric, multi-dimensional characterization models, and achieve multi-scale spatial temporal transformation and verification of characters agreement between ground and space.

I. Scientific Target

Characterization of electromagnetic properties and reconfiguration of complex dynamic spatial multi-targets, reveal mechanism of electromagnetic characters of dynamic complex targets, electromagnetic coupling mechanism of neighboring targets, construct models of electromagnetic characterization, reconfiguration of electromagnetic of targets in indoor complex electromagnetic field scenarios, and construct multi-target scenarios and far field electromagnetic environment of multi-beam or multi-wave position. Conduct experiment of multi-data sources, verify agreement of space ground electromagnetic properties of space target, and provide basic theory and key technology for radar identification and counter identification of multi-target in space.

II. Research Contents

1. Modeling and characterization of dynamic and multi-dimensional electromagnetic properties of multi-targets in space

Based on radar reflecting waves of multi-targets in complex electromagnetic environment, construct models of electromagnetic characterization, study laws of evolution and method of analyzing complex and dynamic scattering properties of electromagnetism of

multi-targets in space, reveal coupling mechanism of electromagnetic properties of close neighbor targets in space, and develop double base models of electromagnetism characterization and verification using double base dynamic experiment, so as to achieve complex and dynamic and multi-target coupled electromagnetic modeling of space targets.

2. Theory and method of electromagnetic modeling in ground indoor environment

Study amplitude, distribution and laws of evolution of transient electromagnetic wave in non-ideal conditions in indoor field, develop large indoor field transient electromagnetic simulation algorithm, electromagnetic coupling effect between various testing factors, evaluation of test efficiency, and provide theory and data supporting control and analysis of system errors in the test system, so as to achieve high precision prediction of multi-target multi-dimensional electromagnetic characters in limited space. The error of RCS simulation precision should be limited to within 3 dB.

3. Spatial temporal transformation and signal reconfiguration of radar detecting scenario of multi-targets in space

Study the generation and control of multi-source electromagnetic beams in indoor field, explore mechanism and method of controlling electromagnetic interference and signal interference, develop effective configuration of multi-radar detecting beam space. Explore adaptive method for radar regulation signal in limited indoor space, and develop scattered reflecting signal reconfiguration and process by incomplete pulse signals in limited space, so as to reconstruct dynamic radar detecting process of multi-targets in space on ground. For multi-source electromagnetic wave beam, the reconfiguration error should be less than 0.5 dB for excited signal pulse width between 0.1 μ s to 16 ms.

4. Measurement and check of multi-dimensional electromagnetic properties of dynamic targets in space

Study the theory and method of multi-dimensional electromagnetic properties of dynamic targets in space in large indoor field, analyze error source in laboratory measurement, develop error model for multi-scale target simulation, and achieve high precision measurement of complex multi-target in space and multi-dimensional electromagnetic properties. Study method of checking experimental results, and estimate the confidence level of indoor field on ground.

5. Studies on the space ground agreement of electromagnetic properties of complex and dynamic targets in space

Develop checking and revision method based on small sample data from dynamic flight tests; achieve inversion of radar reflection wave of space targets based on large indoor field data on the ground. The accuracy of computation and measurement should be 80%, and confidence level 90%.

III. Additional Notes on Application

1. Please select F0120 for the application code;
2. The budget is limited to 18 million yuan per project;
3. The application is accepted by the Department of Information Sciences

Major Research Plan

The Major Research Plan focuses on key basic scientific issues with strategic importance to the nation and major frontier areas and gives high priority identified on the basis of the capability and advantages in the country. Rather than individual project, the Major Research Plan is designed to be a program cluster which contains a number of projects with relatively identical objectives for innovative research resources integrity in order to explore the possible breakthroughs in the identified areas.

The Major Research Plan follows the principle of “definite objective, stable support, integration and refinement and leap-forward development”. The funding period for Major Research Plan projects is 8 years in general.

Applicants should meet the following eligibilities:

- (1) Having experience of undertaking basic research projects;
- (2) Bearing a senior academic position (title).

Post-doctors in station and graduate students are not eligible to apply. Researchers without affiliation to a research institution or whose home institutions have not been registered at NSFC cannot apply as the Principle Investigator.

One applicant may submit no more than one application in the same year (excluding Integrated Program and Strategic Research Program); and grantees of the Major Research Plan program are not allowed to apply for this kind of programs in the following year.

The Major Research Plan is framed with three types of programs, namely, the Fostering Program, Key Program and Integrated Program, of which each one is open to application. Proposals shall be prepared in accordance with the requirement for the Major Research Plan and outlines for proposal preparation, featuring interdisciplinary research, emphasizing on the contributions to solving key scientific issues and fulfilling the overall goals of the Major Research Plan. Applicants should select “Major Research Plan” for the column of the funding type in the application form of proposal, and Fostering Program, Key Program, or Integrated Program for the column of sub-type, and input the title of the Major Research Plan in the annotation.

Generally, duration for Fostering Program project is 3 years, for Key

Program project is 4 years, and that for Integrated Program project is determined by the Steering Committee of each Major Research Plan according to the actual need. For Fostering Program project and Key Program project, the collaborative organizations involved may not exceed 2 in number. The number of collaborative organizations involved in one Integrated Program project may not exceed 4. The main participants must be the actual contributor to the Integrated Program project, and total number of main participants may not exceed 9.

Regulations on sharing of data and information should be observed in order to achieve the overall scientific objectives and multi-disciplinary integration of the Major Research Plan.

Each Major Research Plan should hold an academic workshop or seminar once a year on related areas so as to strengthen academic exchange and achieve the overall scientific objectives and integration of disciplines. The principal investigators of the granted projects are required to participate in these activities.

For details of each Major Research Plan, please refer to the relevant sections of introductions on Major Research Plan in this *Guide to Programs*.

Other Major Research Plan Program Guidances will be released online on the NSFC website.

Physics and Application of New Optical Field Regulation

This major research plan aims at obtaining new type of optical field with specific multi-dimensional time space structures (polarization, phase, frequency, and pulse width and module field) by precise control of the physical process of the interaction of optical field and matter, studying the regulation of systems such as atomic, molecular, electron and artificial nano micro structures by the new type of optical field, discovering new phenomena and physics, and promoting application of optics in information science, chemistry, life sciences and material sciences.

I. Scientific Target

Main target of this major research plan is to study the construction, propagation, measurement and phase interference of new types of optical field, explore new physical concepts and related method of multi-dimensional optical field regulation required in research in physics, information processing and communications, materials, chemistry and life sciences, discover new phenomenon and effects through research in the interaction of new types of optical field and matter, develop related new techniques. By implementing this research plan, the NSFC aims to meet the need of national importance, provide knowledge for sustainable development and national security, foster high level research team and leading scientists of international importance.

II. Key Scientific Problem

This major research plan mainly funds multi-dimensional regulation physics and application of new types of optical field, multi-dimensional precision configuration, regulation and characterization of new type of optical field, and key problems in new physics, new effect and new applications related to the interaction of new type of optical field and matter.

III. Funding for 2017

In 2017, NSFC received 170 applications, among them, 33 for Key Projects, and 137 for Fostering Projects. After evaluation, 7 Key Projects and 15 Fostering Projects were granted. The total funding was 37 million yuan.

IV. Funding Plan for 2018

In 2018, NSFC plans to fund 20 Fostering Projects with strong emphasis on exploration. The funding will be 800,000 yuan per project for 3 years. NSFC also plans to fund 8 to 9 Key Projects for applications with good research background and potential to make breakthrough. The funding will be 4 million yuan per project for 4 years.

V. Funding Areas for 2018

1. Multi-dimensional construction, regulation and characterization of new types

of optical field, breaking the classical diffraction limit of phase interference, realizing the generation, transport, characterization and control at nano and sub nano level, promoting integration and application of low consumption, high speed and high level of integration nano photoelectric devices, hence providing new principles and new method for research in areas of information, life and material sciences.

Main research directions are:

(1) New principles and related effects related to the generation, transport, regulation and detection of new type of optical field;

(2) New principles and new effects in manmade nano micro structures, including photon crystals, surface Plasmon, micro optical cavity, metamaterial and meta surface;

(3) Developing functional device physics, technique and application based on new optical field and new structures.

2. New characteristics of the interaction between light and electron, atom, molecule and manmade nano micro structure and condensed matters beyond the diffraction limit, revealing new phenomena and new laws of the interaction of regulated optical field and important forms of matter, developing new concept and new theory, and core technology for super high spatial resolution, no-mark and fast imaging based on far field optical field.

Main research directions are:

(1) New effect, new principles and applications for the interaction between new types of optical field and matter;

(2) Far field, wide field, no-mark, dynamic super high resolution imaging based on optical regulation;

(3) Interactions between photon and electron, exciton, phonon at meso scale, and regulation of light absorption and radiation, and optical devices of light source, light regulation and detection of deep sub wavelength scale.

3. Study the generation and regulation of ultra-fast optical field, develop core technology for obtaining high energy ultra-short attosecond pulse, and reveal new characteristics of femtosecond and attosecond dynamics for matters such as atoms, molecules and condensed matters.

Main research directions are:

(1) Generation of attosecond new types of optical field, and new phenomena and new physics of its interaction with other matters;

(2) New principles, new methods and new technologies for multi-dimensional controls of ultra-fast optical field phase, amplitude, polarization and frequency, develop new technologies for multi-dimensional optical field regulation;

(3) Observation and regulation of ultra-fast behavior, molecular orbit and structure and its dynamic evolution process for atoms and molecules in the interior of matter, explore multi-body interactions for complex systems.

VI. Principles of Selection

All application must focus on new principles of new types of optical field regulation, focusing on 1 or 2 key problems.

1. Exploration in frontier areas is encouraged; priority will be given to the research with original creativeness;

2. Research focusing on discovering new phenomena, new physics, novel technologies and potential of applications is encouraged;
3. Interdisciplinary research, especially intercrossing with information, chemical, life and material a science is encouraged;
4. Integration of theory and experiment is preferred.

Generation and Evolution of Turbulent Structures and Mechanism of Its Effect

I. Scientific Target

Main goal of this major research plan is to obtain original results in developing new ideas, new theories, new methods and new technologies, solve several key difficulties in major engineering applications, so as to promote innovation capabilities, provide scientific theories for technology development. The research plan also aims at fostering outstanding talents in turbulent research, developing several interdisciplinary research platforms in turbulent research, developing basic and applied basic research in complex problems in turbulence, and a school of turbulent research with Chinese characteristics. We plan to make breakthroughs in the following 4 aspects:

1. New ideas based on turbulent structures, exploring disruptive ideas;
2. New theories based on structural unit, new models based on spatial temporal coupling and physical constraints;
3. New method of characterizing turbulent structures based on Lagrange views, and computational and experimental method for near boundary 3D turbulent structures with spatial temporal analysis of high precision efficiency;
4. New technology of flow control, and drag reduction, thermal protection and noise reduction, new design based turbulent structure, and improvement on turbulent software.

II. Key Scientific Problem

1. Dynamics of turbulent structure generation in different conditions, study transitions from the view of turbulent structure generation, and propose transition theory based on dynamics of turbulent structure generation by breaking the current framework stability theory.

2. Dynamics of multi-spatial temporal scales, study the evolution of turbulent structures from spatial temporal coupling, break theoretical framework of turbulent energy level process develop turbulent theory, computation method and experimental techniques based on multi-spatial temporal scale dynamics.

3. Mechanism and principles of controlling the impact on mechanical thermal and acoustic transport by turbulent structures by fine description of turbulent structures, hence break the traditional framework of viscous vortex model, and make accurate prediction and control of drag, heat flow and flow noises.

III. Funding Plan for 2018

It is going to fund about 20 fostering projects, with average funding of about 1 million yuan per project for 3 years, and 8 key projects, with average funding of about 4 million yuan per project for 4 years.

IV. Key Funding Areas for 2018

In the initial phase of the major research plan, NSFC is going to fund projects in the form of fostering projects and key projects. The fostering projects will be of the exploring and novel type, and key projects will be of the type having originality, solid research accumulation, and hopes of making breakthrough. NSFC encourages participation of different disciplines such as mechanics, mathematics, physics, atmospheric science, engineering thermal physics and information sciences.

The following 4 research directions will be funded.

1. Generation and evolution of complex turbulent structures

Study the transition mechanism and prediction models under curved surface, flexible surface and rotating boundary conditions. Study complex flow structures and transition mechanism of blade machines in dynamic and static interference process. Study dynamics of the coupling of turbulent structure and interface motion, and multi-scale characteristics and generation of turbulent structures in multi-phase turbulent mixing. Study the instability of multi-interface and turbulent mixing structures.

2. Multi-time space scale interactions of turbulent structure evolution

Study turbulent dissipation mechanism and turbulent mixing mechanism in high Reynolds number, and interactions of turbulent structure and shear, compression and basic process of thermodynamics. Reveal dynamic properties of turbulent structure in high speed flow with complex boundaries, develop big data mining and processing techniques for the analysis of turbulent structure evolution, develop method and models for the analysis of turbulent flows based on AI, develop turbulent models based on statistical laws of turbulent structure evolution, develop high precision RANS/LES model for unsteady turbulent flows, and study LES with multi-coupling constraints, and statistical and model theories based on time space evolution statistics.

3. Mechanism of impact of turbulent structure on mechanical, thermal and acoustic properties

Develop principles and method of drag reduction based on turbulent structure, study theories of flow noise in fluid solid couples systems, explore mechanism of generation of turbulence induced structure vibration and noise, develop LES for turbulent structure evolution and noises, study impact of hypersonic turbulent structure on aerodynamic and thermal properties, the wake of high speed turbulent flows and mechanism and modeling of cavities in turbulent flows and interactions of cavitation and turbulent flows.

4. High precision computation of turbulent flows and high resolution experimental techniques

Develop high precision computation method and efficient parallel algorithm for turbulent structures, develop high resolution 3D turbulent experimental techniques and display and measurement techniques, develop efficient, high precision, robust numerical simulation method and software for compressible turbulent flows, and develop high precision experiment measurement method and techniques for aero thermal properties of

hypersonic boundary layers.

V. Basic Principles of Selection

This major research plan requires:

1. Research should meet the requirement outlined in this guide;
2. Exploratory research is encouraged. Priority is given to new concept, new theory, new systems and new method of turbulent structure evolution and models;
3. Interdisciplinary research is encouraged;
4. International cooperation is encouraged.

Fundamental Theory and Key Technology of Coexisting-Cooperative-Cognitive Robots

Coexisting-Cooperative-Cognitive Robots (Tri-Co Robots) refer to the robots that can interact naturally with the working environment, human and other robots, adapt themselves to complex dynamic environments autonomously, and cooperate with each other. The Tri-Co robots are characterized as flexible and reconfigurable structure, multi-modal perception, and distributed and autonomous cooperation. This research initiative aims at developing theoretical foundations, key technology as well as systems for Tri-Co robots to meet the challenges in intelligent manufacturing, rehabilitation and national security, and lay down the foundations for the robotic technology development, commercialization and applications.

I. Scientific Objectives

This major research plan aims to develop innovative approaches, state-of-art research results, and advanced systems for Tri-Co robots. It will contribute to the development of innovation driven economy and future work force for science and technology, and push forward the development of robotic technology to new frontiers.

II. Major Research Topics

1. Kinematics and controllability of the integrated rigid-flexible-soft robots

Rigid-flexible-soft robot design and mechanical behavior analysis, dynamics and control for robot-human-environment interaction.

2. Multimodal perception of human-robot-environment multimodal interaction

Multimodal perception and situational awareness in unstructured environment, biometric signal-based behavioral perception and human-robot natural interaction.

3. Swarm intelligence and related software systems

Architecture for autonomous robot and swarm intelligence in robotics, polymorphic architecture of operating system for swarm robotics.

III. Major Research Directions in 2018

The following directions will be supported in the form of “Fostering Program” and

“Key Program”. The average funding of “Fostering Program” is 650,000 yuan for 3 years, and the average funding of “Key Programs” is 3 million yuan for 4 years.

Fostering Program

1. Structure, actuation and dynamics of robot mechanisms

- (1) Principles of movement and actuation mechanisms for rigid-flexible-soft multi-body coupling system;
- (2) Large-deformation actuators and variable stiffness mechanism for soft robots;
- (3) Human-robot-environment interaction dynamics and ergonomic design theory.

2. Autonomous operation of robots and human-robot collaboration

- (1) Robot autonomous operation in dynamic unstructured environment;
- (2) Understanding intention and behaviors in human-robot collaboration;
- (3) Human-robot interactive autonomous learning and mechanisms of knowledge evolution.

3. Swarm intelligence in robotics and robot software system

- (1) Multi-robot cooperation and control;
- (2) Behavior management of Tri-Co robots;
- (3) Intelligent software systems.

4. Other new principles of Tri-Co robots for structure design, perception and control

- (1) Design and control of collaborative robots;
- (2) Adaptation mechanism of human-robot interaction (HRI) to specialized tasks.

Key program

New principles and new methods of Tri-Co robots structures and drive, perception and interaction, intelligence and control, and system integration in the application such as intelligent manufacturing, rehabilitation and national security, etc., will be supported. Joint research effort between Medical and Engineering with focuses on rehabilitation is strongly encouraged. However, the research proposals entirely focusing on biological signal and information processing will not be considered. .

IV. Basic selection criteria

To ensure that the overall goal can be achieved, it is required that all proposed research should strictly follow the Notes to applications, and all proposals will be evaluated based on the following criteria:

- (1) Exploratory research in frontier fields is encouraged and priority will be given to the new research directions;
- (2) Interdisciplinary proposals with Engineering and Materials Science, Information Science, Mathematical Science and Medical Science are strongly encouraged;
- (3) Joint applications with outstanding international scholars in the field of robotics are strongly encouraged; priority will be given to the proposals with substantive international cooperation;
- (4) Proposals led by junior scholars will be considered with high priority;
- (5) The proposals not consistent with the objectives of this program and not related to Tri-Co robots will not be considered.

V. Notes to applications

(1) Please read the Notes to applications carefully before filing applications. This major research plan aims to guide research directions strategically and integrate advantages in related fields, then to build a project cluster with a unified research goal or direction. Proposals should focus on the key topics specified in the Notes to applications. The contributions to the focused scientific topic and to the overall research objectives of this major research plan should be illustrated clearly in the proposals. Proposals not complying with the Notes will not be accepted. If the applicant has undertaken other National Science and Technology Projects related to this major research plan, distinction and relationship between the proposed project and other related undertaken projects should be discussed in the “Research Background” in the proposals.

(2) Choose funding category of “major research plan” and sub-category of “Fostering Program” or “Key Program” in your application. Explanation of “Research on Fundamental Theory and Key Technology of Coexisting-Cooperative-Cognitive Robots/Tri-Co Robots” should be indicated. Application code should be chosen according to your specific research topic.

(3) The application should be submitted to the Department of Engineering and Materials Sciences in NSFC.

Young Scientists Fund

The Young Scientists Fund supports young scientists to freely choose their research topics within the funding scope of NSFC to conduct basic research, fosters the ability of young scientists to independently undertake research projects and conduct creative research, stimulates young scientists' creative thinking and trains backup talents for basic research.

Eligibility for applicants:

- (1) Have experience of doing basic research;
- (2) Have senior professional position (title) or PhD degree, or be recommended by 2 researchers with senior professional position (title) in the same research area;
- (3) Should be younger than 35 by Jan. 1 of the year of application (born on or after Jan. 1, 1983). Female applicants should be younger than 40 by Jan. 1 of the year of application (born on or after Jan. 1, 1978).

Full time PhD students who satisfy the above criteria may apply through their host institutions with the consent of their supervisors, but full-time master degree students can not apply. Those who are the PIs of ongoing NSFC projects or have undertaken projects of Young Scientists Fund, including one-year small fund for exploratory studies, and terminated or withdrawn projects, cannot apply again.

For Young Scientists Fund, the creative potential of the applicant is mainly evaluated. Applicants should follow the outlines of proposal for Young Scientists Fund when preparing applications. They may have up to 2 collaborating units within one proposal and the research period is 3 years in general. The funding period for applications submitted by post-doctors is decided in consideration of the letter of commitment from their host institutions.

In 2017, a total of 17,523 Young Scientist Fund projects were funded. The direct cost was 400.27 million yuan. The average funding was 228.4 thousand yuan per project, with a success rate of 22.41% and a decrease of 0.48% over that of 2016 (for the funding situation, please refer to the table below).

In 2018, the average funding intensity for Young Scientist Fund is 250,000 yuan per project (200,000 yuan for management science department). Please write the application truthfully according to the actual need for research.

Funding for the Young Scientists Fund in 2017

Unit: 10,000 yuan

Department	No. of applications	Awards			Success rate (%)	
		No. of awards	Funding for direct cost	Average funding for direct cost		Share of NSFC total funding for direct cost (%)
Mathematical and physical sciences	5,899	1,749	42,160	24.11	10.53	29.65
Chemical sciences	6,161	1,541	37,400	24.27	9.34	25.01
Life sciences	10,566	2,395	57,460	23.99	14.36	22.67
Earth sciences	6,026	1,712	41,270	24.11	10.31	28.41
Engineering and materials sciences	13,131	3,080	73,910	24.00	18.47	23.46
Information sciences	7,620	2,031	49,370	24.31	12.33	26.65
Management sciences	4,127	815	14,690	18.02	3.67	19.75
Health sciences	24,665	4,200	84,010	20.00	20.99	17.03
Total	78,195	17,523	400,270	22.84	100.00	22.41

Department of Mathematical and Physical Sciences

The fostering of young scientists is particularly important for the development of mathematical and physical sciences. The Department has always been paying attention to fostering and supporting young scientists, and the success rate of the Young Scientists Fund has always been higher than that of General Program projects. In 2018, the Department will maintain a higher success rate for the Young Scientists Fund so as to give more young people the opportunity to do independent research, fostering outstanding talents for basic research.

Funding for Projects of the Young Scientists Fund in Department of Mathematical and Physical Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost funding	Success rate (%)	Projects	Direct cost funding	Success rate (%)
Mathematics	Mathematics I	259	4,793	30.72	290	6,382	29.74
	Mathematics II	284	5,247	29.01	308	7,071	29.62
Mechanics	Basic problems and methods in mechanics	10	208	30.30	5	122	31.25
	Dynamics and control	52	1,128	29.89	57	1,435	29.23
	Solid mechanics	120	2,671	29.63	128	3,182	29.56
	Fluid mechanics	70	1,555	29.54	84	2,069	29.68
	Bio-mechanics	20	446	29.85	22	547	28.95
	Explosive and impact dynamics	40	887	30.08	41	1,044	29.71
Astronomy	Astrophysics	38	868	29.92	43	1,161	31.16
	Astrometry and celestial mechanics	45	992	29.41	55	1,400	28.95
Physics I	Condensed matter physics	195	4,284.50	29.73	205	5,070	29.58
	Atomic and molecular physics	48	1,050.50	30.19	49	1,208	29.52
	Optics	125	2,785.00	29.76	145	3,575	29.65
	Acoustics	27	610.00	30.34	27	649	30.34
Physics II	Fundamental physics and particle physics	75	1,532	32.05	69	1,639	29.74
	Nuclear physics, nuclear technology and its application	81	1,820	28.62	79	2,034	29.15
	Particle physics and nuclear physics experimental facilities	83	1,924	28.72	82	2,084	29.18
	Plasma physics	58	1,289	30.69	60	1,488	30.93
Total		1,630	34,090	29.80	1,749	42,160	29.65
Direct cost per project		20.91			24.11		

Department of Chemical Sciences

The Department of Chemical Sciences upholds the principle of people first and fosters innovative talents, brings into full play the maintaining and fostering role of the Young Scientists Fund, and steadily enhances the funding following the idea of properly controlling the funding intensity and further expanding the funding scope. The Young Scientists Fund stresses on the research projects with innovative ideas, discourages the research that simply continue the advisors' topics, and gives less weight to research accumulation and the constitution of the relevant research teams, so as to facilitate the growth of young scientists.

In 2018, the Department will have a comprehensive readjustment for disciplines to conduct classified funding and management based on the main research orientations of chemistry and chemical engineering. This will be helpful for better adaption to the trend of international chemical development and will promote the transformation development of research in chemistry and chemical engineering in China. The applicants should read the instructions of all research areas carefully (refer to the General Program Projects) and select the proper application code.

The new research orientations funded by the Department of Chemical Sciences are listed as follows: (1) synthetic chemistry; (2) catalysis and surface/interface chemistry; (3) chemical theory and mechanism; (4) chemical metrology; (5) materials chemistry and energy chemistry; (6) environmental chemistry; (7) chemical biology; (8) chemical engineering and industrial chemistry.

Funding for Projects of the Young Scientists Fund in Department of Chemical Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Success rate (%)
Division I	Inorganic	213	4,264	26.17	203	4,925	25.15
	Analytical	164	3,283	26.16	167	4,053	25.30
Division II	Organic chemistry	258	5,165	26.17	241	5,849	25.37
	Chemical biology				54	1,311	25.47
Division III	Physical chemistry	280	5,607	26.24	292	7,086	25.35
Division IV	Polymers	95	1,902	26.24	112	2,719	25.63
	Environmental chemistry	178	3,564	26.06	177	4,306	25.21
Division V	Chemical engineering	262	5,245	23.48	295	7,151	23.77
Total or average		1,450	29,030	25.64	1,541	37,400	25.01
Direct cost per project		20.02			24.27		

Department of Life Sciences

In 2017, the Department of Life Sciences received a total of 10,566 applications for the Young Scientists Fund. 10,238 applications were accepted and 2,395 projects were funded with a success rate of 22.67%. The average direct cost of funding was 239,900 yuan per project. The Department will continue to follow the principle of “stabilizing research teams, fostering young talents, stimulating innovative thinking and supporting independent research” for the Young Scientists Fund, and provide steady support to researchers at the early stage of their academic career. In 2018, the average direct cost of funding will be roughly the same as that in 2017. For application details and special notifications, please refer to the section of General Program of the Department in this *Guide to Programs*.

Funding for Projects of the Young Scientists Fund in Department of Life Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Success rate (%)
Division I	Microbiology	151	3,011	24.08	160	3,842	22.86
	Botany	139	2,775	25.88	156	3,740	26.76
Division II	Ecology	157	3,146	26.61	160	3,843	26.02
	Forestry	143	2,866	20.11	169	4,046	21.34
Division III	Biophysics/Biochemistry/ Molecular biology	102	2,036	25.00	105	2,522	26.85
	Immunology	58	1,163	29.74	58	1,400	27.49
	Biomechanics and tissue engineering	68	1,368	20.54	72	1,739	20.81
Division IV	Neurosciences	52	1,036	21.14	56	1,332	21.79
	Psychology	63	1,251	20.45	67	1,609	20.06
	Physiology & integrative biology	43	869	23.89	47	1,134	25.13
Division V	Genetics and bioinformatics	110	2,211	25.82	114	2,746	24.73
	Cell biology	72	1,445	23.69	94	2,256	32.87
	Developmental biology and reproductive biology	50	995	27.93	50	1,206	24.75
Division VI	Agriculture and crop sciences	180	3,594	19.52	206	4,940	20.44
	Food science	193	3,867	18.38	216	5,172	19.57
Division VII	Plant protection	123	2,453	20.53	133	3,198	21.49
	Horticulture and plant nutrition	133	2,660	19.79	140	3,351	19.64
Division VIII	Zoology	72	1,433	25.99	74	1,766	26.06
	Animal husbandry and grassland science	107	2,143	20.54	118	2,822	20.92
	Veterinary medicine	111	2,231	26.00	116	2,785	23.82
	Aquaculture	81	1,617	19.95	84	2,011	19.91
Total		2,208	44,170	22.27	2,395	57,460	22.67
Direct cost per project		20.00			23.99		

Department of Earth Sciences

In 2017, the Department of Earth Sciences received 6,026 applications for the Young Scientists Fund from 877 research institutions. Among them, 3,548 were from universities, accounting for 58.88%, and 2,246 from research institutes, accounting for 37.27%. Totally, 1,712 projects were funded with a fund of 412.7 million yuan (direct cost and hereinafter). The average funding was 241,100 yuan per project and the success rate was 28.41%. Among the projects funded in 2017, 1,007 were obtained by universities, accounting for 58.82%, and 668 by research institutes, accounting for 39.02%. One of the most important goals of NSFC is to foster outstanding young scientists continuously and steadily. The Department will further strengthen the funding for young scientists, especially outstanding young scientists. The main function of Young Scientists Fund is “cultivation”, and to provide more opportunities for young scholars at the very beginning of their career, especially for the researchers who are just awarded PhD degrees and start their basic research.

In 2018, the Department of Earth Sciences adjusted the structure of sub-disciplines in order to strengthen support for Environmental Geoscience. Applicants should pay close attention to the related changes.

Funding for Projects of the Young Scientists Fund in Department of Earth Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Funding rate (%)
Division I	Geography (including soil science and GIS)	616	12,197	28.44	640	15,451	28.37
Division II	Geology	374	7,399	28.46	391	9,431	28.40
	Geochemistry	129	2,545	28.54	136	3,274	28.45
Division III	Geophysics and space physics	158	3,120	28.52	178	4,273	28.53
Division IV	Marine science	223	4,409	28.48	225	5,417	28.45
Division V	Atmospheric science	122	2,410	28.50	142	3,424	28.40
Total		1 622	32,080	28.47	1 712	41,270	28.41
Direct cost per project		19.78			24.11		

Department of Engineering and Materials Sciences

In order to encourage and foster innovative young researchers and to create a good academic ecology, the Department will continue to implement favorable funding policy for the Young Scientists Fund. In 2017, the Department received 13,131 applications (268 rejected) for the Fund with an increase of 10.45%. 3,080 projects were funded with a total direct cost of 739.10 million yuan. The average funding was 240,000 yuan per project with a success rate of 23.46% (24.11% in 2016).

Please refer to the General Program and other related parts of this *Guide to Programs* for general instruction of the Department and detailed requirements on application.

**Funding for Projects of the Young Scientists Fund
in Department of Engineering and Materials Sciences in 2016 and 2017**

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Average funding for direct cost	Success rate (%)	Projects	Average funding for direct cost	Success rate (%)
Materials sciences I	Metallic materials	229	4,574	24.26	244	5,844	23.71
	Polymer materials	236	4,714	23.53	260	6,236	22.89
Materials sciences II	Inorganic non-metallic materials	358	7,154	23.72	380	9,128	23.68
Engineering sciences I	Metallurgy and mining science	311	6,219	23.26	339	8,136	23.05
Engineering sciences II	Mechanics and mechanical manufacturing	499	9,986	24.07	546	13,098	23.07
Engineering sciences III	Engineering thermo physics and energy utilization	227	4,545	23.84	249	5,964	23.10
Engineering sciences IV	Architecture, environmental and civil engineering	548	10,971	25.02	567	13,606	24.47
Engineering sciences V	Electrical science and engineering	188	3,752	24.80	204	4,904	23.10
	Hydrology and marine engineering	271	5,415	24.13	291	6,994	23.37
Total		2,867	57,330	24.11	3,080	73,910	23.46
Direct cost per project		20.00			24.00		

Department of Information Sciences

In 2017, the Department of Information Sciences received 7,620 applications for the Young Scientists Fund, which was increased by 1.46% compared with that in previous year. The Department funded 2,031 projects with an average success rate of 26.65%. The total direct cost funding was 493.7 million yuan and the average direct cost funding intensity was 243,100 yuan per project. In 2018, the Department will continue to pay attention to applications for the Young Scientist Fund, and increase properly the success rate. The direct cost funding intensity will be increased.

Funding for Projects of the Young Scientists Fund in the Department of Information Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost funding	Funding Rate (%)	Projects	Direct cost funding	Funding Rate (%)
Division I	Electronics and technology	177	3,506	27.44	192	4,692	27.08
	Information and communication system	181	3,639	27.18	179	4,354.5	27.25
	Information acquisition and processing	166	3,282	27.44	183	4,375.5	27.35
Division II	Theoretical computer science, computer software and hardware	121	2,435	26.59	121	2,934	29.16
	Computer application	256	5,121	26.64	283	6,991	29.06
	Network and information security	163	3,250	27.08	166	4,035	29.02
Division III	Control theory and control engineering	195	3,930	24.31	204	4,967	25.19
	Systems science and system engineering	66	1,311	21.78	68	1,574	22.30
	AI and intelligent system	160	3,206	23.64	175	4,258	24.31
Division IV	Semiconductor science and information devices	180	3,616	24.32	192	4,670	25.70
	Information optics and photoelectric devices	117	2,351	24.27	133	3,235	25.73
	Laser technology and technical optics	136	2,733	24.41	135	3,284	25.71
Total		1,918	38,380	25.54	2,031	49,370	26.65
Average Direct cost per project		20.01			24.31		

Department of Management Sciences

In recent years, the application quality and research level of the Young Scientists Fund in the Department of Management Sciences have shown significant improvement. Most applicants focus on scientific frontier areas, propose appropriate research methods, and have published high-level academic papers. On the other hand, some applicants still lack the understanding of NSFC's funding principles. Therefore, the proposed research content cannot be completed with the limited budget or within the proposed time period. Some other applicants repeat their PhD or postdoctoral research, or fail to provide information as required by NSFC.

In 2017, the Department received 4,127 applications for the Young Scientists Fund, much more than those in 2016. 815 projects were funded with a success rate of 19.75%, and the average funding for direct cost was 180,200 yuan per project.

Please note that the requirements given in the general description section of the General Program of the Department of Management Sciences in this *Guide to Programs* are also applied to the Young Scientists Fund. So please read carefully before submitting proposals.

Funding for Projects of the Young Scientists Fund in Department of Management Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate(%)	Projects	Direct cost	Success rate(%)
Division I	Management science and engineering	192	3 272	20.10	223	4 018	20.44
Division II	Business administration	199	3 392	19.88	209	3 766	20.31
Division III	Economic Sciences	130	2,220	17.93	188	3 388	19.09
	Macro-management and policy	176	2,996	19.05	195	3 518	19.08
Total or average		697	11 880	19.33	815	14 690	19.75
Direct cost per project		17.04			18.02		

Department of Health Sciences

Eligible young scientists are encouraged to submit proposals to the Department for funding. Applicants are expected to have the ability to undertake and complete research project independently, and the ability to identify creative scientific questions and research schemes. The PDF copies of no more than five relevant representative papers should be attached to the proposal. For more detailed information, please refer to sections in the Young Scientists Fund and General Program in this *Guide to Programs*.

The funding intensity for the Young Scientists Fund has been basically stable resulting from the continued increase of both national investment and the number of grants.

An overview of the award number, funding, and success rate of the Young Scientists Fund in 2016 and 2017 by the Department is listed in the following table.

Funding for Projects of the Young Scientists Fund in Department of Health Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Average funding for direct costs	Success rate (%)	Projects	Average funding for direct costs	Success rate (%)
Division I	Respiratory system, circulatory system, blood system	397	6,902	18.94	447	8,952	18.07
Division II	Digestive system, urinary system, endocrine system/metabolism and nutrition support, ophthalmology, otorhinolaryngology head and neck science, oral and craniomaxillo-facial Science	520	9,055	17.81	590	11,792	16.68
Division III	Neurological and psychiatric diseases, gerontology	316	5,490	18.92	357	7,131	17.53
Division IV	Reproductive system/perinatology/neonatology, medical immunology	218	3,799	19.66	247	4,940	17.31
Division V	Medical imaging and biomedical engineering, special medicine, forensic sciences	204	3,546	17.72	229	4,581	17.26
Division VI	Medical pathogenic microorganisms and infection, orthopedics and sports medicine, emergency and intensive care medicine/trauma/burns/laboratory medicine/plastic surgery/rehabilitation medicine	328	5,699	16.85	371	7,415	16.29
Division VII	Oncology (leukemia not included)	755	13,147	17.16	853	17,052	16.28
Division VIII	Skin and appendages, preventive medicine, epidemiology, occupational medicine, radiology	206	3,592	23.49	230	4,593	22.82
Division IX	Materia medica and pharmacology	275	4,781	22.95	307	6,172	23.29
Division X	Chinese medicine, Chinese materia medica, integrated Chinese and western medicine	501	8,699	15.23	569	11,382	14.15
Total		3,720	64,710	18.01	4,200	84,010	17.03
Direct cost per project		17.40			20.00		

Fund for Less Developed Regions

The Fund for Less Developed Regions supports scientists in specified regions of China to conduct creative research within the funding scope of NSFC, so as to foster and support researchers in the regions, to stabilize and gather outstanding talents to facilitate the construction of the regional innovation system as well as the social and economic development of the regions.

Applicants for the Fund for Less Developed Regions should meet the following qualifications:

(1) Have the experience of undertaking basic research project or doing other basic research;

(2) With senior academic position (title) or doctoral degree, or recommendations by 2 researchers with senior academic position (title) in the same research area.

Researchers meeting above qualifications and working in Inner Mongolia Autonomous Region, Ningxia Hui Autonomous Region, Qinghai Province, Xinjiang Uyghur Autonomous Region, Xinjiang Production and Construction Corps, Tibet Autonomous Region, Guangxi Zhuang Autonomous Region, Hainan Province, Guizhou Province, Jiangxi Province, Yunnan Province, Gansu Province, Yanbian Korean Prefecture of Jilin Province, Enshi Tujia and Miao Prefecture in Hubei Province, Xiangxi Tujia and Miao Prefecture in Hunan Province, Liangshan Yi Prefecture in Sichuan Province, Ganzi Tibetan Prefecture in Sichuan Province, Aba Tibetan and Qiang Prefecture in Sichuan Province, Yanan City and Yulin City in Shaanxi Province may apply for the Fund for Less Developed Regions. Researchers seconded by the Organization Department of the Central Committee of the CPC to Xinjiang Uyghur Autonomous Region and Tibet Autonomous Region as aid scientists for 3 or more years are also eligible to apply for this fund, on the condition that they provide certificate documents issued by the organization departments or personnel department of their host institutions to prove their identity of aid scientists when applying for this fund.

Researchers from other provinces and regions, and researchers from the affiliated institutions to the central government or the PLA in the above regions and provinces cannot apply, but may join the application as main participants. Graduate students can not apply, but on-job students may apply through their employer institutions at the consent of their supervisors. Researchers without a supporting institution or their supporting institutions have not been registered at NSFC cannot apply for the Fund for Less Developed Regions.

In order to provide balanced preference for qualified applicants for the Fund for Less Developed Regions and encourage them to apply for projects of General Program and other competitive programs of NSFC, researchers who have been granted 3 or more projects under the Fund for Less Developed Regions are not allowed to apply for this fund again since the year 2016, but the Fund for Less Developed Regions grants approved in 2015 and earlier will not be counted in.

Applications for Fund for Less Developed Regions should be in accordance with the fund's outline requirements. The number of cooperative research institutes shall not exceed 2, and the fund duration shall be 4 years (only post-doctoral researchers can fill in duration according to the written commitment from their supporting institution).

In 2017, the Fund for Less Developed Regions supported 3,017 projects with a total funding of 1.0952 billion yuan. The average funding was 363,000 yuan per project, and the success rate was 18.93%, which is 1.36% lower than that in 2016 (please refer to the table below for the funding statistics).

In 2018, the average funding for direct costs will be 400,000 yuan per project. Please refer to the actual funding levels of relevant departments and make budget request in a practical manner.

Please refer to sections of the General Program of various departments for the funding scope of the Fund for Less Developed Regions and funding statistics in recent years and relevant requirements.

Funding for Projects of the Fund for Less Developed Regions in 2017

Unit: 10,000 yuan

Department	No. of applications	Awards				Success rate (%)
		No. of awards	Funding for direct cost	Average funding for direct cost	Share of NSFC total funding for direct cost (%)	
Mathematical and Physical Sciences	758	183	6,940	37.92	6.34	24.14
Chemical sciences	1,212	244	9,330	38.24	8.52	20.13
Life sciences	3,576	765	29,060	37.99	26.53	21.39
Earth sciences	932	187	7,080	37.86	6.46	20.06
Engineering and Materials Sciences	2,078	372	14,140	38.01	12.91	17.90
Information sciences	1,237	218	8,280	37.98	7.56	17.62
Management sciences	782	136	3,820	28.09	3.49	17.39
Health sciences	5,360	912	30,870	33.85	28.19	17.01
Total	15,935	3,017	109,520	36.30	100.00	18.93

Department of Mathematical and Physical Sciences

The Fund for Less Developed Regions in mathematical and physical sciences is aiming at creating a good research environment for these regions, fostering and stabilizing an appropriate amount of researchers, training talents in basic research for local scientific and technological development, and increasing the capability of solving urgent scientific problems in the development of national economy and society. In the evaluation, special attention is paid to researches that have relative good research background with regional characteristics and advantage, so as to give full play to the role of the Fund for Less Developed Regions in talent fostering, and strengthen the support to researchers in the western regions of China.

**Funding for Projects of the Fund for Less Developed Regions
in Department of Mathematical and Physical Sciences in 2016 and 2017**

Unit: 10 000 yuan

Divisions		2016			2017		
		Projects	Direct cost funding	Success rate (%)	Projects	Direct cost funding	Success rate (%)
Mathematics	Mathematics I	41	1,436	27.03	48	1,698.5	28.07
	Mathematics II	43	1,588	25.15	35	1,247.5	20.23
Mechanics	Basic problems and methods in mechanics				2	76	50.00
	Dynamics and control	3	135	21.43	3	130	21.43
	Solid mechanics	11	446	24.44	10	397	22.73
	Fluid mechanics	6	235	42.86	5	189	23.81
	Bio-mechanics				1	44	20.00
	Explosive and impact dynamics	1	42	100.00	1	42	33.33
Astronomy	Astrophysics	7	288	35.00	9	360	33.33
	Astrometry and celestial mechanics	2	83	18.18			
Physics I	Condensed matter physics	22	868	27.16	25	985	24.04
	Atomic and molecular physics	5	208	29.41	8	326	30.77
	Optics	15	643	26.32	11	446	20.00
	Acoustics	2	79	25.00	3	121	30.00
Physics II	Fundamental physics and particle physics	10	393	27.03	7	266	19.44
	Nuclear physics, nuclear technology and its application	7	291	41.18	8	321	29.63
	Particle physics and nuclear physics experimental facilities	1	48	14.29	3	133	37.50
	Plasma physics	4	167	22.22	4	158	20.00
Total		180	6,950	26.87	183	6,940	24.14
Direct cost per project		38.61			37.92		

Department of Chemical Sciences

On the basis of stabilizing the funding scale of the Fund for Less Developed Regions, the Department of Chemical Sciences will make efforts to further promote the research quality and efficiency of the Fund, stabilize a batch of research talents for fundamental research, and continuously bridge the gap with the developed regions. Applicants are encouraged to carry out research by taking advantage of the local resources, so as to promote the economic development for the regions in a coordinated way.

In 2018, the Department will have a comprehensive readjustment for disciplines to conduct classified funding and management based on the main research orientations of chemistry and chemical engineering. This will be helpful for better adaption to the trend of international chemical development and will promote the transformation development of research in chemistry and chemical engineering in China. The applicants should read the instructions of all research areas carefully (refer to the General Program Projects) and select the proper application code.

The new research orientations funded by the Department of Chemical Sciences are listed as follows: (1) synthetic chemistry; (2) catalysis and surface/interface chemistry; (3) chemical theory and mechanism; (4) chemical metrology; (5) materials chemistry and energy chemistry; (6) environmental chemistry; (7) chemical biology; (8) Chemical engineering and industrial chemistry.

Funding for Projects of the Fund for Less Developed Regions in Department of Chemical Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Success rate (%)
Division I	Inorganic	38	1,491	21.84	36	1,371	20.11
	Analytical	31	1,216	22.14	27	1,028	20.00
Division II	Organic chemistry	50	1,963	22.12	55	2,094	20.22
	Chemical biology				6	229	22.22
Division III	Physical chemistry	34	1,334	22.22	34	1,294	20.48
Division IV	Polymers	15	590	22.06	16	609	20.51
	Environmental chemistry	31	1,216	22.30	30	1,142	20.27
Division V	Chemical engineering	39	1,530	21.08	40	1,563	19.32
Total or average		238	9,340	21.94	244	9,330	20.13
Direct cost per project		39.24			38.24		

Department of Life Sciences

In 2017, the Department of Life Sciences received 3,576 applications for the Fund for Less Developed Regions (accepted 3,419 as eligible applications), and funded 765 projects. The success rate was 21.39% with the average direct cost of 379,900 yuan per project. The average funding for 2018 will be similar to that of 2017. In the future, the Department will continue to follow the principle of “fostering regional talents, supporting sustained exploration, gathering outstanding talents and promoting regional development” for this Fund, provide steady support to local talents and support researches related to local resources and natural conditions. For details about funding scope, etc., please refer to the sections in the General Program of the Department in this Guide.

Funding for Projects of the Fund for Less Developed Regions in Department of Life Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Success rate (%)
Division I	Microbiology	44	1,705	24.04	42	1,615	20.69
	Botany	60	2,330	23.53	58	2,193	21.17
Division II	Ecology	67	2,604	23.67	79	3,000	21.64
	Forestry	68	2,661	23.61	66	2,499	21.71
Division III	Biophysics/Biochemistry/Molecular biology	14	551	24.56	12	459	21.43
	Immunology	7	284	22.58	6	221	22.22
	Biomechanics and tissue engineering	6	216	22.22	7	255	23.33
Division IV	Neurosciences	9	341	23.08	10	365	22.73
	Psychology	8	297	24.24	9	324	23.08
	Physiology & integrative biology	11	442	22.92	10	365	23.26
Division V	Genetics and bioinformatics	28	1,098	23.93	19	739	20.65
	Cell biology	14	530	24.56	13	476	23.21
	Developmental biology and reproductive biology	10	407	22.73	8	306	21.62
Division VI	Agriculture and crop sciences	89	3,475	22.70	91	3,468	20.54
	Food science	62	2,415	21.68	66	2,507	21.64
Division VII	Plant protection	49	1,922	23.33	50	1,921	20.92
	Horticulture and plant nutrition	60	2,339	23.72	69	2,626	21.56
Division VIII	Zoology	27	1,051	24.32	27	1,029	21.60
	Animal husbandry and grassland science	63	2,453	23.25	73	2,788	21.73
	Veterinary medicine	37	1,458	23.27	39	1,479	21.55
	Aquaculture	13	521	22.41	11	425	19.30
Total		746	29,100	23.30	746	29,060	21.39
Direct cost per project		39.01			37.99		

Department of Earth Sciences

In 2017, the Department of Earth Sciences received 932 applications for the Fund for Less Developed Regions from 140 research institutions. Among them, 806 were from universities, accounting for 86.48%, and 114 from research institutes, accounting for 12.23%. Totally, 187 projects were funded with a direct cost of 70.8 million yuan. The average fund was 378,600 yuan per project and the success rate was 20.06%. Among the projects funded in 2017, 168 were obtained by universities, accounting for 89.84%, and 16 by research institutes, accounting for 8.56%.

In 2018, the Department of Earth Sciences adjusted the structure of sub-disciplines in order to strengthen support for Environmental Geoscience. Applicants should pay close attention to the related changes.

Funding for Projects of the Fund for Less Developed Regions in Department of Earth Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Success rate (%)
Division I	Geography (including soil science and GIS)	117	4,523	22.29	118	4,475	20.03
Division II	Geology	24	913	22.64	23	881	19.83
	Geochemistry	16	603	22.86	20	737	20.62
Division III	Geophysics and space physics	8	327	21.05	7	273	19.44
Division IV	Marine science	8	319	21.62	7	258	20.59
Division V	Atmospheric science	10	405	21.28	12	456	20.00
Total		183	7,090	22.24	187	7,080	20.06
Direct cost per project		38.74			37.86		

Note: The statistics of this table was made according to the former sub-disciplines in the Department of Earth Sciences before 2017.

Department of Engineering and Materials Sciences

According to NSFC policy on the Fund for Less Developed Regions, the Department of Engineering and Materials Sciences will provide steady support to foster researchers in these regions, and encourage applicants to do basic researches by taking advantage of local resources and for regional economic development. In 2017, the Department received 2,078 applications (69 rejected) for the Fund with an increase of 6.73%. 372 projects were funded with a total direct cost of 141.40 million yuan. The average funding was 380,100 yuan per project with a success rate of 17.90% (17.51% in 2016).

Please refer to the General Program and other related parts of *Guide to Programs* for general instruction by the Department and the funding scope for the Fund.

**Funding for Projects of the Fund for Less Developed Regions
in Department of Engineering and Materials Sciences in 2016 and 2017**

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Average funding for direct cost	Success rate (%)	Projects	Average funding for direct cost	Success rate (%)
Materials sciences I	Metallic materials	33	1,324	17.55	37	1,415	17.29
	Polymer materials	22	895	17.32	24	907	18.46
Materials sciences II	Inorganic non-metallic materials	39	1,545	17.49	43	1,628	17.70
Engineering sciences I	Metallurgy and mining science	47	1,870	17.03	52	1,960	17.87
Engineering sciences II	Mechanics and mechanical manufacturing	58	2,342	17.74	63	2,378	18.42
Engineering sciences III	Engineering thermo physics and energy utilization	18	703	16.98	18	678	19.57
Engineering sciences IV	Architecture, environmental and civil engineering	68	2,707	17.75	74	2,860	17.29
Engineering sciences V	Electrical science and engineering	21	865	17.21	24	905	17.91
	Hydrology and marine engineering	35	1,379	17.95	37	1,409	18.14
Total		341	13,630	17.51	372	14,140	17.90
Direct cost per project		39.97			38.01		

Department of Information Sciences

In 2017, the Department of Information Sciences received 1,237 applications for the Fund and funded 218 projects with a total direct cost of 82.8 million yuan. The success rate was 17.62% and the average direct cost was 379,800 yuan per project. In 2018, the Department will continue to give preferential support to the Fund for Less Developed Regions, and properly increase the success rate. The average direct cost will be 400,000 yuan per project.

Funding for Projects of the Fund for Less Developed Regions in Department of Information Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost funding	Success rate (%)	Projects	Direct cost funding	Success rate (%)
Division I	Electronic science and technology	15	580	18.75	15	563	18.52
	Information and communication system	16	608	18.82	16	585	17.58
	Information acquisition and processing	20	768	19.23	18	657	17.48
Division II	Theoretical computer science and computer software and hardware	23	894	20.00	20	786	18.02
	Computer application	47	1,821	19.83	53	2,000	17.49
	Network and information security	20	760	19.61	20	758	17.24
Division III	Control theory and control engineering	18	666	21.18	16	606	18.60
	Systems science and system engineering	9	375	16.98	10	386	15.87
	AI and intelligent systems	22	862	19.60	23	878	17.83
Division IV	Semiconductor science and information devices	10	394	18.18	12	472	17.65
	Information optics and photoelectric devices	6	237	19.35	7	274	17.50
	Laser technology and technical optics	8	315	20.51	8	315	17.39
Total		214	8,280	19.40	218	8,280	17.62
Average funding per project		38.69			37.98		

Department of Management Sciences

In 2017, the Department of Management Sciences received 782 applications for the Fund for Less Developed Regions, slightly more than those in 2016. 136 projects were funded with a success rate of 17.39%, and the average funding for direct cost was 280,900 yuan per project.

In 2018, the average funding for direct cost will be approximately 300,000 yuan per project, and the duration will be 4 years.

Please note that the requirements described in the general description section of the General Program of the Department of Management Sciences in this *Guide* are also applied to the Fund for Less Developed Regions. So please read carefully before submitting proposals.

Funded for Projects of the Fund for Less Developed Regions in Department of Management Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Direct cost	Success rate (%)	Projects	Direct cost	Success rate (%)
Division I	Management science and engineering	30	888	20.69	32	899	17.88
Division II	Business administration	36	1,066	20.00	34	955	17.80
Division III	Economic sciences	33	975	18.86	34	955	16.92
	Macro management and policy	31	921	18.79	36	1,011	17.06
Total or average		130	3,850	19.55	136	3,820	17.39
Direct cost per project		29.62			28.09		

Department of Health Sciences

Applicants are encouraged to propose creative research ideas, and conduct basic research on local diseases by using modern medical research concepts and methods. Joint research by applicants with researchers in developed regions is also encouraged in order to fully utilize the various advanced research facilities in developed regions.

The PDF copies of no more than five relevant representative papers should be attached to the proposal. For more detailed information, please refer to sections in the Fund for Less Developed Regions and General Program in this guide.

In 2017, 5,360 proposals were received by the Department, and 912 of them were funded, with an average funding of 338,500 yuan (direct cost). The funding intensity of this program will remain the same as that in 2017 and the applicants are expected to fill in the budget form with detailed justification.

An overview of the award number, funding, and success rate of the Fund for Less Developed Regions in 2016 and 2017 by the Department is listed in the table below.

Funding for Projects of the Fund for Less Developed Regions in Department of Health Sciences in 2016 and 2017

Unit: 10,000 yuan

Divisions		2016			2017		
		Projects	Average funding for direct costs	Success rate (%)	Projects	Average funding for direct costs	Success rate (%)
Division I	Respiratory system, circulatory system, blood system	89	3,277	19.73	97	3,301	18.27
Division II	Digestive system, urinary system, endocrine system/metabolism and nutrition support, ophthalmology, otorhinolaryngology head and neck science, oral and craniomaxillo-facial Science	101	3,687	18.74	108	3,637	17.22
Division III	Neurological and psychiatric diseases, gerontology	54	1,973	16.51	59	1,999	14.64
Division IV	Reproductive system/perinatology/neonatology, medical immunology	37	1,339	18.50	40	1,353	18.02
Division V	Medical imaging and biomedical engineering, special medicine, forensic sciences	30	1,097	16.76	33	1,107	16.67
Division VI	Medical pathogenic microorganisms and infection, orthopedics and sports medicine, emergency and intensive care medicine/trauma/burns/laboratory medicine/plastic surgery/rehabilitation medicine	74	2,722	17.83	81	2,723	16.04
Division VII	Oncology (leukemia not included)	127	4,656	14.33	139	4,681	13.52
Division VIII	Skin and appendages, preventive medicine, endemiology, occupational medicine, radiology	57	2,136	22.09	62	2,141	22.79
Division IX	Materia medica and pharmacology	53	2,007	21.99	55	2,005	18.97
Division X	Chinese medicine, Chinese materia medica, integrated Chinese and western medicine	211	7,909	21.93	216	7,918	18.53
Total		820	30,800	18.80	840	30,810	18.02
Direct cost per project		36.68			33.85		

Excellent Young Scientists Fund

The Excellent Young Scientists Fund supports young scholars with good achievements in basic research to conduct innovative research in areas on their own choice, so as to promote fast growth of creative young talents and foster a number of outstanding talents on the international science frontiers. It mainly supports applicants who meet the following qualifications:

- (1) Citizenship of the People's Republic of China;
- (2) Under the age of 38 (for male, born on or after Jan. 1, 1980) or 40 (for female, born on or after Jan. 1, 1978) by Jan. 1 of the year of application;
- (3) Good scientific integrity;
- (4) Senior professional position (title) or PhD degree;
- (5) Experience of conducting basic research projects or other basic research;
- (6) No employment with foreign institutions;
- (7) Able to work in home institution for no less than 9 months per year.

Young Chinese scholars without Chinese citizenship may apply if they meet the requirements from (2) to (7) listed above.

The following people may not apply:

- (1) Grantees of the National Science Fund for Distinguished Young Scholars or the Excellent Young Scientists Fund;
- (2) Applicants for the National Science Fund for Distinguished Young Scholars in the same year;
- (3) Post-doctors and graduate students.

Special reminder to the applicants: In 2018, for Excellent Young Scientists Fund, pilot paperless application is carried out. In the process of submission, the supporting institution shall only confirm the online application and the attachments, without having to submit a paper form application. After the project has been approved, the signature and seal page (A4) of the application form should be submitted at the time of submitting the project plan. The signature and seal information should be consistent with that of the electronic application.

In 2017, NSFC received 4,867 applications for the Excellent Young Scientists Fund and granted 399 awards with a total funding of 518.7 million yuan for direct cost.

In 2018, the Fund plans to grant 400 projects, and the average funding is 1.3 million yuan per project for 3 years.

Funding for Projects of the Excellent Young Scientists Fund in 2017

Unit: 10,000 yuan

Department	No. of applications	No. of awards	Success rate (%)
Mathematical and physical sciences	563	48	8.53
Chemical sciences	695	57	8.20
Life sciences	716	58	8.10
Earth sciences	473	39	8.25
Engineering and materials sciences	888	73	8.22
Information sciences	761	59	7.75
Management sciences	183	15	8.20
Health sciences	588	50	8.50
Total	4,867	399	8.20

National Science Fund for Distinguished Young Scholars

The National Science Fund for Distinguished Young Scholars supports young scholars who have made outstanding achievements in basic research to select their own research directions and conduct creative research, so as to speed up the growth of young scientific talents, attract overseas talents and foster a group of prominent academic pacemakers in the forefront of international science and technology.

Eligibility for application:

- (1) Citizenship of the People's Republic of China;
- (2) Under the age of 45 by Jan. 1 of the year of application (born on or after Jan. 1, 1973);
- (3) Good scientific integrity;
- (4) Senior professional position (title) or PhD degree;
- (5) Experience of conducting basic research projects or other basic research;
- (6) No employment by foreign institutions;
- (7) Able to work in home institution for no less than 9 months per years.

Young Chinese scholars without Chinese citizenship may apply if they meet the requirements from (2) to (7) listed above.

The following people may not apply:

- (1) Post-doctors doing research or graduate students;
- (2) Grantees of ongoing project of the Excellent Young Scientists Fund (application is allowable on the year of completion of the ongoing project of the Excellent Young Scientists Fund);
- (3) Applicants for the Excellent Young Scientists Fund in the same year;
- (4) Having received the National Science Fund for Distinguished Young Scholars.

Notes to applicants:

To further simplify application materials and management procedure, since 2017 recommendation comments from the host institutions are not required, yet comments from Academic Committee or Expert Panel are still required.

In 2017, NSFC received 2,684 applications for the National Science Fund for Distinguished Young Scholars and granted 198 awards with a total funding

of 679.35 million yuan for direct cost.

In 2018, the National Science Fund for Distinguished Young Scholars plans to fund 200 projects, and the average funding is 3.5 million yuan per project for 5 years (2.45 million yuan per project for 5 years in the Department of Mathematical and Physical Sciences and the Department of Management Sciences).

Funding for Projects of the National Science Fund for Distinguished Young Scholars in 2017

Unit: 10,000 yuan

Department	No. of applications	No. of awards	Success rate (%)
Mathematical and physical sciences	311	24	7.72
Chemical sciences	393	30	7.63
Life sciences	353	26	7.37
Earth sciences	286	21	7.34
Engineering and materials sciences	501	38	7.58
Information sciences	399	28	7.02
Management sciences	92	7	7.61
Health sciences	349	24	6.88
Total	2,684	198	7.38

Science Fund for Creative Research Groups

The Science Fund for Creative Research Groups supports prominent middle-aged and young scientists to work as academic leaders and PIs on creative research focusing on key research issues, and fosters research groups with international influence.

Applicants and participants should meet the following requirements:

- (1) Experience of conducting basic research projects or other basic research;
- (2) Guarantee to work in home institutions for no less than 6 months per year within the funding period;
- (3) Have a research team based on long-term collaboration, including 1 academic leader and 5 or more backbone researchers;
- (4) The academic leader or the PI should have senior professional position (title), high academic qualifications and international influence, and be less than 55 years old by Jan. 1 of the year of application (born on or after Jan. 1, 1963);
- (5) Backbone researchers or group members should hold senior professional position (title) or have PhD degrees;
- (6) Applicants and participants should be in the same host institution.

PIs who have been awarded the Science Fund for Creative Research Groups before may not apply again. PI and participants with senior academic title of an ongoing project supported by the Science Fund for Creative Research Groups may not apply or participate in the application. Participants who quit from a project supported by the Science Fund for Creative Research Groups are not permitted to apply again in 2 years after the quit.

Applicants with senior academic titles may only apply for one project of the Science Fund for Creative Research Groups each year.

Notes to applicants:

To further simplify application materials and management procedure, since 2017 recommendation comments from the host institutions are not required, yet comments from Academic Committee or Expert Panel are still required.

In 2017, a total of 256 applications for the Science Fund for Creative Research Groups and 38 awards were made with a total funding of 389.55 million yuan for direct costs.

In 2018, the Science Fund for Creative Research Groups plans to support 38 awards, with duration of 6 years and a funding amount of 10.5 million yuan per award for direct cost (7.35 million yuan for awards by the Department of Mathematical and Physical Sciences and the Department of Management Sciences).

Awards Granted by the Science Fund for Creative Research Groups in 2017

Unit: 10,000 yuan

Department	No. of applications	Awards		Success rate (%)
		No. of awards	Direct cost	
Mathematical and physical sciences	33	5	4,935	15.15
Chemical sciences	29	5	5,250	17.24
Life sciences	34	5	5,250	14.71
Earth sciences	33	5	5,250	15.15
Engineering and materials sciences	44	6	6,300	13.64
Information sciences	36	5	5,250	13.89
Management sciences	14	2	1,470	14.29
Health sciences	33	5	5,250	15.15
Total	256	38	38,955	14.84

Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao

In order to take advantage of the overseas (including Hong Kong and Macao) resources in science and technology and encourage overseas excellent young scholars to serve mainland China, NSFC sets up the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao to support excellent overseas (including Hong Kong and Macao) Chinese scholars under the age of 50 to conduct high-level joint research with scientists in mainland China.

The Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao adopts a “2+4” funding mode, and extended funding may be requested at the end of the two-year period.

Two-Year Funding Projects

1. Eligibility for application:

(1) Under the age of 50 by Jan. 1 of the year of application (born on or after Jan. 1, 1968);

(2) Have good scientific integrity;

(3) Hold professional title of associate professor (or above) in the country (region) that applicant lives in;

(4) Engagement in scientific research abroad, in Hong Kong or Macao, and in charge of a laboratory or an important research project, and have made outstanding academic achievements recognized by international peers;

(5) Have collaborator in mainland China, and sign with the host institution of the collaborator the collaborative agreement wherein clarifications are contained on the title, research direction and the proposed goals of the joint research projects, the commitment of the host institution to provide main experimental facilities, human resources and other materials necessary for the joint research;

(6) Have strong research capabilities on both sides and the proposed research should be focused on the international science frontiers;

(7) Guarantee to work in the host institution for more than 2 months per year.

Both the applicant and the collaborator may apply for no more than one two-year project of the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao. Those who have not finished their post-doctor or graduate studies are not eligible collaborators in mainland China.

2. Notes to applicants:

(1) The two-year proposals of the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao are mainly evaluated on the academic aspects, the capacity of the applicants and the background of the cooperation with their collaborators;

(2) Applicants are advised to prepare the research proposals in accordance with the outlines for the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao, and submit the proposal with relevant required supplementary documents, including (i) valid certificate documents for their professional positions and research work, and (ii) agreement on collaboration.

In 2017, NSFC received 329 applications for the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao and granted 120 awards with an average funding of 180,000 yuan per project for direct cost. The total funding for direct cost amounted to 21.60 million yuan.

In 2018, the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao plans to fund 120 projects and the total funding for direct cost will be 180,000 yuan per project for 2 years.

Extended Funding Projects

1. Eligibility for application:

(1) Grantees of two-year projects of the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao who were approved in 2015 are eligible, if their projects have made substantial progress and have been completed in due time. For grantees of two-year projects of the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao who were approved in 2014, they are eligible for application if they did not apply for extended funding after the completion of the two-year project or failed to obtain extended funding;

(2) Applicants have to ensure enough time to stay at the host institution for research during the funding period (2 years) of the project;

(3) Applicants have to sign extended agreement of cooperation with the host institution. The agreement should include such content as the title, research direction and proposed goal of the joint research project, the host institution's promise to provide main experimental facilities, human resources, and other materials necessary for the joint research;

(4) Proposed extended cooperation should be focused on the international science frontiers with much significance and should facilitate disciplinary development and talent

fostering;

(5) The applicants are required to work in the host institution for more than 2 months per year.

Both the applicant and the collaborator may apply for no more than one extended project of the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao. Those who have not finished their post-doctor or graduate studies are not eligible collaborators in mainland China.

2. Notes to applicants:

(1) The extended funding mainly evaluate the progress of the cooperative work, whether the proposed research for extended funding is at the international frontier areas of research, and its contribution to disciplinary development and talent fostering;

(2) Applicants are advised to prepare their research proposals by providing accurate information in accordance with the outlines for the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao, and submit the proposals with relevant required supplementary documents, including (i) valid certificate documents for their professional positions and research work, and (ii) agreement on collaboration.

In 2017, NSFC received 82 extended funding applications for the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao and granted 22 awards with a total funding of 39.6 million yuan for direct cost.

In 2018, the Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao plans to fund 20 extended projects and the total funding for direct cost will be 1.8 million yuan per project for 4 years.

International (Regional) Cooperation and Exchange Programs

In order to improve the quality of China's scientific research and its international competitiveness, the International (Regional) Cooperation and Exchange Programs aim at funding Chinese scientists to conduct substantial cooperation with their international collaborators in science frontier and take full advantage of international scientific and technological resources on the basis of "equal cooperation, mutual benefits, and equal sharing of research results".

The funding system of the International (Regional) Cooperation and Exchange Programs is currently comprised of Key International (Regional) Joint Research Program, International (Regional) Joint Research and Exchange Programs funded under the Agreements/MoUs between NSFC and its foreign partners, and Research Fund for International Young Scientists.

Key International (Regional) Joint Research Program

The Key International (Regional) Joint Research Program (hereafter referred to as Key Joint Research Program), gives priority to research in the following areas: the priority funding areas of NSFC, areas that China urgently needs to develop, international mega projects and programs with Chinese participation, and utilizing large-scale scientific facilities abroad.

Researchers applying for this program shall, in accordance with the priority funding areas announced by relevant scientific departments, choose innovative joint research subjects centering on major scientific issues, and clarify the necessity and complementarities of the cooperation. Chinese applicants and their foreign partners shall have long-term steady collaboration (e.g., coauthored publications and continued personnel exchanges and interactions) and the overseas partners shall have matching resources for this research. In the process of cooperation, attention shall be given to the protection of intellectual property rights.

In 2017, altogether 107 out of the total 609 applications under the Key International (Regional) Joint Research Program were funded with a total funding of 255 million yuan for direct costs, and an average success rate of 17.57%.

In 2018, the Key International (Regional) Joint Research Program plans to fund 100 projects with the same average funding for direct costs per project as in 2017, and each project usually lasts for 5 years.

Eligibility of Applicants

- (1) With the title of professor or associate professor; and
- (2) Principal investigators of on-going or completed NSFC research project with the duration of no less than 3 years.

Eligibility of Foreign Partners

- (1) Independent researchers in charge of research laboratories or key research projects abroad; and
- (2) With the title of professor or associate professor in the host countries/regions.

Appendix Documents

Aside from the Chinese application form, the applicant should also submit the following documents as required:

(1) English Application Form: The English Application Form can be downloaded in NSFC's Internet-based Science Information System (ISIS) and should be uploaded online when filled in.

(2) Letter of Agreement: A copy of the Letter of Agreement signed between the collaborating PIs should be provided. Unilaterally signed letters are not valid. The Letter of Agreement mainly covers:

- (i) Research contents and objectives;
- (ii) List of collaborating PIs and participants;
- (iii) Period, mechanism and plan of joint research;
- (iv) Ownership, use and transfer of IP rights;
- (v) Relevant budgetary arrangements.

The applicant could refer to the sample Letter of Agreement which can be downloaded at <http://www.nsf.gov.cn/nsfc/cen/gjhz/cjwt/cjwt2011-10-26-06.html>.

(3) Documents verifying the foreign partners' holding of or participation in research projects related to the submitted application, as well as a list of publications related to the submitted application by the foreign partners in the past 3 years.

(4) Letter of confirmation by the foreign collaborator: If the foreign collaborator cannot sign the English Application Form, a letter of confirmation by him/her should be provided. The letter of confirmation should contain true contact information about the foreign collaborator. The letter of confirmation should be written in official forms including the title, logo and contact information of the foreign collaborator's employer. In addition, the letter of confirmation should contain detailed information such as the title of the research, the content and period of cooperation, the way to share IPR, etc. The foreign collaborator should confirm in the letter that he/she has read and agrees with the English Application Form.

Funding Priorities for the International (Regional) Joint Research Program in 2018:

1. Department of Mathematical and Physical Sciences

- (1) New methods and new technologies of experimental mechanics
- (2) Nonlinear mechanical issues of complex systems
- (3) Sky surveys and space observations
- (4) New astronomical technological methods associated with the large telescopes
- (5) Quantum computation and simulation in extensible solid physics system
- (6) Light field control and its interaction with matter
- (7) Precision measurement of physical constants
- (8) Research on high performance particle detector
- (9) Hadron structure and new cutting-edge research of hadron states
- (10) Physical uncertainty of magnetically confined fusion plasma and advanced measurement diagnosis technology
- (11) Physical issues in new energy
- (12) Joint research based on large-scale scientific facilities at home and abroad

2. Department of Chemical Sciences

Applicants are encouraged to focus on topics featuring basic, interdisciplinary, frontier and complementary research.

- (1) Catalysis and chemical precision synthesis
- (2) Green chemistry and the reaction and process of sustainable chemistry
- (3) Process and mechanism of surface and interface chemistry
- (4) Theoretical and computational chemistry of complex systems
- (5) Precise chemical measurement and imaging
- (6) Molecular assembly, structure and function

- (7) Molecular basis for advanced functional materials
- (8) Natural products chemistry and drug discovery
- (9) Chemical biology
- (10) Environmental pollution chemistry and control
- (11) Scientific issues on the medium scale in chemical process

3. Department of Life Sciences

Due attention will be paid to joint research between strong partnering research teams and joint research between Chinese researchers and foreign partners with superior research capacities or facilities. Chinese applicants are encouraged in taking the lead in joint research activities.

- (1) Basic and applied research on stem cells
- (2) Synthetic biology
- (3) Theory on the construction and bionic building of vital organs
- (4) Collection, data base and analysis of large-scale biological data
- (5) Adaptation and response of species and ecosystems to global climate change
- (6) Biodiversity
- (7) Cross-border monitoring, warning and prevention of major animal and plant diseases and biological invasion
- (8) Collection, evaluation and utilization of agricultural biological germplasm resources
- (9) Response of agricultural production to global climate change

4. Department of Earth Sciences

- (1) Global change and surface process
- (2) Environmental pollution and its impacts
- (3) Eco-environment effect of globalization and human activities
- (4) System and mechanism of metallogenic accumulation
- (5) Processes in and between continental plates
- (6) Coupling relation between deep and surface earth processes
- (7) Mechanism, monitoring, early warning and risk prevention and control of geological disasters
- (8) Solar-terrestrial energy transfer between and its impact on human activities
- (9) Water cycle and ecohydrological process
- (10) Mechanism and numerical simulation of weather and climate system changes
- (11) Asia monsoon-arid environmental systems and global environmental change
- (12) Origin and major evolutionary events of key biological taxa and the environmental backgrounds
- (13) Life process under extreme conditions
- (14) Dynamic process and mechanism of marine multi-scale interactions
- (15) Marine ecological system security and deep-sea biological resources
- (16) Advanced technology platforms to promote the development of earth sciences
- (17) Resources, environment and ecology along the Belt and Road regions

5. Department of Engineering and Materials Sciences

- (1) Energy materials
- (2) Nano material and devices
- (3) Biomedical materials
- (4) High performance structural materials

- (5) Sustainable materials
- (6) Resource circulation and clean metallurgy
- (7) Advanced manufacturing, green manufacturing and smart manufacturing
- (8) Sustainable energy, efficient and clean utilization of energy
- (9) High efficiency power electronic system
- (10) Efficient high quality motor system
- (11) Water resources and water environment
- (12) Urban water environment and water quality safety
- (13) Civil engineering disaster prevention and whole life reliability
- (14) Deep-sea engineering

6. Department of Information Sciences

- (1) Basic theory and key technology of electromagnetic vortex
- (2) THz science and technology
- (3) Intelligent network and its applications
- (4) High performance computation and analysis of scientific research data
- (5) Big data calculation theory and system practice
- (6) Basic theory and key technologies of new internet
- (7) Design method and application verification of new control system analysis
- (8) Novel high precision and reliable testing technology and system
- (9) High-performance robotics and advanced artificial intelligence system
- (10) Uv photodetectors
- (11) Integrated circuit design
- (12) Microwave photonics
- (13) Interactions between spatial structure light field and semiconductor materials
- (14) Micro-nano structure optoelectronic devices
- (15) Integrated theory and design of millimeter wave circuits and antennas
- (16) Detecting imaging theory and key technologies

7. Department of Management Sciences

- (1) Behavioral law in the management systems
- (2) Analysis, experiment and modeling of complex management systems
- (3) Complex engineering and complex operation management
- (4) Analysis and optimization of traffic system in mobile Internet environment
- (5) Data-driven financial innovation and risk laws
- (6) Laws of entrepreneurial activity and its ecosystem
- (7) Laws of the transformation and innovation of Chinese enterprises
- (8) Enterprise innovation behavior and national innovation system management
- (9) Management science issues in service economy
- (10) Laws governing China's green and low-carbon socio-economic development
- (11) Research on China's economic restructuring and mechanism reconstruction
- (12) Laws of the basic management of national security
- (13) Basic laws of state and social governance
- (14) Rules and mechanisms of new urbanization management
- (15) Mobile Internet medical and health management

8. Department of Health Sciences

In principle, PIs in programs with large funding amounts such as Key International (Regional) Joint Research Program, Major Program, Key Projects of Major Research Plan

Program granted in 2017 will not be considered for funding under the Key International (Regional) Joint Research Program in 2018.

(1) New mechanisms of the common pathology of development, inflammation, metabolism, probiotics, microenvironment, etc.

(2) Pathogenesis and precise diagnosis and treatment of major chronic diseases

(3) Epidemiology of chronic diseases and injuries and related prevention and intervention strategies

(4) Rapid identification, pathogenesis, prevention, early warning new treatment of emerging and emergency infectious diseases

(5) Infectious diseases and antibiotic resistance

(6) Frontier research on first aid, trauma, rehabilitation and regenerative medicine

(7) Women and children's health

(8) Research on the frontier of reproduction, development, aging related diseases

(9) Nutrition, environmental, genetic and health

(10) Stem cells and diseases

(11) Organ fibrosis and prevention mechanism

(12) Tissue and organ damage, dysfunction and intervention

(13) Protection of organs and replacement therapy

(14) Pathogenesis and intervention of neuropsychiatric disorders

(15) Mechanisms of immune-related diseases and new immunotherapy strategies

(16) Interdisciplinary scientific research on diseases

(17) Medical imaging and biomedical engineering

(18) Innovative medical technologies and personalized medicine

(19) Biomarkers and personalized medicine

(20) Discovery of new drug targets and pharmacological validation

(21) Modern scientific connotation of traditional Chinese medicine theories

(22) Material basis and mechanism of traditional Chinese medicine

(23) Basic research on special and forensic medicine

International (Regional) Cooperation and Exchange Programs under Agreements/MoUs

Jointly organized and funded by NSFC and foreign science funding agencies (or research institutions and international organizations), the International (Regional) Cooperation and Exchange Programs under Agreements/MoUs support bilateral and multilateral joint research and academic exchanges between Chinese scientists and their foreign partners. In recent years, greater efforts by NSFC have been focused on policy research on international collaboration, and both the cooperation network and funding areas have been expanded with the U.S., Canada, and Australia. More extensive exchanges have been conducted between NSFC and partners in South America. The partnership between NSFC and European partners has been promoted comprehensively by further enhanced diverse collaborative activities with respective European partner countries and the EU as a

whole. The collaboration mechanisms with Japan and South Korea have been further deepened, with expanded funding scale for the Asian 3 Foresight Program. The scientific cooperation with Israel and Singapore has also been promoted to more expanded research areas. Greater efforts have been put in furthering the bilateral cooperation with partners of key potentials and impacts in such developing countries as India, South Africa, Brazil, Thailand, Egypt, etc. Multi-lateral international cooperation between Chinese applicants and their international partners has been encouraged to take advantage of the coordinative role played by international scientific organizations in promoting cross-border scientific research plans, and participate in and conduct cross-border regional research plans. Besides, NSFC plays an active role in promoting the cooperation between Chinese scientists and their partners along the Belt and Road route. Adhering to the “one country, two systems” policy of the central government, NSFC has always been attaching significance to the collaboration between researchers in mainland China with partners in Hong Kong, Macao and Taiwan regions.

NSFC has by far concluded 91 cooperation agreements/MoUs with science funding agencies and research institutions in 49 countries/regions. By negotiation, NSFC reaches agreements with its foreign partners on cooperation and exchange pattern, funding area, volume of awards, funding amount and review mechanism. Based on mutual agreement, NSFC launches joint call for proposals with its foreign partners on their websites and then organize scientists to submit and review applications. The International (Regional) Cooperation and Exchange Programs under Agreements/MoUs include Joint Research Program and Personnel Exchange Program.

The Joint Research Program under Agreements/MoUs includes bilateral or multilateral joint research projects funded by NSFC and its international partners under the framework of cooperation agreements/MoUs signed between them to support Chinese researchers and their collaborators abroad to carry out research in basic sciences.

The Personnel Exchange Program under Agreements/MoUs aims to encourage NSFC grantees to participate in extensive international cooperation and exchange activities, and to enhance the innovativeness, talent training, disciplinary development and research quality of the on-going NSFC projects. The Personnel Exchange Program under Agreements/MoUs include personnel exchange program and academic conference program featuring the mobility of scientists. Meanwhile, it encourages scientists to maintain sound bi/multilateral relations with overseas partners through wide cooperation and exchange, laying a solid foundation for future in-depth and substantial collaboration. Academic Conference Program under Agreements/MoUs is aimed at supporting scientists to hold bilateral or multi-lateral international conferences in China or outside the mainland with a view to enabling Chinese scientists to keep pace with the latest research frontiers and hotspots in the international academic arena, to enhancing the partnership between Chinese scientists and their foreign peers, and to promoting the visibility of the results achieved by NSFC funded projects and raising the profile of China’s academic community.

Applicants could refer to the following introductions and the calls for proposals irregularly launched on NSFC website for application eligibility, priority funding areas, funding duration, and application requirements. Besides, applicants could also refer to the column for International Cooperation on NSFC’s website for relevant information about these programs in 2018. An introduction of the funding opportunities under this category in 2018 is listed as follows.

Asia and Africa

Japan

Japan Science and Technology Agency (JST)

The NSFC and JST Joint Research Program was initiated in 2004 on the theme of “S&T for Environmental Conservation and Construction of a Society with Less Environmental Burden”. Every year both sides negotiate and define specific priority areas for cooperation, followed by a bilateral workshop alternately held in China and Japan in the defined priority area. Participants in the annual workshop will propose concrete research topics for joint funding. Since 2015, the priority area for both sides has been changed into biological genetic resources.

In 2018, the joint call for proposals with specific collaborative topics will be launched by NSFC and JST on their websites respectively, and no more than 3 projects with duration of three years would be funded per year, with an investment of 2 million yuan (direct cost) by NSFC for each project.

Japan Society for the Promotion of Science (JSPS)

The call for proposals of exchange project and bilateral workshop is issued jointly by both NSFC and JSPS on their respective websites in June every year. The submission deadline is on Friday of the first complete week in September.

(1) Exchange project

NSFC and JSPS jointly support 10 exchange projects each year, the duration of which is 3 years. The exchange volume shall not exceed 60 person-days per year for each side.

(2) Bilateral workshop

NSFC and JSPS support 4 bilateral workshops per year organized jointly by Chinese and Japanese scientists, of which two are held in China and two in Japan. Participants of a bilateral workshop from each side must come from at least three institutions.

South Korea

NSFC and National Research Foundation of Korea (NRF) would jointly support joint research project, exchange project and bilateral workshop in 2018.

Two calls for proposals would be released in 2018 by both foundations on their respective websites, one for joint research project, and the other for exchange project & bilateral workshop. The joint funding decision for exchange project and bilateral workshop will be made at the Sino-Korean Joint Committee on Basic Science after deliberation and discussion of participating experts.

(1) Joint research project

Two three-year joint research projects are planned to be funded by NSFC and NRF in 2018 with NSFC investing 2 million yuan (direct cost) for each project.

(2) Exchange project

Around 20 two-year exchange projects are planned to be funded by NSFC and NRF in 2018.

(3) Bilateral workshop

Around 10 bilateral workshops are planned to be funded by NSFC and NRF in 2018. Participants of bilateral workshops from each side must come from at least three institutions.

Israel

NSFC and Israel Science Foundation (ISF) carry out their joint funding on joint research project and bilateral workshop.

(1) Joint research project

The priority areas are Life Science and Medical Science in 2018. Around 35 three-year projects are planned for joint funding with NSFC investing 2 million yuan (direct cost) for each project.

(2) Bilateral workshop

Each year, no more than 2 bilateral workshops are planned to be funded by NSFC and ISF. The workshop themes are decided by both sides through negotiation.

Three Asian Countries (China, Japan and South Korea)

Asian 3 Foresight Program

Jointly sponsored by NSFC, Japan Society for the Promotion of Science (JSPS) and National Research Foundation of Korea (NRF), the Asian 3 Foresight Program supports the cooperation of scientists from China, Japan and South Korea to conduct world-class cutting-edge research in selected strategic areas, so as to foster excellent young researchers and make contributions to the solution of common regional issues.

The priority area of Asian 3 Foresight Program for each year is in accordance with the theme of the Northeastern Asian Symposium jointly organized by NSFC, JSPS and NRF in the previous year. The priority funding area in 2018 is emerging materials innovation.

The call for proposals is simultaneously announced on the websites in November by the three parties and 2 five-year projects will be jointly funded annually, with NSFC investing 4 million yuan (direct cost) in each approved project.

South Africa

NSFC and National Research Foundation of South Africa (NRF) carry out joint funding on joint research project and bilateral workshop.

(1) Joint research project

For more information regarding application in 2018, please refer to the call for proposals to be launched by NSFC on its website in due time.

(2) Bilateral workshop

NSFC and NRF support bilateral workshops every year. The themes and number of workshops to be funded would be decided by both sides through negotiation.

Thailand

National Research Council of Thailand (NRCT)

NSFC and NRCT jointly support joint research project, exchange project and bilateral workshop.

(1) Joint research project

In 2018, the joint call for proposals with specific collaborative topics will be

launched by NSFC and NRCT on their websites respectively, and around 5 projects with duration of three years will be funded, with an investment of 2 million yuan (direct cost) by NSFC for each project.

(2) Exchange project

Chinese and Thai scientists are required to submit proposals to NSFC and NRCT respectively. The two agencies will make a funding decision after consultation.

(3) Bilateral workshop

NSFC and NRCT support bilateral workshops every year. The themes and number of workshops to be funded will be decided by both sides through negotiation.

Thailand Research Fund (TRF)

NSFC and TRF will jointly support joint research project, exchange project and bilateral workshop.

(1) Joint research project

In 2018, the joint call for proposals with specific collaborative topics will be launched by NSFC and TRF on their websites respectively, and around 5 projects with duration of three years will be funded, with an investment of 3 million yuan (direct cost) by NSFC for each project.

(2) Exchange project

Chinese and Thai scientists are required to submit proposals to NSFC and TRF respectively. The two agencies will make a funding decision after consultation.

(3) Bilateral workshop

NSFC and TRF support bilateral workshops every year. The themes and number of workshops to be funded will be decided by both sides through negotiation.

Singapore

NSFC and National Research Foundation of Singapore (NRF) carry out joint funding on joint research project and bilateral workshop.

(1) Joint research project

In 2018, the joint call for proposals with specific collaborative topics will be launched by NSFC and NRF on their websites respectively, and around 10 projects with duration of three years will be funded, with an investment of 2 million yuan (direct cost) by NSFC for each project.

(2) Bilateral workshop

NSFC and NRF support bilateral workshops every year. The themes and number of workshops to be funded will be decided by both sides through negotiation.

Pakistan

NSFC and Pakistan Science Foundation (PSF) carry out joint funding on joint research project and bilateral workshop.

(1) Joint research project

In 2018, the joint call for proposals with specific collaborative topics will be launched by NSFC and PSF on their websites respectively, and around 10 projects with duration of three years will be funded, with an investment of 2 million yuan (direct cost) by NSFC for each project.

(2) Bilateral workshop

NSFC and PSF support bilateral workshops every year. The themes and number of workshops to be funded will be decided by both sides through negotiation.

Sri Lanka

NSFC and National Science Foundation of Sri Lanka (NSF) carry out joint funding on joint research project and bilateral workshop.

(1) Joint research project

For more information regarding application in 2018, please refer to the call for proposals to be launched by NSFC on its website in due time.

(2) Bilateral workshop

NSFC and NRF support bilateral workshops every year. The themes and number of workshops to be funded will be decided by both sides through negotiation.

Other Cooperation Channels

NSFC has signed bilateral collaborative agreements for funding personnel exchange projects and bilateral workshops with Academy of Scientific Research and Technology of the Arab Republic of Egypt (ASRT), the Department of Science and Technology of India (DST), Council of Scientific & Industrial Research of India (CSIR), Iran National Science Foundation (INSF), Mongolian Foundation for Science and Technology (MFST), etc. The specific projects are jointly decided on a case by case basis through mutual agreement.

International Scientific Organizations

Center of European Nuclear Research (CERN)

According to the cooperation agreement with CERN, NSFC supports Chinese scientists' participation in LHC experiment at CERN together with the Chinese Ministry of Science and Technology and the Chinese Academy of Sciences.

International Center for Theoretical Physics (ICTP)

About 50 Chinese young scholars are funded by NSFC every year in the areas of mathematics, physics and earth sciences to participate in various research activities at ICTP, such as summer seminars and short-term joint research.

An open call for candidates of short-term specific activities at ICTP is announced on NSFC's website in November every year. A list of candidates is recommended by NSFC to ICTP after being selected by experts. The recommended candidates should apply to ICTP according to requirements of each ICTP activity.

International Institute of Applied Systems Analysis (IIASA)

NSFC encourages Chinese scientists to conduct multilateral cooperation with various IIASA Programs in the areas of energy, environment, land use, water, population, etc., and to jointly apply for research funding from various governmental organizations, private and national science foundations, World Bank and EU Framework Program.

NSFC provides full support for 5 to 7 Chinese young scholars to participate in the annual 3-month Young Scientists Summer Program (YSSP) from June to August at IIASA in Vienna every year. For detailed information, please refer to the IIASA website at www.iiasa.ac.at. Besides, NSFC also supports workshop, exchange and joint research projects jointly applied by Chinese and IIASA scientists.

As per IIASA's 10-Year Strategic Plan (2011 to 2020), Chinese scientists and IIASA researchers are encouraged to conduct joint scientific research on 3 global issues, i.e., food and water, energy and climate change, poverty and equity, based on systematic analysis methods.

For more information in 2018, please refer to the call for proposals to be launched by NSFC on its website in due time.

Consultative Group on International Agricultural Research (CGIAR)

NSFC has reached agreements with 11 CGIAR institutes/centers (i.e., Bioversity, CIAT, CIFOR, CIMMYT, CIP, ICARDA, ICRAF, ICRISAT, IFPRI, ILRI, and IRRI) to fund joint research projects conducted by scientists from both sides.

The call for proposals is released by NSFC on its website in February every year, and the deadline for application is Apr. 20th. Around 17 projects are planned for funding in 2018 with an average funding amount of 2 million yuan (direct cost) per project with duration of 5 years.

United Nations Environment Program (UNEP)

According to the cooperation agreement between NSFC and UNEP, both sides support scientists to conduct scientific collaborative research in the fields of eco-system management, climate change, resource efficiency and environment governance. Special importance is placed on cooperation with developing countries in Africa and Asian-Pacific regions.

The call for proposals is released by NSFC on its website in February every year, and the deadline for application is Apr. 20th. Around 4 projects are planned for funding in 2018, with a funding amount of 3 million yuan (direct cost) per project for 5 years.

International Union of Pure and Applied Chemistry (IUPAC)

According to the agreement among NSFC, Sao Paulo Research Foundation (FAPESP), the U.S. National Science Foundation (NSF), the German Research Foundation (DFG), and the International Union of Pure and Applied Chemistry (IUPAC), scientists from aforementioned countries have been co-funded to carry out joint research in the field of sustainable chemistry starting from 2013. IUPAC is responsible to provide the project implementation framework and scientific guidance including the launch, review and funding of multilateral projects with the support of all contracting funding agencies and research organizations. For more information regarding application in 2018, please refer to the call for proposals to be launched by NSFC on its website in due time.

Multilateral Collaboration under Belmont Forum (BF/IGFA)

According to the agreement between NSFC and Belmont Forum, since 2014 NSFC have supported Chinese scientists to participate in the multilateral cooperation under the

framework of Belmont Forum. For more information regarding application in 2018, please refer to the call for proposals to be launched by NSFC on its website in due time.

International Centre for Integrated Mountain Development (ICIMOD)

According to the agreement between NSFC and ICIMOD, starting from 2016, both sides have supported Chinese scientists, ICIMOD scientists and scientists from ICIMOD member countries to carry out cooperation and advance research in China and the surrounding countries in the region of Hindu Kush-Himalayas. For more information regarding application in 2018, please refer to the call for proposals to be launched by NSFC on its website in due time.

BRICS STI (Science, Technology and Innovation) Framework Program

According to the agreement to fund joint research projects under the framework of BRICS STI Framework Program among research funding agencies such as NSFC, Chinese Ministry of Science and Technology (MOST), Brazil National Council for Scientific and Technological Development (CNPq), Foundation for Assistance to Small Innovative Enterprises of Russia (FASIE), Russia Ministry of Education and Science (MON), Russian Foundation for Basic Research (RFBR), Department of Science and Technology of India (DST), Department of Science and Technology of South Africa (DST), and National Research Foundation of South Africa (NRF), the aforementioned parties have jointly supported scientists from the countries to carry out cooperation starting from 2016. For more information regarding application in 2018, please refer to the call for proposals to be launched by NSFC on its website in due time.

America and Australasia

USA

The National Science Foundation (NSF)

NSFC and NSF jointly support research projects and bilateral workshops.

(1) Joint research project

NSFC and NSF accept joint research applications in the areas of Food, Energy and Water in the year of 2018.

NSFC and NSF together fund joint research projects in the area of Food, Energy and Water between scientists of China and the U.S. NSFC provides up to 3 million yuan for each approved project with an implementation period of 4 years. In 2017, NSFC and NSF launched the first round of solicitation and up to seven projects of this kind will be jointly funded. For information about the specific application requirements for a new round solicitation in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and NSF will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

The National Institutes of Health (NIH)

NSFC and the U.S. National Institutes of Health (NIH) signed an MoU in Oct. 2010

to jointly support research projects and bilateral workshops.

(1) Joint research project

In 2016, NSF and NIH launched a call in cancer, allergic diseases, infectious diseases including HIV/Aids and comorbidities, medical immunology, mental health with an average funding of 2 million yuan (including direct costs and indirect costs) for 5 years per project. 24 projects of this kind were jointly funded.

For information about the specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and NIH will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

Bill & Melinda Gates Foundation (BMGF)

NSFC and Bill & Melinda Gates Foundation (BMGF) signed an MoU in Oct. 2015 to jointly support research projects and bilateral workshops.

(1) Joint research project

In Feb. 2016, NSFC and BMGF announced a call for proposals according to their agreement and 4 projects were jointly funded. For information about the specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and BMGF will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

Canada

Canadian Institutes of Health Research (CIHR)

NSFC and CIHR jointly support research projects and bilateral workshops.

(1) Joint research project

In 2017, NSFC and CIHR jointly supported research projects in the areas of mental health and dementia. NSFC provided up to 5 million yuan for each approved project with an implementation period of 5 years. 7 projects have been jointly supported. For information about the specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and CIHR will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

Fonds de Recherche du Québec (FRQ)

NSFC and FRQ jointly support research projects and bilateral workshops.

(1) Joint research project

In 2017, NSFC and the department of Natural Science and Technology of FRQ (FRQ-NT) launched a call for proposals in areas of global change and photonics. Four projects of this kind are expected to be jointly funded. In 2018, NSFC and the department of Health Research of FRQ (FRQ-S) will launch a call for proposals in the area of cardiovascular disease research. For specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and FRQ will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

Australia

National Health and Medical Research Council of Australia (NHMRC)

NSFC and NHMRC signed an agreement on cooperation in Jan. 2013 to jointly support research projects and bilateral workshops.

(1) Joint research project

For specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and NHMRC will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

New Zealand

Health Research Council (HRC)

In March 2017, NSFC and HRC signed an agreement of scientific cooperation to jointly support research projects and bilateral workshops.

(1) Joint research project

In 2018, NSFC and HRC will launch a call for proposals in the area of non-communicable diseases research. For specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and HRC will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

Chile

National Commission for Scientific and Technological Research of Chile (CONICYT)

In August 2014, NSFC and CONICYT signed an MoU to jointly support research projects and bilateral workshops.

(1) Joint research project

In 2017, NSFC and CONICYT launched a call for proposals in the area of natural disaster management. Up to 5 projects are expected to be jointly funded.

For specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and CONICYT will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

Argentina

National Scientific and Technical Research Council of Argentina (CONICET)

In June 2015, NSFC and CONICET signed an MoU to jointly support research projects and bilateral workshops.

(1) Joint research project

In 2017, NSFC and CONICET launched a call for proposals in the area of water resource management. Up to 5 projects are expected to be jointly funded.

For specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and CONICET will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

Cuba

Ministerio de Ciencia, Tecnología y Medio Ambiente-República de Cuba (CITMA)

In Feb. 2017, NSFC and CITMA signed an MoU to jointly support research projects and bilateral workshops.

(1) Joint research project

In 2017, NSFC and CITMA, in collaboration with Fonds de Recherche du Québec (FRQ), launched a call for proposals in the area of brain imaging. One project is expected to be jointly funded.

For specific application requirements in 2018, please refer to the call for proposals to be released on NSFC's website.

(2) Bilateral workshop

NSFC and CITMA will fund bilateral workshops in areas and numbers mutually identified and agreed by both parties.

Other Cooperation Channels

NSFC has signed bilateral collaborative agreements for funding joint research projects, personnel exchange projects and bilateral workshops with the Department of Energy of the United States (DOE), the Natural Sciences and Engineering Research Council of Canada (NSERC), the Australian Research Council (ARC), National Council for Scientific and Technological Development of Brazil (CNPq), Secretaria de Educacion Superior, Ciencia, Tecnologia e Innovacion of Ecuador (SENESCYT) and Consejo Nacional de Ciencia y Tecnología of Mexico (CONACTY), etc. The specific projects are jointly decided on a case by case basis through mutual agreement.

Europe

European Research Council (ERC)

Talent program

NSFC and ERC together fund Chinese researchers to go to Europe for single long-term or multiple short-term research visits (6 to 12 months in total). Chinese researchers could join the ERC-funded project teams to carry out joint research of mutual benefits in closely related scientific fields. NSFC will support the international travel expenses for Chinese researchers while ERC will provide their local and research costs in Europe through its funded projects. For detailed requirements, please refer to the call for

proposals to be launched on NSFC's website.

European Commission Research and Innovation (DG-RTD)

Joint research program

According to the agreement on cooperation, NSFC and DG-RTD provide support for multilateral research projects in areas of common interest between researchers from China and multiple European countries. Both sides will jointly launch call for proposals. Chinese and European applicants shall submit proposals to NSFC and DG-RTD respectively. For detailed requirements about applications in 2018, please refer to the call for proposals launched on NSFC's website.

European Union, Joint Programming Initiative Urban Europe (JPI)

Joint research program

NSFC and JPI Urban Europe of European Union will provide support for substantial cooperative research between researchers from China and European countries based on mutually interested areas and Sino-Euro cooperative foundation. Both sides will jointly launch call for proposals. Chinese and European applicants shall submit proposals to NSFC and JPI respectively. NSFC and JPI will make the joint decision for funding following agreed evaluation procedure. For detailed requirements about applications in 2018, please refer to the call for proposals launched on NSFC's website.

UK

Royal Society (RS)

(1) Exchange program

NSFC and the Royal Society of UK (RS) provide support for exchange visits between Chinese and UK researchers with duration of 2 years. NSFC provides up to 100,000 yuan for each project, covering international travel costs of Chinese scientists to UK and local costs of British scientists in China. RS provides at most 12,000 pounds for each project, covering international travel costs for British scientists to China and local costs for Chinese scientists in UK. For detailed requirements about applications in 2018, please refer to the call for proposals to be launched on NSFC's website.

(2) Talent program

NSFC, RS and the Academy of Medical Sciences (AMS) together set up the Talent Program to support the exchange visits as well as joint research activities between excellent young Chinese researchers and their British collaborators. NSFC will provide, in a period of three years, up to half a million yuan for each grantee while RS or AMS will offer up to 111 thousand pounds for each grantee to use as salary top-up, research and training as well as international cooperation and exchange costs. For detailed requirements about applications in 2018, please refer to the call for proposals to be launched on NSFC's website.

Royal Society of Edinburgh (RSE)

Exchange program

NSFC and the Royal Society of Edinburgh (RSE) provide joint funding for 2-year joint projects between scientists from China and Scotland, UK, in areas of common interest, according to the MoU signed between NSFC and RSE. The specific areas for cooperation and the number of projects to be approved each year are decided by both sides through negotiation. NSFC provides up to 100,000 yuan for each project, covering international travel costs for Chinese scientists to UK and local costs for British scientists in China. RSE

provides at most 12,000 pounds for each project, covering the international travel costs for British scientists to China and local costs for Chinese scientists in UK. NSFC and RSE announced their call for proposal simultaneously in both countries at the end of 2017. Chinese scientists should submit proposals directly to NSFC and Scottish scientists to RSE, and the result will come out in June of 2018. Projects approved will start on July 1, 2018 and end on June 30, 2020.

Research Councils UK (RCUK)

(1) Joint research program

NSFC, together with EPSRC, BBSRC, NERC, MRC, ESRC and STFC, the 6 research councils under RCUK, support substantial collaborations between scientists of both countries in areas of common interest, in consideration of the existing cooperation between scientists. NSFC and the RCUK will announce their call for proposal after discussion, and scientists from both countries shall submit proposals to their respective funding agencies. According to the agreed evaluation approach and procedures, NSFC and RCUK will jointly make decisions for funding. For detailed requirements about applications in 2018, please refer to the call for proposals to be launched on NSFC's website.

(2) Bilateral workshop

NSFC will continue to cooperate with EPSRC, BBSRC, NERC, MRC, ESRC and STFC to fund small-scale bilateral workshops co-organized by Chinese and British scientists.

British Council (BC)

Bilateral workshop

According to the MoU signed between NSFC and BC, both sides will together support small-sized bilateral academic workshops between young Chinese and British researchers to help them build up networks and thus have better career opportunities.

Germany

German Research Foundation (DFG)

According to the agreement on cooperation between NSFC and DFG, both sides provide support for joint research projects in areas of common interest between researchers from China and Germany.

For detailed requirements about applications in 2018, please refer to the call for proposals to be launched on NSFC's website. Scientists from both countries shall submit proposals to their respective funding agencies, and according to the agreed evaluation approach and procedures, NSFC and DFG will jointly make decisions for funding.

France

French National Center for Scientific Research (CNRS)

Exchange program

NSFC and CNRS support exchange visits with duration of 3 years between Chinese and French scientists. NSFC funds up to 150,000 yuan for each project, covering the international travel costs for Chinese scientists to France and the local costs for French scientists in China, and CNRS funds the local expenses for Chinese scientists in France and international travel costs for French scientists to China. For detailed application requirements in 2018, please refer to the call for proposals launched on NSFC's website.

Italy

Ministry of Foreign Affairs and International Cooperation (MAECI)

Exchange program

According to the cooperative agreement between NSFC and MAECI, both sides support exchanges between researchers and research teams from both countries. For detailed requirements about application in 2018, please refer to the call for proposals to be launched on NSFC's website.

National Research Council (CNR)

Exchange program

NSFC and CNR support 2-year exchanges between researchers and research teams from China and Italy. For detailed requirements about application in 2018, please refer to the call for proposals to be launched on NSFC's website.

Russia

Russian Foundation for Basic Research (RFBR)

(1) Joint research program

NSFC and RFBR encourage scientists or research teams of both countries to carry out substantial joint research in areas of common interest. The call for proposals for 2018 will be launched on NSFC's website.

(2) Exchange program

NSFC and RFBR jointly support exchange activities between Chinese and Russian researchers for duration of 2 years. Projects approved receive a two-year funding of 150,000 yuan from NSFC, for Chinese researchers' international travel and living expenses in Russia. RFBR also provides funding for Russian researchers' international travel and living expenses in China. The call for proposal will be announced on the websites of NSFC and RFBR in 2018.

Norway

The Research Council of Norway (RCN)

NSFC and RCN encourage scientists or research teams of both countries to carry out substantial joint research in areas of common interest. Both sides will jointly launch call for proposals. Chinese and Norwegian applicants shall submit proposals to NSFC and RCN respectively. NSFC and RCN will make the joint decision for funding following agreed evaluation procedure. For detailed requirements about applications in 2018, please refer to the call for proposals launched on NSFC's website.

Finland

Academy of Finland (AF)

(1) Exchange program

Chinese and Finnish researchers shall submit their applications for personnel exchanges and visits anytime throughout the year to their respective funding agencies 3 months in advance, and the joint funding decision is made according to respective evaluations and consultation.

(2) Bilateral workshop

Chinese and Finnish researchers shall submit their applications for bilateral workshops anytime throughout the year to their respective funding agencies 3 months in advance, and the joint funding decision is made according to respective evaluations and consultation.

Netherlands

Netherlands Organization for Scientific Research (NWO)

(1) Joint research program

NSFC and NWO encourage scientists or research teams of both countries to carry out substantial joint research in areas of common interest. For detailed requirements about application in 2018, please refer to the call for proposals to be launched on NSFC's website.

(2) Exchange program

Chinese and Dutch researchers shall submit applications for personnel exchanges and visits to their respective funding agencies 3 months in advance (for Chinese researchers visiting the Netherlands they shall submit 6 months in advance), and both organizations will make joint funding decisions based on respective evaluations. Applicants may submit their applications anytime throughout the year.

(3) Bilateral workshop

Chinese and Dutch researchers shall submit applications for bilateral workshops to their respective funding agencies 3 months in advance, and both organizations will make joint funding decisions based on respective evaluations. Applicants may submit their applications anytime throughout the year.

Austria

Austrian Science Foundation (FWF)

Joint research program

NSFC and FWF support substantial joint research between scientists from both countries in areas of mutual interest based on the existing collaboration. For detailed requirements about application in 2018, please refer to the call for proposals to be launched on NSFC's website. Researchers from both countries shall submit their proposals to their respective funding organizations. NSFC and FWF will jointly make decisions for funding according to the agreed evaluation approach and procedures.

Switzerland

Swiss National Science Foundation (SNSF)

Joint research program

NSFC and SNSF support substantial joint research between scientists from both countries in areas of mutual interest based on the existing collaboration. NSFC and SNSF will together publish guide to programs, decide through discussion how to organize evaluation and jointly make the final funding decision. Researchers from both countries shall submit their proposals to their respective funding organizations. For detailed requirements about applications in 2018, please refer to the call for proposals launched on NSFC's website.

Sweden

Swedish Research Council (VR)

Joint research program

NSFC and VR support substantial joint research between scientists from both countries in areas of mutual interest based on the existing collaboration. NSFC and VR will together publish guide to programs, decide through discussion how to organize evaluation and jointly make the final funding decision. Researchers from both countries shall submit their proposals to their respective funding organizations. For detailed requirements about applications in 2018, please refer to the call for proposals launched on NSFC's website.

Swedish Foundation for International Cooperation in Research and Higher Education (STINT)

Exchange program

NSFC and STINT together support the exchange visits and small-sized bilateral workshops between Chinese and Swedish researchers, and the duration of the approved projects lasts 3 years. The funding from NSFC and STINT will cover the international travel costs for Swedish researchers to China and Chinese researchers to Sweden, as well as expenses of the accommodation, meals and inter-city transportation of Swedish researchers in China and Chinese researchers in Sweden, and small-sized bilateral workshops. Up to 400 thousand yuan from NSFC and up to 600 thousand Swedish krona from STINT is allocated for each approved joint project. For detailed requirements about application in 2018, please refer to the call for proposals to be launched on NSFC's website.

Belgium

National Fund for Scientific Research (FWO)

Joint research program

NSFC and FWO support substantial joint research between scientists from China and Dutch-speaking Flanders region of Belgium in areas of mutual interest based on the existing collaboration. NSFC and FWO will together publish guide to programs, decide through discussion how to organize evaluation and jointly make the final funding decision. Researchers from both countries shall submit their proposals to their respective funding organizations. For detailed requirements about applications in 2018, please refer to the call for proposals launched on NSFC's website.

The Fund for Scientific Research (FNRS)

Exchange program

NSFC and FNRS jointly support exchange activities between researchers from China and Brussels-Wallonia Federation (BWF) of Belgium for duration of 2 years. Projects approved receive a two-year funding for Chinese researchers' international travel to Belgium and Belgian researchers' living expenses in China. FNRS also provides funding for Belgian researchers' international travel to China and Chinese researchers' living expenses in Belgium. For detailed requirements about applications in 2018, please refer to the call for proposals launched on NSFC's website.

Ireland

Science Foundation Ireland (SFI)

Joint research project

NSFC and SFI support substantial joint research between scientists from both countries in areas of mutual interest based on the existing collaboration. NSFC and SFI will together publish guide to programs. Chinese and Irish researchers submit to NSFC and SFI respectively. NSFC and SFI jointly make final funding decisions based on the agreed evaluation methods and procedures. For detailed requirements about application in 2018, please refer to the call for proposals to be launched on NSFC's website.

Poland

National Science Centre (NCN)

NSFC and NCN support substantial joint research between scientists from both countries in areas of mutual interest based on the existing collaboration. NSFC and NCN will together publish guide to programs. Chinese and Polish researchers submit to NSFC and NCN respectively. NSFC and NCN jointly make final funding decisions based on the agreed evaluation methods and procedures. For detailed requirements about application in 2018, please refer to the call for proposals to be launched on NSFC's website.

Czech Republic

Academy of Science of the Czech Republic (CAS)

Exchange program

NSFC and CAS together funds the exchange visits between Chinese and Czech researchers. NSFC and CAS will together publish guide to programs. Chinese and Czech researchers submit to NSFC and CAS respectively. For detailed requirements about application in 2018, please refer to the call for proposals to be launched on NSFC's website.

Belarus

Belarusian Republican Foundation for Fundamental Research

Exchange program

NSFC and BRFFR jointly support exchange activities and small bilateral workshops between researchers from China and Belarus for duration of 2 years. Projects approved receive a two-year funding of 200,000 yuan for Chinese and Belarusian researchers' international travels, accommodation, meals, inter-city transportation and small bilateral workshop fees. For detailed requirements about applications in 2018, please refer to the call for proposals launched on NSFC's website.

Hong Kong and Macau SARs and Taiwan Region of China

NSFC has established cooperation with the Research Grant Council of Hong Kong (RGC), Beijing-Hong Kong Academic Exchange Centre, Macau Foundation, Macau Foundation for the Development of Science and Technology, and K.T. Li Foundation for the Development of Science and Technology in Taiwan, jointly funding cooperation and exchange between researchers from mainland China and Hong Kong and Macau SARs, and between researchers from two sides of the Taiwan Straits in areas of common interest. Types of activities that can be funded are joint research projects and exchange projects

(including academic workshop and exchange visit).

Hong Kong

NSFC and the Research Grant Council of Hong Kong (RGC) will continue to fund joint research in areas of natural sciences in 2018. Priority funding areas include information sciences, biological sciences, new materials, marine and environmental sciences, medical sciences, and management sciences. Meanwhile, to encourage academic exchanges between young researchers from Hong Kong SARs and inland China, academic forums are organized and funded in areas of common interest. For detailed requirements, please refer to the call for proposals launched on NSFC's website.

Macau

In 2018, NSFC and Macau Foundation for Science and Technology Development (FDCT) will, under the framework of the newly signed cooperative agreement, together fund joint basic research projects between scientists from inland China and Macau. The priority areas include: information science, TCM research, marine science, environmental science, biological science, new materials, as well as management science. Meanwhile, NSFC and FDCT will organize and fund academic workshops in areas of mutual interest for academic communities from inland China and Macau region. For detailed requirements, please refer to the call for proposals launched on NSFC's website.

Taiwan

NSFC has been dedicated to encouraging and promoting scientific cooperation and exchange between scientists on both sides of the Taiwan Straits. In 2018, NSFC will continue to support cross-Straits academic workshops held by scientists from mainland China and Taiwan region. NSFC will also fund substantial joint research projects according to the consensus reached with K.T. Li Foundation for the Development of Science and Technology. For detailed requirements, please refer to the call for proposals launched on NSFC's website.

In view of the fact that some universities in Hong Kong and Macao have established research branches in different forms in mainland China, NSFC will not accept applications by one scientist as both inland and outside PIs at the same time.

Sino-German Center for Research Promotion

The Sino-German Center for Research Promotion, jointly founded by NSFC and DFG, aims at promoting scientific cooperation and exchange between Chinese and German researchers in the fields of natural sciences, engineering, and management sciences. NSFC and DFG provide respectively 50% of the Center's budget and the budget for 2018 is around 43.5 million yuan.

The budget of the Center is a special fund for organization and funding of joint research and academic activities between universities and research institutions from China and Germany. Scientists from universities and academic institutions from both China and

Germany are eligible to apply for the funding. **The funded projects by the Center will not be counted into the limitation on the number of projects one PI may hold according to NSFC regulations.** Chinese applicants shall have been previously funded by NSFC, with the exception of young researchers under the age of 35 with a PhD degree. German applicants should apply in line with DFG requirements. The Center accepts proposals submitted jointly by Chinese and German scientists at any time of the year, but applications have to be submitted at least 4 months prior to the implementation of the planned academic activities. Applications must be written in both Chinese and German or Chinese and English and the content of the Chinese and German (English) version applications shall be the same. In the applications, the content, theme, academic significance and academic purpose of the project, the participants, contact information, detailed schedule as well as specific costs and distribution shall be specified. Related personnel costs shall be listed according to the funding standard set by the Center on its website. The application form can be downloaded from the Center's website, and shall be submitted directly to the Center after completion (8 hard copies and one electronic copy for each application). The applications will be evaluated by Chinese and German reviewers and the Center will make final decision according to the evaluation results. Specific requirements and relevant information are available on the website of the Center (<http://www.sinogermanscience.org.cn>).

The Center currently provides funds for the following categories of activities:

1. Bilateral Academic Workshop

The Center encourages Chinese and German scientists to have in-depth discussion on cutting edge issues in a certain research area. The main purpose of the workshop, which can be held either in China or in Germany, is to foster joint research projects through discussion and exchange. Each workshop can have 8-15 participants from the sending party, more but at most 25 participants from the host party. Participants shall represent the academic level of the relative country and come from different universities or scientific institutions. The Center provides funding for international travel expenses and local subsistence of all formal participants and other necessary costs for the workshop. The Center does not provide funding for participants from industries or administrative institutions or postgraduates. Participants from a third country can be invited to attend the workshop and their costs will be covered by the workshop, but the total number of them should be no more than 20% of the number of participants from the sending party.

2. Sino-German Joint Research Group

The Center adopts flexible modules to fund Sino-German joint research groups for in-depth cooperation between Chinese and German scientists in areas of common interest. Chinese and German scientists may apply for this program to plan for larger projects and establish necessary collaborative platform. Funding for this program covers costs for bilateral workshops, short-term exchange visits, joint research, publications and consumables, etc. Applicants may apply for funding according to the funding requirements of the Center, which does not provide staff salaries. Applicants must be participants of workshops or undertakers of projects funded by the Center so as to ensure a solid foundation for cooperation. The funding period is 3 years and should not be extended. Funding for each project approved is usually 3 million yuan (or equivalent Euros) for both Chinese and German scientists.

3. Funding Schemes for Young Scientists

(1) Short-term Seminar

The scheme aims to introduce advanced scientific methods, techniques and their applications and provide training on specific issues in a certain area. The Center may fund 4 to 6 senior scientists from both countries as lecturers and participants shall be mainly university undergraduates, graduates or young researchers. The number of participants is assessed according to specific conditions, such as equipment and infrastructure of the laboratory, but it shall not exceed 40 people in total. The number of participants shall not exceed 15 from sending party, and 25 from the hosting party. The seminar can be held either in Germany or in China and usually lasts at most 14 days, including two days for arrival and departure. Funding includes international travel, local accommodations as well as costs for the organization of the meeting and academic tours.

(2) Lindau PhD Students Program and Post-Lindau Program

Lindau Program: The Center, together with Lindau Nobel Laureates Foundation, funds 30 (including 15 in the field of economics) excellent PhD students or post-doctors under the age of 35 to participate in the Nobel Laureate meeting in Lindau, Germany, followed by a week-long visit to the German research institutions. Candidates are selected throughout the country and must be recommended by their home institutions. The final approval list is decided by correspondence review and interviews by Chinese and German reviewers.

Post-Lindau Program: grantees with PhD degree of this program may apply for the funding from the Center for a stay of less than 12 months in Germany if they could get invitations from German research institutions or universities, and approval from their host institutions.

(3) Visit of German Excellent Young Researchers to China

This funding scheme is launched by the Center for excellent young German scientists. During the trial period, eligible applicants for this program are grantees of DFG's Emmy Noether Program or other programs of equivalent quality, such as the principle investigators of SFB-excellent Young Research Groups, grantees of the ESF Starting Grants, Lichtenberg Professorship and principle investigators of Young Research Teams. The Center funds German young scientists to come to China for academic visits and research, and explore bilateral cooperation with their Chinese partners. The funding covers international and domestic travel costs and local subsistence in China. Short-term academic visits usually last less than 2 weeks, cover at most 3 cities, and shall be arranged by host institutions and hosts.

(4) Young Scientists Forum

The forum aims at providing an opportunity for Chinese and German young scientists to meet and discuss with the outstanding scientists in their own fields. The forum shall have a specific focused theme and can in principle invite at most 40 young scientists under the age of 40, and one senior scientist from each side depending on the scale of the forum. The number of participants shall not exceed 15 from sending party, and 25 from the hosting party. Funding includes international and domestic travel costs, local subsistence and other necessary costs for the forum.

4. Pre-Activity Planning

The Center invites applications from qualified applicants who would like to pay a visit to make preparation and plans for a meeting or a project, and to organize small-scale meetings to formulate such plans. The funding is provided for a short visit of less than 5 days and only 1 person can be funded.

5. Personnel Exchange Program

Undertakers of various on-going funding programs or programs that have just come to an end can apply for this program, and the specific requirements will be published online recently.

The Research Fund for International Young Scientists

The Fund supports foreign young scientists to conduct basic research in mainland China in all areas of NSFC's funding scope so as to promote long-term sustainable academic collaboration and exchanges between Chinese and foreign young scientists.

Grantees are also eligible for renewing the existing Fund in case of need.

Applicants with foreign citizenship should meet the following qualifications:

- (1) Less than 40 years old by Jan. 1, 2018 (born on or after Jan. 1, 1978);
- (2) Have a PhD degree;
- (3) Have the experience of conducting basic research or postdoctoral research;
- (4) Guarantee of full-time work at the host institutions during the project implementation;
- (5) Abide by Chinese laws and NSFC's relevant rules and regulations while doing research in China.

The host institution should meet the following conditions:

- (1) Appoint a contact person responsible for providing consultation to the institution's applicant and assist project management such as the use of budget.
- (2) Sign an agreement with the applicant. The agreement should include the following items:
 - (i) The title of the research project and the expected outcomes;
 - (ii) Living expenses and necessary working conditions that the host institution offers;
 - (iii) The attribution of the intellectual property;
 - (iv) Obligation to have applicant work in full time at the host institution during the project implementation.

The PI of the granted project can apply for renewal if needed and provided that the on-going project has made good progress.

In 2017, 155 foreign young scientists were granted with 45 million yuan for direct cost. Among them, 9 foreign young scientists were granted project renewal. It is expected that 150 foreign young scientists (including 20 project renewal) will be granted with 45 million yuan for direct cost in 2018.

Project duration:

Programs funded in 2018 start from Jan. 1, 2019. The funding amount is 200,000 yuan per project for one year or 400,000 yuan per project for two years, which only includes direct cost.

Application procedure

Applicants should fill out and submit on-line proposal forms via the Internet-based

Science Information System (ISIS) with the following supplementary documents:

- (1) Copy of agreement signed by applicant and host institution;
- (2) Copies of the front pages of no more than five representative papers.

Please pay attention to the column of Research Fund for International Young Scientists on NSFC's homepage for more detailed information on application and requests.

Please visit <http://www.nsf.gov.cn/nsfc/cen/gjhz/jjzb/index.html>.

Programs of Joint Funds

The joint funds set up by NSFC and other relevant government departments, provincial governments and industrial sectors aim at supporting basic research in agreed scientific areas.

The joint funds are designed to play a guiding role of the National Natural Science Fund, guide and integrate social resources in basic research, promote cooperation of relevant departments, industries and regions with universities and research institutions, foster scientific and technological talents and enhance China's indigenous innovation capabilities in relevant research areas, industries and regions.

The joint funds are part of the Natural Science Funds. The application, evaluation and management of the joint funds will comply with management methods such as the *Regulations*, *NSFC's Rule on Funding Management* and *NSFC's Rule on Joint Fund Management*.

In 2018, the joint funds in the *Guide to Programs* include NSAF Joint Fund, Joint Fund for Iron and Steel Research, Joint Fund of Civil Aviation Research, NSFC-GenerTec Joint Fund for Basic Research, Joint Fund for the Innovation-Driven Development of China Automobile Industry, Yalong River Joint Fund, Joint Fund for Smart Grid, NSFC-Guangdong Joint Fund, NSFC-Yunnan Joint Fund, NSFC-Xinjiang Joint Fund, NSFC-Henan Joint Fund, Joint Fund to Promote Cross-Straits Scientific and Technological Cooperation, NSFC-Shandong Joint Fund, NSFC-Liaoning Joint Fund, NSFC-Zhejiang Joint Fund for the Integration of Industrialization and Informatization, NSFC-Shanxi Joint Fund for Coal-Based Low-Carbon Technology, NSFC-Guangdong Center for Big Data Research and NSFC-Shenzhen Robotics Research Center Project, etc. **Guidance for other Joint Funds will be published on NSFC website.**

Applicants for the Joint Funds should:

- (1) Have the experience of conducting basic research;
- (2) Hold senior professional position (title) or PhD degree;
- (3) Meet other requirements in the *Guide to Programs*.

For any research achievements funded by the Joint Fund, NSFC's contribution and support to the project should be acknowledged in a prominent place and in an appropriate form according to the *Guide to Programs* with the title of the joint fund and the project number.

Applications for the joint funds should be prepared according to relevant project type (such as General Program or Key Program) outlines. Please select “Joint Fund” for funding category, “Fostering Program Project” or “Key Program Project” or “Foster Local Talents” or “Center Project” or “Integrated Project” for subcategories, and select the name of the joint fund in the notes section.

The number of collaborative institutions for “Key Program Project” or “Fostering Program Project” shall not exceed two.

The funding duration for “Fostering Program Project” is three years and the funding period shall be “from Jan. 1, 2019 to Dec. 31, 2021” in the application. The funding duration for “Key Program Project” is four years and the funding period shall be “from Jan. 1, 2019 to Dec. 31, 2022” in the application.

NSAF Joint Fund

Jointly set up by NSFC and the China Academy of Engineering Physics (CAEP), the Fund is aimed to encourage scientists in related fields to carry out basic and applied researches for national security, so as to explore new research directions, discover new phenomena and natural laws, promote the innovative ability of science and technology in national defense, and foster young talents in this area.

In 2018, this joint fund plans to fund two types of projects, namely “Key Program Project” and “Fostering Program Project”. The Key Program Project has 9 directions, with average direct cost of 2.4 to 3 million yuan per project for 4 years, namely from Jan. 1, 2019 to Dec. 31, 2022. There are 13 encouraged research directions for Fostering Program Project, and 42 projects with defined targets are planned to be funded with an average direct funding of 650,000 yuan per project for 3 years, namely from Jan. 1, 2019 to Dec. 31, 2021.

I. Directions for Key Program Project

1. Research on a new method for spin-needed polarization neutron analysis
2. Multimodal electromechanical detection and reliability diagnosis for 3D packaging
3. Study on degradation mechanism and damage behavior of chemical films under multiple instantaneous radiation environments
4. Research on 1THz radiation source based on large cyclotron harmonic electron cyclotron maser
5. Experimental and theoretical study on the conductivity of THz band in warm and thick material
6. Coordination chemistry of lanthanides in ionic liquids and extraction of trace ions
7. Design, synthesis and stabilization mechanism of high energy ionic total nitrogen compounds
8. Study on the formability and microstructure evolution of glass-aluminum alloy made by laser additives
9. Microstructure evolution and darkening kinetic process of optical fiber materials under extreme conditions

Note: CAEP researchers can apply for or participate in application for this program. Collaboration among two or three institutions is encouraged.

II. Directions and Projects for Fostering Program Projects

1. Projects for encouraged research directions

- (1) Construction and application of atomic interaction potential of metal iridium and uranium under high temperature and pressure
- (2) Study on phase field method of dislocation structure and mechanics of metal materials
- (3) Study on micro-mesoscopic evolution and formation mechanism of adiabatic shear failure
- (4) Study on crack propagation and self-healing mechanism of polymer bonded particles

- (5) Research on surface flashover characteristics and insulation performance improvement in vacuum
- (6) Research on application of fast neutron coding imaging diagnosis technology
- (7) Study on novel gate dielectrics and passivation medium for ternary nitride oxide electronic devices
- (8) Quantum imaging and image transmission in random scattering media
- (9) Research on dynamics of light and heavy media mixing problems
- (10) Functional analysis and processing based on deep learning
- (11) Relationship between charge transfer effect and laser initiation characteristics of high nitrogen metal complexes
- (12) Spectral analysis of optical constants of multivalent oxide mixed phases
- (13) Study on electrothermal effect of pulsed electric auxiliary tantalum thermos-plastic deformation

Note: CAEP researchers may not apply, but may be a participant.

2. Projects with defined targets

- (1) Research on MCMC-Bayesian theory and calculation method in X-ray image analysis
- (2) Impedance matching design and impact properties of AION transparent ceramics
- (3) Study on the mechanical properties of closely packed hexagonal metal titanium under high temperature and high strain rate
- (4) Study on fatigue evolution mechanism of interface bonding strength of PBX explosive
- (5) Study on force-chemical coupling mechanism of corrosion failure of TiN coatings under multiple atmospheres
- (6) Multi-scale simulation of mechanical behavior of typical doped GaN materials under irradiation
- (7) Research on design method of multi-component system guaranteed structure layout for optimization of dynamical performance
- (8) Research on multibody dynamic modeling method and dynamic characteristics of precision gear transmission mechanism under dynamic environment
- (9) Research on self-excited vibration mechanism and suppression method of ultra-precision gas hydrostatic bearing
- (10) Study of terahertz sensing based on ultra-thin structure artificial surface plasmon
- (11) Study on characteristics of photorefractive glass for recording high-speed multi-volume holography
- (12) High spatial resolution volume Bragg grating narrow band filtering spectral imaging technology
- (13) Study on neutron imaging and probing techniques with high space and fast time resolution of accompanying particles
- (14) Research on detection model of abnormal user behavior in independent local area network
- (15) Micro-nano-scale friction drive mechanism and its application
- (16) Design and application of cold atom holographic optical waveguide with controllable structure
- (17) Low-noise single photon detection mechanism for nitride APD at room

temperature Geiger mode

(18) Extended surface target wide-angle radar echo accumulation method under mobile platform

(19) Preparation and electromagnetic protection performance of nickel-coated CNT composite films

(20) Fault prediction and health management method of time-effect in digital-analog hybrid circuit system

(21) Multimodal high resolution quantitative reconstruction and augmented reality of gamma ray sources

(22) Study on the molecular dynamics model of initial laser damage of optical materials

(23) Research on algorithms for nuclear acquisition analysis and feature inversion of nuclear material

(24) Evolution and quantitative description of products after neutron-induced heavily nuclear fission

(25) Study on high resolution adaptive simulation method of agglomerated explosive detonation

(26) Research on thermal effect evolution of surface defects of optical elements under high average power continuous laser

(27) Research on flow field-thermo-optic coupling mechanism in flat microchannel

(28) Study on single crystallization mechanism of laser ceramic materials

(29) Research on key technologies of pulsed power semiconductor switch

(30) Preparation and breakdown mechanism of highly breakdown strong organic coated nanoparticle/polypropylene composite dielectrics

(31) Simulation study of non-harmonic lattice phonon energy spectrum

(32) Structure design of novel fluorocarbon-containing hydroxyl polymers and control of cross-linked network

(33) Study on heat-conducting and flame-retardant cooperative mechanism of carbon-based auxiliaries for electronic packaging

(34) Research on mechanism of damping vibration of lightweight alloy

(35) Research on failure mechanism of lithium ion battery and its key materials under severe environmental conditions

(36) Anode modification of solid state lithium metal batteries and nanostructured electrode/electrolyte interface

(37) Study on the mechanism of solidification evolution and defect control of U-Nb alloy under external field

(38) In-situ investigation of oxidation mechanism of uranium nitride

(39) A mesoscale model for the growth and elemental segregation of nitrogen bubbles in bismuth alloys

(40) Microstructures of ultraviolet and porous manganese oxide porous materials and their ultra-high power and large capacity energy storage mechanism

(41) Study on spectral regulation technology of rare-earth doped Yb:CaF₂ laser crystals

(42) Research on Brillouin scattering suppression techniques of high power narrow linewidth laser fiber amplifier system

Note: CAEP researchers may not apply, but may participate in projects.

Please refer to the CAEP website (<http://www.caep.ac.cn>) for detailed information on specific content and form of research results, etc.

Joint Fund for Iron and Steel Research

The Joint Fund for Iron and Steel Research, financed by NSFC and Baowu Steel Group Co., Ltd. (formerly Baosteel Group Co., Ltd.), supports pioneering researches so as to speed up the technological advancement of the Chinese iron and steel industry. In 2018 a direct funding will be 0.5 to 0.8 million yuan per project for three years with General Programs, and 2 to 3.8 million yuan per project for four years with Key Programs.

The Joint Fund specifically supports fundamental research focusing on key aspects of new metallurgical technologies and interrelated processes, materials, energy, environment, equipment, and information sciences, etc. The fund is managed jointly by NSFC and Baowu Steel Group Co., Ltd., and proposals should be submitted to the Department of Engineering and Materials Sciences of NSFC.

The Joint Fund advocates interdisciplinarity among different research fields and collaboration between R&D activities and industries. The involvement of young professionals and research institutions outside metallurgical science community are all encouraged. Any other resources than NSFC grants are also preferred.

I. General Program

1. Fundamentals on BF ironmaking technology combined with coal gasification
2. Mechanism on simultaneous removal of sulfur and chlorine from top gas of BF using dry processes
3. Fundamentals and technologies on fluidization of steelmaking slag mixed with sludge
4. Formation mechanism and control of longitudinal cracks in surface layer of CC slab of high aluminum steels
5. Research on correlation between carbon segregation and solidification structure of CC slab of high quality steels
6. Fundamentals and applications of manufacturing automobile components with low residual stress utilizing super high strength steel
7. Design of seamless steel and structure control of welding zone for critical applications requiring super high strength and plasticity
8. Assessment and design of hermetic seal of whorl applied in oil and gas well of high temperature and pressure
9. Impact of flash heating on structure and properties of cold rolling steel strip having high strength and plasticity
10. Toughening mechanism on metastable austenite stainless steel with low nickel content
11. Fundamentals on micro-alloying, orientated solidification and controlled rolling formation of high silicon electric steel
12. Alloy design and toughening mechanism of super tough steel by manipulating low energy interfaces and orientated precipitation

13. Study on key technologies of packing materials utilized as thin film
14. Operation optimization of multi-procedure processes for manufacturing steel strips

II. Key Program

1. Crucial manufacturing fundamentals on a new functional refractory and inclusions at the interface of steelmaking slag-molten steel-refractory (E042202)
2. Development and application of surface modified materials for controlling oxidation of hot rolling processes at high temperature (E0412)
3. Online control mechanism of cooling and deformation/phase transition for manufacturing seamless steel pipes by hot rolling process (E0416)
4. Phase evolution of non-metallic precipitations in austenite heat-resisting steel applied in super-critical coal power stations (E0104)
5. Simultaneous control of multiple pollutants emitted during iron and steel making processes (E0420)
6. On new processes and technologies for iron and steel industry (E0422)
7. On energy and environmental protection in iron and steel industry (E0414)

In the above areas about 5 to 8 projects will be funded according to application and evaluation situations.

Joint Fund of Civil Aviation Research

The Joint Fund of Civil Aviation Research is jointly set up by NSFC and the Civil Aviation Administration of China (CAAC). The Fund is aimed to attract researchers from the universities and research institutions across China to participate in basic research for the sustainable development of aviation science and technology, so as to foster high level scientific talents, enhance the ability of original innovation in the aviation industry, promote the integration of knowledge and technology innovation in the field, and contribute to making China a nation with strong aviation industry.

As a component of the National Natural Science Fund, the Joint Fund is open to all scientists across China. Researchers in non-aviation sectors are encouraged to carry out joint research with those in aviation sectors.

I. Funding Plan and Priority Areas in 2018

In 2018, the Joint Fund of Civil Aviation Research is going to support 3 Key Program Projects. Average funding (direct cost) for each “Key Program Project” will be 2.1 million for 4 years. Average funding (direct cost) for each “Fostering Program Project” will be 0.4 million for 3 years. The Fostering Program supports researches on scientific issues and new technologies related to the sustainable development of civil aviation. Young researchers under the age of 35 (born after Jan. 1, 1983) will be given priority. Priority funding areas in 2018 includes:

1. Themes for fostering program project

- (1) Intelligent transportation and information security for civil aviation; theories and

methods of airspace resource management; theories and technologies of future air navigation system; system simulation and verification for passenger and freight traffic flow, flight flow and air traffic flow.

(2) Theories and technologies of situation awareness in airport; theories and technologies of information technology-based airline operations.

(3) Theories and technologies on aviation crime prevention and control; optimization and realization of coordinated decision making for aircraft emergency in abnormal situations.

(4) Theories and methods of the reliability and security of civil aviation system; aviation safety theory; new methods and technologies for airline safety inspection; processing techniques and inspection theory and technologies for new materials of aircraft operation and maintenance.

(5) Optimal design and simulation for civil aviation transport service quality; theories and methods of aviation medicine.

2. Themes for key program project

(1) Basic theory and technology of the anti-icing effect of super-hydrophobic coating on civil aircraft.

(2) Key technologies of spatial-temporal analysis and early warning of flight risk based on multi-source data.

(3) Key technologies for the monitoring of non-cooperative unmanned aerial vehicles in airfield clearance zone.

(4) Key technologies of the stability and control of airfield pavement base for permafrost conditions.

NSFC-GenerTec Joint Fund for Basic Research

The NSFC-GenerTec Joint Fund for Basic Research was jointly established by NSFC and China Academy of General Technology in 2015. The joint fund aims at pooling talented scientists and research teams to solve major scientific issues and key technical problems for China Academy of General Technology in serving the country and fulfilling its mission, and promoting research and team building in related disciplines.

In 2018, the NSFC-GenerTec Joint Fund for Basic Research calls for proposals of “Key Program Project” and “Fostering Program Project”. Average funding (direct cost) for each “Key Program Project” will be 2.6 million for 4 years and the funding could be increased for projects of exceptionally high quality. Average funding (direct cost) for each “Fostering Program Project” will be 0.7 million for 3 years. The NSFC-GenerTec Joint Fund for Basic Research is open to all Chinese researchers. Eligible researchers are welcomed to apply for this fund according to the research scope and requirements listed in this *Guide to Programs*.

I. Themes for Key Program Project

1. Theory and methods of behavior pattern recognition based on big data

2. Authentication and authorization system for massive multi-source heterogeneous data

3. Basic theory and architectural design of block data for data sharing and application

4. Speaker identification and keyword retrieval from speech data in complex environments

5. Accurate personal identification based on information fusion

6. High security data hiding methods against statistical analysis

7. Covert transmission and application technology for blockchain data

8. Methods and application of virtual identity concealment and digital trace erasure

9. Satellite signal analysis and communication in covert information channels

10. Vulnerability feature database analysis and forecasting methods based on vulnerability dataset

11. Network behavior anomaly detection and judgment methods

12. Key technologies of domain-specific text-based semantic analysis

13. Theoretical model of password guessing and its application in practice

14. Key technologies of visual intelligent detection and analysis in complex scenes

15. Hidden clue discovery for specific targets based on open knowledge network

16. Compute-intensive data analysis method for cross-organizational heterogeneous computing resources

17. Attack detection and prevention for SWIFT system and blockchain

18. Knowledge-based intelligent machine translation technology

19. Key technologies of secure communication protocol for autonomic network

20. Intelligent network metadata extraction and analysis in a big data environment

II. Themes for Fostering Program Project

1. Visualization technologies for multi-dimensional and multi-level big data

Studies on the comprehensive integration of multi-dimensional and multi-level data by visualization technologies to reveal the hidden relations, deep structure and operation mechanism embedded in big data.

2. Theory and key technology of big data-based social behavior prediction

Research on techniques of data fusion, correlation analysis and behavior statistics based on big data, modeling and simulation for macro level social behaviors of human beings, related theoretical models and application scenarios, and social behavior inference and prediction base on the above-mentioned studies.

3. Domain-specific machine reading and optimization methods

Research on technologies and optimization methods for high-efficiency machine reading for textual data to achieve automatic extraction of key elements and logical relations from large-volume textual data and create knowledge map.

4. Multi-source heterogeneous data processing and intelligent data push

Research on knowledge mapping, data mining and correlation analysis for specific people; Homomorphic encryption in transmission and content security protection for sensitive data; pre-warning mechanism and response technology based on data push.

5. Security technology and method for artificial intelligence systems in network

environment

Research on deep learning system security in the context of security attacks; security and credibility attributes of deep learning systems in network environment; design and realization of security attributes test and verification methods for typical deep learning systems; provable security protection technology and method for deep learning

6. Analysis of security flaws for classifier of machine learning

Research on analysis of security threats to common classifiers of machine learning in order to establish attack-avoiding security models; research on methods of attacking classifiers of machine learning, especially the generation of Adversarial examples; research on security enhancement methods for classifiers of machine learning to improve classifiers' robustness and ability to detect adversarial examples.

7. Model and technology of covert channel detection based on multi-dimensional flow analysis

Research on establishing models to estimate the suspiciousness of sink IP in target-specific network based on data flow according to the characteristics of sink and communication behaviors of covert communication, and technologies for detecting network covert communication based on multiple time scale flow analysis.

8. Long-haul side-channel analysis for the Internet of Things devices

Research on technologies of collecting and processing new side-channel signals such as sound, electrical potential of device enclosure, time consumption, web applications and etc., side-channel analysis technology based on statistical methods, long-haul side-channel attack based on the vulnerability of Internet of Things devices.

9. Methods of security analysis for quantum key distribution technology

Research on the methods of security flaw detection for quantum channel and detector in consideration of the complexity of attacks based on the theoretic security of QKD technology; research on security analysis method for the composite application of post processing algorithm and QKD system from the perspective of the indistinguishability of output data.

10. Key techniques of collaborative intelligent analysis for binary codes

Research on feature extraction and matching for binary code functions in uncertain environment; technologies for extraction and injection of analyzing and debugging information of common reverse analysis tools; tracking technology for dynamic code execution; database of malicious software function call trace and API invocation trace; establishment of collaborative working mechanism for reverse analysis and knowledge sharing repository; automatic and intelligent reverse analysis of malicious codes.

11. In-depth detection and dynamic defense without prior knowledge against malicious behaviors in the kernel layer of virtualization platforms

Research on detection methods for malicious behaviors in the Kernel layer without accurate prior knowledge in a contaminated virtual system; research on dynamic defense methods against Kernel layer attacks that can keep the integrity of dynamic data; research on the compatibility and extensibility of the dynamic defense methods for various types of operating systems and virtual machine monitors.

12. Deep learning-based detection and recognition for cross-domain video target

Research on methods to improve the adaptive capacity of video target detection and recognition system in practical use based on deep learning theory and technology, semi-supervised learning methods and transfer learning mechanism.

13. In-depth analysis of enciphered data in communication link

Research on in-depth identification, recognition and clustering and protocol analysis for enciphered data in communication link.

14. Data encryption based on general databases

Research on transparent data encryption based on general databases, indexing techniques for encrypted data in database, techniques of database encryption key distribution and management, Homomorphic encryption technology for database, database intrusion detection and analysis.

15. Recognition and classification for vulnerability exploitation programs in network flow

Research on quick recognition, classification and feature extraction methods for vulnerability exploitation programs in network flow; development of vulnerability attack database and vulnerability identification against attack programs; methods of quick setting up of honeypot, automatic feature analysis and key element extraction for unknown vulnerability exploitation programs.

16. Malware recognition and early warning technology for industrial control system based on sequence analysis

Research on semantic models for threats based on malware database of industrial control system and extraction and analysis of threat information; calling sequence feature database, long- and short-term memory model which spans multiple time points based on sequence analysis, deep feature extraction for malware behaviors of industrial control system based on convolutional neural network; pre-warning methods against malware threats to industrial control system.

Joint Fund for the Innovation-Driven Development of China Automobile Industry

The Joint Fund for the Innovation-driven Development of China Automobile Industry is financially supported by NSFC, China Association of Automobile Manufacturers and eight domestic automobile enterprises, namely, First Automotive Works, Dongfeng Motor Corporation, SAIC Motor Corporation Limited, Chongqing Changan Automobile Co., Ltd., Guangzhou Automobile Group Co., Ltd., Brilliance Auto Group, Anhui Jianghuai Automobile Co., Ltd., China National Heavy Duty Truck Group Co., Ltd. By giving full play to the guiding and coordinative role of NSFC on the basis of combining government-industry-university-research and application, it funds major basic research in China's Automobile Industry Development and related areas, so as to promote the sustainable development and improve capability of independent innovation of the industry.

In 2018, the Joint Fund for the Innovation-driven Development of China Automobile Industry calls for proposals of the "Key Program Project" in three priority areas with average direct cost of 2.5 million yuan per project for four years. Any eligible scientists and technicians over the country are encouraged to submit applications in accordance with research scope and requirements listed in this *Guide to Programs*.

I. Intellectualization

1. Vehicle dynamics optimal control theory and technology
2. Multi-objective coordination and optimization of intelligent network-based diesel vehicle combustion and aftertreatment system
3. Research on intelligent sensor multi-sensor information fusion technology
4. Smart car complex environment perception understanding theory and method
5. Electric vehicle intelligent energy management based on road condition prediction
6. Design theory and method of intelligent suspension based on multi-source information
7. Power battery intelligent management information physical fusion cloud system

II. Lightweight

1. Study on the structure and performance control of high strength and high strength automotive steel
2. Regulation and key technology of microstructure and properties of high-strength and high-toughness aluminum alloy in the chassis of passenger cars
3. Research on basic application of ultra-high strength steel for automobile industry
4. Research on low cost manufacturing, service performance and material structure control of high performance fiber reinforced composite auto parts
5. Study on the service performance of body carbon fiber composites/aluminum alloys
6. Study on lightweight design method of multi-material automotive body structure

III. Electrification

1. Research on design method of large-size monolithic power battery and system
2. Research on key technology of multi-axle distributed drive series hybrid heavy duty truck chassis
3. Research on life prediction of transmission system of electric vehicle based on load spectrum
4. Interface construction and charge transfer mechanism of high specific energy solid state lithium battery
5. Thermal field distribution, heat transfer mechanism and thermal management of vehicle power battery system
6. Research on simulation and test technology of vehicle fuel cell stack operation state

Yalong River Joint Fund

The Yalong River Joint Fund (phase II) was jointly set up by NSFC and Yalong River Hydropower Development Company, Ltd. (hereinafter referred to as Yalong River Company) from 2017 to 2019. Aiming at giving full play to NSFC's guiding role and combine with the national strategic needs, the Yalong River Joint Fund promotes the independent innovation capability of China's clean renewable energy and deep-roots

science, enhance the application of important achievements in basic research in the construction of the wind and water complementary clean energy demonstration base in the Yalong River Basin and in the underground laboratory in Jinping, China, provide scientific basis and technical support for solving the key issues facing China's development and utilization of clean renewable energy and deep-roots science, and cultivate a group of scientific and technological talents.

In 2018, the Yalong River Joint Fund calls for proposals of "Key Program Project" and "Supporting Program Project" from the following 3 priority areas. The average direct cost of Key Program Project is 3 million yuan per project for 4 years and that of the Supporting Program Project is 500,000 yuan per project for 3 years. Any eligible scientists and technicians over the country are encouraged to submit applications in accordance with research scope and requirements listed in this *Guide to Programs*.

I. Research on Development Technology of Wind, Light and Water Complementary Clean Renewable Energy

1. Comprehensive life cycle, intelligent operation and maintenance and remote centralized control of demonstration bases for multi-energy complementation of wind, light and water in the river basin

Combined with the construction of demonstration bases for wind, light, and water complementary clean energy in the Yalong River basin, proposals are expected to utilize comprehensively technologies such as the internet of things and big data to realize the full life cycle, intelligent operation and maintenance, and remote centralized control of the demonstration base. Main research areas include:

- (1) Theory and techniques of life cycle management of wind, light, and water power systems in a river basin;
- (2) Theory and method of multi-energy complementary and intelligent operation and maintenance of wind, light and water in a river basin;
- (3) Key technologies of remote, joint, centralized control for water-powered hydropower projects centering on the watershed control center.

2. Regional electricity consumption forecasting method and study on multiple clean and renewable energy consumption models

Combining with the electricity consumption conditions of each electricity-receiving area in the Yalong River basin's wind, light, and water complementary clean energy demonstration bases, proposals are expected to develop the method for forecasting regional demand for electricity at different time scales, and study the consumption patterns and trading strategies of various power generation companies based on clean and renewable power including wind, light, and water when they participate in the power markets of different regions. Main research areas include:

- (1) Conducting power demand forecasting in different time scales in power receiving areas;
- (2) Studying the mode of consumption, trading strategies of various clean renewable energy power generation enterprises participating in the power market in wind, light and water;
- (3) Research on key technologies of trans-regional and long-distance power transmission under conditions of complex transmission, transmission, transformation,

matching, and utilization of wind, light, and water complementary clean and renewable energy sources.

3. Wind farm optimization site selection, wind resources measurement, assessment and unit equipment selection methods in Yalong River Basin

Proposals are expected to carry out research on the optimization of site selection for wind farms, measurement and assessment of wind resources, and evaluation of unit equipment selection based on the complex topography of high-altitude areas in the wind, light, and water complement demonstration sites in Yalong River. Main research areas include:

- (1) Study on measurement and evaluation of wind energy resources in Yalong River Basin wind farm;
- (2) Study on multi-scale coupling evaluation method of wind energy resources in Yalong River Basin;
- (3) Wind farm optimization selection and unit selection in Yalong River Basin.

II. High dam project construction and long-term safe and economical operation of river cascade power stations

1. Study on evolution regularity and mechanism of freeze-thaw performance of soil material for super high earth-cored rockfill dam

Combined with the two Yahekou hydropower stations in the middle reaches of the Yalong River, proposals are expected to study the effects of freezing and thawing soil materials on the seepage stability and deformation stability of dams under different conditions.

- (1) To study the micro-structural changes, changes in mechanical properties, and changes in permeability characteristics and mechanisms of contact between clay and vermiculite in cores (and bank slopes) under different compaction conditions after freeze-thaw cycles;
- (2) To study the micro-structure, permeability and mechanical properties of clay and gravel soil material after the freeze-thaw damage compacted core wall (and bank slope), and to the re-compaction measures to improve or recover the permeability and mechanical properties of soil material after freeze-thaw damage;
- (3) To study a new comprehensive system (including theory, indicators, methods, etc.) for rapid and comprehensive judgment of large-area soil freezing and thawing.

2. Study on long-term deformation characteristics and cracking mechanism of super high earth core rockfill dam

By use of the cracks and long-term deformation of 200 m high earth-rock dams in recent years, and combined with the experimental results of the dam materials in the Lianghekou project and the on-site monitoring results during the construction period, proposals are expected to study the long-term deformation characteristics and cracking mechanism of the special high earth core rockfill dams, and raise corresponding pre-control measures.

3. Study on interval water inflow forecasting scheme and flow communication law between power stations of river basin cascaded hydropower plants

With the completion of the cascade hydropower stations in the Yalong River Basin, the transmission methods of the power stations and the uncertainty of the water flow in the

interval have become the main hurdles affecting the safety and economic operation of the power plant group. Main research areas include:

- (1) Study on the way of flow dissemination between cascade hydropower stations in the river basin;
- (2) Study on interval water inflow forecasting method of river basin cascaded hydropower plants;
- (3) Study on the influence of the operation of inter-regional tributary power stations in river basin cascade hydropower plants on the safety and economic operation of downstream power stations.

III. Basic Research of Deep Underground

1. Research on radiation background/advanced detection technology in extremely deep underground laboratory environment

Based on the extremely low background physics experiment of dark matter, double-beta and beta-titanium decay in underground laboratory in Jinping, China, proposals are expected to study the measurement and control techniques of gamma, neutron, charged particles and air radon concentration in the underground laboratory environment so as to provide support for effectively evaluating the influence of environmental radiation background on extremely low background physics experiments. Main research areas include:

- (1) Research on in-place gamma spectrometry measurement technology in 4π large space;
- (2) Study on neutron energy spectrum measurement technology in low background environment;
- (3) Study on extremely low background helium concentration measurement technology;
- (4) Low temperature adsorption and radon reduction technology;
- (5) Advanced detection technology.

2. Deep fault activation law and cavern stability evaluation and environmental assessment

With regard to the long-running Jinping Extreme Underground Laboratory and the deep hydraulic tunnel group, proposals are expected to study the evolution rules of deep geological fractures, and provide the basis for deep underground laboratories and hydraulic tunnel engineering safety and living environment evaluation. Main research areas include:

- (1) Monitoring and identification of the evolution rules of deep geological fractures under dynamic disturbance;
- (2) Geomechanical analysis of the release and migration of deep cavern chambers and the long-term variation of cavernous concentration in caverns;
- (3) Correlation and characterization of environmental factors such as mechanical response, fracture evolution, fracture activity, and radon concentration in deep cavern surrounding rock structure;
- (4) Evaluation method of stability of deep caverns based on geological fracture evolution characteristics.

Joint Fund for Smart Grid

The Joint Fund for Smart Grid is financially supported by NSFC and State Grid Corporation. It aims to support researchers to conduct researches on basic and cutting-edge technologies in the area of smart grid so as to promote the integration of industry-university-research.

In 2018, the Joint Fund for Smart Grid calls for proposals of “Key Program” or “Project Group Program” for the following areas. “Key Program” provides an average direct cost of 3 million yuan per project for four years; “Project Group Program” provides an average direct funding of 15 million yuan for four years.

I. Project Group Program

Direction 1: Artificial intelligence (AI) analysis methods for large scale power grids based on digital simulation

1. Application methods of expert knowledge and experience using artificial intelligence modeling for large scale power grid simulation;
2. Simulation analysis of large scale power grid and knowledge discovery;
3. Intelligent analysis and regulation of power flow for large scale power grid;
4. Analysis and control for large scale power grid stability using artificial intelligence.

Direction 2: Basic theory of multi-timescale non-linear coupled oscillations in power electronics dominated power systems

1. Formation mechanism and generalized modeling theory and method of the dynamics of apparatus with multi-scale control;
2. Aggregation mechanism and generalized modeling theory and method of the dynamics of power electronic apparatus cluster;
3. Formation mechanism and generalized modeling method of network dynamics under multi-scale excitation;
4. Interaction mechanism of coupled apparatuses in parallel or series and system stability analysis theory and method;
5. Coordination mechanism of the dynamic characteristics among coupled apparatuses and system stability control theory and method.

Direction 3: Multi-parameter based adaptive protection and secure operation of power transformers

1. Time-space distribution and interaction during the transient of transformers;
2. Fault information sensing under new principle of transformer protection;
3. Novel multi-parameter based principle and method for adaptive protection of power transformer;
4. Safety margin evaluation and active secure protection of transformer.

II. Key Program

The research fields are as follows:

- 1. The basic problems of the new generation power system such as “extensive interconnection, intelligent interaction, flexible, safe and controllable”;**

2. **Planning and operation of multi-energy complementary system;**
3. **The theory and method of insulation status monitoring and evaluation;**
4. **The morphological characteristics analysis and coordinated planning theory of the intelligent distribution system;**
5. **High conducting conductors for power transmission lines, ferromagnetic materials and electrical contact materials for electrical equipment;**
6. **The principle and method of life cycle attenuation and safety assessment for electric energy storage battery;**
7. **Basic research on new power electronic equipment for DC transmission;**
8. **Failure mechanism of intelligent power equipment and electromagnetic interference suppression method under complex electromagnetic environment.**

NSFC-Guangdong Joint Fund

The third phase of the NSFC-Guangdong Joint Fund is jointly initiated by NSFC and the People's Government of Guangdong Province (hereinafter referred to as NSFC-Guangdong Joint Fund) from 2016 to 2020. It aims at giving full play of the guiding role of NSFC, attracting and gathering outstanding scientists all over the country, solving the major S&T issues and key technology problems concerning the strategic development of economy, society and science and technology in Guangdong Province and the surrounding areas. It tries to promote the development of science and technology and build up the team of talents in the Province, enhance the independent innovation capability and international competitiveness of universities and research institutes in the province, and advance the sustainable development of economy and society of Guangdong province.

NSFC-Guangdong Joint Fund calls for proposals of "Key Project" or "Integration Project" from the following research areas. "Key Project" provides an average direct cost of 3 million yuan per project for four years; "Integration Project" provides an average direct cost of 14 million yuan for four years. Any eligible scientists and technicians over the country are encouraged to submit applications in accordance with research scope and requirements listed in this *Guide to Programs*.

I. Integration Projects

1. Intelligent information processing and new generation communication Quantum simulation frontier basic research

Proposals are expected to conduct theoretical and experimental research on quantum simulation, in particular through controlled quantum system including superconducting quantum wire, cold atomic light crystal system and nuclear magnetic resonance system. Main research areas include:

(1) Research on quantum simulation theory based on thermodynamic processes

Proposals are expected to study the complementary relationship between quantum physics and information science, explore thermodynamic limits and applications based on quantum information, as well as the computational complexity of quantum systems; explore the role of Shannon entropy and Neumann entropy in thermodynamics; study the influence of quantum coherence and entanglement on information and energy conversion; quantum

simulation scheme for physical model of condensed state such as Ising's spin-glass; decide the computational complexity of various types of physical problems; study the resources that Turing machines need to simulate quantum computers.

(2) Quantum simulation experiments based on superconducting quantum wiring

Proposals are expected to study Superconducting qubits and related control circuitry, the coupling between quantum resonance circuit and transmon quantum bit, and achieve a single bit of control and information read through the application of programmable microwave pulse signal; study quantum simulation experiments such as molecular spectroscopy, quantum less system, Ising model with arbitrary interaction and topological quantum bit manipulation on superconducting circuits; preparation and characterization of mixed superconducting quantum bits.

(3) Quantum manipulation and quantum simulation experiment of super-cooled atomic optical lattice system

Proposals are expected to establish experimental platforms to study the super-cooled atomic optical lattice system; achieve controlled quantum bit array through quantum coherent control technology; study physics issues of important scientific and applied value, such as phase transition of metal insulator, fractionalized particles, topological quantum phenomena, topological quantum computation, and gauge field theory.

(4) Control technology based on NMR system and quantum simulation experimental research

Proposals are expected to establish experimental platforms, prepare high-bit quantum processor, optimize control technology, conduct quantum simulation experiments centering on the nuclear spin system. They are expected to find the 10 to 20 quantum bit number of enhance nuclear spin samples; develop and improve high-precision, low noise, self-fault tolerance coherent control and feedback control technology; conduct quantum simulation experimental study with high quantum bit and high complexity based on the number of bits and manipulation advantages of the NMR platform.

2. Population and health

Neuronal death mechanism and regeneration in major neurodegenerative diseases

Proposals are expected to focus on the major issues in brain science such as the major neurodegenerative diseases, conduct multi-disciplinary integration study, reveal the neuronal death and neuroinflammation mechanism, elucidate the mechanism of key pathogenic protein transmission, explore neuronal regeneration and repair methods, establish clinical molecular imaging technology with high sensitivity to detect specific neuronal density and function, and provide the theoretical basis and technical support for the early diagnosis, intervention and multi-functional reconstruction of major neurodegenerative diseases. Main research areas include:

(1) The key mechanism for the neuronal selectivity and progressive death of major neurodegenerative diseases

Proposals are expected to analyze the mechanism and key molecule of neuronal selectivity and progressive death and establish a number of neuroprotective therapeutic targets based on the study of the interaction between gene-gene and gene-environment.

(2) The neuroinflammation mechanism and function of major neurodegenerative diseases

Proposals are expected to explore the function and mechanism of the gliocyte in the neuronal death and repair of major neurodegenerative diseases, find out gliocyte receptors, ligands, signal transduction pathways/networks and regulatory factors, explain the nature of the interaction between different types of nerve cell and immune cell; analyze the differences in phenotypes and roles of neuroinflammation in brain regions where cell bodies and axons are located.

(3) The “Peptone-like” transmission mechanism of neurodegenerative diseases

Proposals are expected to study the molecular mechanism of the peripheral-central, cell-cell “prion-like” transmission of neurodegenerative disease-causing proteins, and to clarify the role of the “protein-like” transmission of the pathogenic protein in the pathogenesis and progression of the disease, and to study a new neurodegenerative disease intervention method for severing the aggregation and spread of pathogenic proteins.

(4) Glial cell-mediated neuronal regeneration and repair

Proposals are expected to use epigenetics, genomics, proteomics, bioinformatics and other techniques to map the molecular networks of astrocytes reprogrammed into functional neurons, study several key factors, and establish stable, efficient reprogramming methods; to study “Single molecule multi-target” compounds or screening small molecule compound compositions promote in situ regeneration of neurons.

(5) Study on dynamic monitoring system of changes in number and function of somatic neurons

Proposals are expected to targeting different stages of the disease process, developing highly biocompatible molecular imaging probes, establishing accurate in vivo quantitative and quantitative monitoring methods for specific neuronal density and function, studying the spatio-temporal dynamic evolution of specific neurons in each disease course, and exploring molecular-specific imaging with the correlation of neuronal degeneration death, changes in neurotransmitter concentration, pathological stage and clinical stage, so as to establish an objective and accurate dynamic monitoring and early diagnosis system of neuronal function.

“Integration Program Project” should include the above-mentioned five research areas, carry out in-depth and systematic research focusing on the project themes, and research results should include principles, methods, technology, devices as well as patents.

II. Key Supporting Project

1. The intelligent information processing and new generation communication

(1) Intelligent processing technology of internet information

To carry out relevant basic research on the development needs of Guangdong Province in smart computing, intelligent information processing, artificial intelligence and application fields. Main research areas include:

- (i) Communication theory and edge calculation method for big data applications;
- (ii) Intelligent computing and communication integration theory and key technologies;
- (iii) Intelligent processing chip for information security;
- (iv) Artificial intelligence application and intelligent information processing key technologies;
- (v) Artificial intelligence drive optimization and control.

(2) New generation communication system theory and network technology

To meet the major demand for the development of next-generation communication technologies in Guangdong, the Joint Fund supports basic theories and application research in the fields of communications and network technologies, advanced electronic devices, and radio frequency technologies that have industrial prospects. Main research areas include:

- (i) Energy-efficient transmission for next-generation mobile communications;
- (ii) Energy transmission mechanism and spectrum sharing in wireless communication;
- (iii) Optical waveguide device development and optical communication.

(3) IoT communication theory and technology for industry applications

Focusing on the key common scientific issues in the development of IoT communication, proposals are expected to conduct research on the new generation of IoT theories and key technologies such as Internet of Things terminal equipment, information security, software-defined Internet of Things, and Internet of Things communications.

- (i) Low-power internet of things terminal equipment and information security;
- (ii) Software-defined internet of things for big data scenarios;
- (iii) Internet of Things information transmission and access method for industry applications;
- (iv) Industrial internet technology and application for intelligent manufacturing.

2. Population and Health

(1) The mechanisms, epidemics and new monitoring principles and methods of major diseases in South China

Main research areas include:

- (i) The molecular mechanism of pathogenic infection and immunity;
- (ii) The study of imaging group in the early diagnosis and outcome of disease;
- (iii) The occurrence mechanism and early warning of endocrine tumors;
- (iv) Research on disease mechanisms based on genome, metagenomics and other multi-omics.

(2) Biological medicine

Main research areas include:

- (i) Innovative drug design based on new structures and new targets;
- (ii) Development of modern biomedical technologies such as immunity, genes, and cell therapy;
- (iii) The mechanism and modernization evaluation of Chinese herbal medicines in South China, marine organisms in the South China Sea.

3. Advanced materials and intelligent precision manufacturing

(1) New functional materials

Main research areas include:

- (i) New electronic materials and devices for display, lighting, and communications;
- (ii) High-performance energy storage materials and technologies for new energy vehicles and electronic information;
- (iii) New biomedical materials;
- (iv) New principles and new processes for preparation of luminescence and photonic materials and devices.

(2) High-performance basic materials

Proposals are expected to conduct research on basic science problems and applied

technologies for high-performance basic materials. Main areas include:

(i) High-performance polymer materials and composite materials for marine engineering;

(ii) Advanced metal material preparation and processing;

(iii) New fine chemical materials for surface protection;

(iv) High-performance energy-saving and intelligent building materials.

(3) Intelligent precision manufacturing

Proposals are expected to carry out cutting-edge scientific research involving new technologies, new methods and new theories in precision machining, micro-nano machining and intelligent equipment with the focus on the development trends and forward-looking needs of strategic new industries and precision manufacturing in Guangdong Province. Main research areas include:

(i) Precise machining and performance mechanism of micro-nano structure on advanced materials;

(ii) Optical/microelectronics intelligent precision manufacturing equipment common key technologies;

(iii) Multi-field auxiliary precision machining theory and key technologies;

(iv) New method for precision manufacturing of key parts of industrial robots.

NSFC-Yunnan Joint Fund

The NSFC-Yunnan Joint Fund is jointly established by NSFC and the Yunnan Provincial Government to implement the National Strategy of Innovation-Driven Development and the guidelines of the National Conference on Science and Technology. It aims at maximizing the guiding role of the National Natural Science Fund and pooling talented scientists across the country to carry out basic researches on important scientific issues and key technical problems that are closely related to the socio-economic and scientific development in Yunnan and surrounding regions, boosting the development of science and technology and the growth of scientific talents in the province, improving indigenous innovation capability and international competitiveness of universities and research institutes of Yunnan and promoting the sustainable development of regional economy and society.

In 2018, the NSFC-Yunnan Joint Fund calls for proposals of “Key Program Project” in the following priority research areas. Average funding (direct costs) for each project will be 2.4 million for 4 years (for projects of “strategic research on sustainable development of Yunnan and regional cooperation with South and Southeast Asia under framework of Belt and Road Initiative”, the average funding will be 1 million for 4 years). The NSFC-Yunnan Joint Fund is open to all researchers across China. Eligible researchers all over the country are welcomed to apply for this fund according to the research scope and requirements listed in this *Guide to Programs*.

I. Biodiversity Conservation

1. Biodiversity

Research on the biodiversity of important animals, plants and microorganisms in the

plateau regions of Yunnan at the molecular, genetic, species and ecosystem levels.

Priority research areas:

- (1) Investigation, evaluation and protection of endemic biological resources in Yunnan;
- (2) Biodiversity patterns and adaptive evolution in mountainous areas of Southwest China;
- (3) Mechanism for species interaction and conservation in mountainous areas of Yunnan;
- (4) Comprehensive protection for biodiversity of endangered species in Yunnan;
- (5) Invasion mechanism of alien species and its prevention and control for Yunnan.

2. Agricultural and forest resources

Priority research areas:

- (1) Genetic basis of important economic traits of endemic animals in Yunnan;
- (2) Germplasm resource exploitation and genetic analysis of important economic traits for endemic plants (crops, tree species and horticultural crops) in Yunnan;
- (3) Functions and preservation mechanism of agro-ecosystem biodiversity in Yunnan;
- (4) Germplasm resource exploitation and mechanism of continuous cropping obstacle of important medicinal plants in Yunnan.

II. Population and Health

1. Basic researches on discovery of natural active substances and development of vaccines aiming at major human diseases using typical medicinal resources in Yunnan

Proposals are expected to target at major diseases, conduct researches related to the searching, structure and functions, functioning mechanism, biosynthesis and synthetic biological studies of active substances of animal and plants, and basic researches on the development of innovative vaccines based on endemic bio-resources in Yunnan.

Priority research areas:

- (1) Studies on the discovery, structure, function and pharmacological mechanism of new natural active substances based on special resources in Yunnan;
- (2) Breeding of vaccine strains, protective immunogen and virulence factor assessment for vaccines of pathogens of cross-border infectious diseases;
- (3) Basic research on effective materials of ethnic medicine and featured Chinese medicine in Yunnan;
- (4) Basic research on sustainable use of medicinal animals and plants in Yunnan;
- (5) Biosynthesis and synthetic biology of active substances of major medicinal bio-resources in Yunnan.

2. Basic researches on the pathogenesis, prevention and treatment of high-incidence diseases and major diseases in Yunnan

Proposals are expected to target at the epidemiologic features, pathogenesis, prevention and treatment and animal models of high-incidence diseases, chronic diseases, major infectious diseases, insect-borne tropical diseases and parasitic diseases that threatens the locals in Yunnan province and surrounding regions as well as the relations between infectious diseases and drug addiction.

Priority research areas:

- (1) Basic researches on high-incidence diseases, endemic diseases and chronic diseases in Yunnan;
- (2) Basic researches on the epidemiology, pathogenesis, prevention and treatment of insect/rat borne tropical diseases and other major infectious diseases in Yunnan and surrounding regions;
- (3) Animal disease modeling for endemic diseases in Yunnan and related basic research;
- (4) Applied basic research on stem cell using endemic animals in Yunnan.

III. Resources and Environment

1. Earth environment changes and co-evolution between life and environment in Yunnan

Yunnan sees a complicated geologic evolution. In particular, the rise of Qinghai-Tibet Plateau had a profound impact on the topography, landscape and climate in Yunnan, which gives Yunnan complicated and diverse earth environments and profoundly influences the distribution of biological species in the past and today. In-depth research on the process will help to solve the scientific questions related to earth environment changes and co-evolution between life and environment.

Priority research areas:

- (1) Yunnan biota and its responses to environmental changes in key geological periods;
- (2) Geologic evolution of river, lake and wetland system and the co-evolution between life and environment in Yunnan;
- (3) Basic research on vertical distribution of natural resources and livability for human in mountain areas;
- (4) Responses and adaptation of important ecosystems in Yunnan to global change.

2. Basic research on mineralization mechanism of important minerals and environmental pollution control in Yunnan

Priorities in environmental pollution treatment in Yunnan includes control of eutrophication of plateau lakes, control of heavy metal soil pollution, restoration of mining wasteland and impact study for new pollutants. Proposals are expected to focus on the above key issues and make in-depth studies on the environmental process, functioning mechanism, persistent impact and theories of prevention and control, providing scientific solutions to the environmental problems in the province.

Priority research areas:

- (1) Mineralization mechanism of typical mineral deposit in Yunnan and new prospecting methods;
- (2) Control of environmental risks and environmental remediation mechanism in the exploitation of important mineral resources;
- (3) Mechanism for plateau lake pollution and river basin regulation.

3. Basic research on meteorological and geological disasters in Yunnan

Yunnan is one of the converge areas of the world's strongest monsoons. Development of fault structure, extreme weather, frequent occurrence of hydrological and geological disasters, tattered landform and human activity intensify the harm and losses by

natural disasters. Promoting basic researches on meteorological, hydrological and geological disasters will be of great importance for preventing and reducing natural disasters and promoting the development of economy and society in Yunnan.

Priority research areas:

- (1) Mechanism for the occurrence of extreme weather disasters in Yunnan and extreme weather disaster forecasting;
- (2) Cause, prevention and control of major geological disasters in Yunnan such as strong earthquake, landslide and mud-rock flow.

IV. Comprehensive Utilization of Mineral Resources and New Materials

Proposals are expected to address theories, methods and cutting-edge technologies that meet the demand of comprehensively utilizing the advantageous mineral resources and secondary resources of Yunnan and developing key material industries.

1. Comprehensive utilization of mineral resources and secondary resources

Priority research areas:

- (1) Green and efficient beneficiation methods for metallic mineral resources and mechanism of metal enrichment in Yunnan;
- (2) New theories, methods and techniques of clean and efficient metallurgy for nonferrous metal and associated resources in Yunnan;
- (3) Beneficiation and metallurgy for specialized mineral resources in Yunnan and recycling of material processing wastes;
- (4) New theories, methods and techniques of noble metal recovery from waste catalysts.

2. Design, preparation and characteristics of rare-noble metal materials

Priority research areas:

- (1) Basic research on the design and application of new rare-noble metal materials;
- (2) Techniques for preparation of high-purity silicon, germanium, indium and gallium and their compounds.

3. Materials for energy and environment

Priority research areas:

- (1) New energy-storage materials and devices using advantageous resources of Yunnan;
- (2) New high-efficiency solar cell materials and devices using advantageous resources of Yunnan.

V. Strategic Research on Sustainable Development of Yunnan and Regional Cooperation with South and Southeast Asia under the Framework of Belt and Road Initiative

To strengthen Yunnan's capability of integrating into and serving the Belt and Road strategy, and to implement the strategic goal of "Three Roles" raised by the Secretary-General Xi Jinping in his important speeches delivered in Yunnan, the Joint Fund calls for proposals that respond to the demand of building Yunnan into a scientific and technological center radiating to South and Southeast Asia and conduct basic, forward-looking and interdisciplinary researches on key issues such as trade, scientific innovation and financial services with South and Southeast Asia.

1. Production capacity cooperation pattern with South and Southeast Asia and improvement of regional value chains

Priority research areas:

Ways of promoting Chinese technical standards and services in South and Southeast Asia via international cooperation on production capacity between Yunnan enterprises and South/Southeast Asian countries, mechanisms and approaches for Yunnan enterprises to improve overseas investment skills; research on new field, content and scope of international cooperation on production capacity; the position of Yunnan bio-industry in global value chain, mechanisms and paths for extending bio-industry and transferring industrial chain of biotechnology to South and Southeast Asia; ways of moving up the industrial chain in international cooperation on production capacity; global value chain management and transition between value chain positions in international cooperation on production capacity.

2. Heterogeneous multi-agent dynamic evolution pattern of and change management for financial cooperation between Yunnan and countries in surrounding regions

Proposals are expected to target at bottlenecks in regional financial cooperation resulted from imbalance in economic and financial development between Yunnan and countries in surrounding regions in the context of implementing the national strategy of setting up a “pilot regions for comprehensive reforms in border areas” based on geographical advantages of Yunnan under the framework of the Belt and Road Initiative. The Joint Fund encourages research on analyzing the heterogeneous multi-agent characteristics of financial development of Yunnan and countries in surrounding regions by comprehensively using theories and methods of system dynamics, networked evolutionary game theory and international economics; research on connectivity of cross-border financial infrastructure of Yunnan and surrounding regions, fostering of regional foreign exchange market for Chinese currency and currencies of surrounding countries and prevention and control of cross border finance; and research on the mechanism, path and model for the development of asymmetric regional financial cooperation system; research on macro-evolution pattern and change management measures for the financial cooperation between Yunnan and countries in surrounding regions to provide supports to the international financial cooperation between counties and regions along the Belt and Road regions.

3. Scientific outreach to South and Southeast Asia and building of a scientific and innovation center in Yunnan

Priority research areas:

Research on S&T database of countries in South and Southeast Asia, measurement of scientific and technological development and contribution of S&T to economic growth, scientific cooperation demands and influencing factors; design of S&T cooperation mechanism and cooperation path innovation, solutions to bottlenecks in agro-technical popularization, technical assistance, trade in technology services, cross-border transformation for science and technology and other S&T cooperation; capacity building, key areas, key partner countries and planning for Yunnan’s scientific outreach to South and Southeast Asia; general planning, key areas and measures for setting up S&T innovation center based on the demands of S&T cooperation with South and Southeast Asia.

4. Theory, method and realization path for cultural integration of cross-border

national cultures in a big-data environment

Priority research areas:

Big-data acquisition, integration and searching technology for cross-border national cultures in border area of Yunnan; theories and methods of big data-based correlation analysis, reasoning and decision making and knowledge mapping for cross-border national culture integration; big data-driven multimodal media computing and cognitive computing for multinational big data, key techniques for digital conservation of national cultures; multinational media information services, public opinion evolution pattern and guidance mechanism for South and Southeast Asia; realization path for multinational cultural integration.

5. Path, model and realization mechanism for economic cooperation between Yunnan and South/Southeast Asia

Under the framework of the Belt and Road Initiative, in order to build Yunnan into an influential economic center for South and Southeast Asia, it is necessary to clearly identify the economic connectivity between Yunnan and South/Southeast Asia first and find the cooperation path for a collaborative development (e.g., bilateral or multilateral trade cooperation, construction and optimization of regional industrial chain); secondly, though the fundamental goal of economic cooperation between Yunnan and South and Southeast Asia is to pursue a win-win situation, the success of economic cooperation may be affected by policy and institutional environment. Solid realization mechanism is indispensable for any potential economic cooperation pattern.

This research topic calls for a combination of basic research and applied research. First, identifying the economic connectivity between Yunnan and South/Southeast Asia is the goal of basic research (including the commodity flow, industrial competitiveness and complementarity, regional industrial chain, interaction between economic systems, etc.) and the starting point for cooperation path selection; secondly, the applied research should focus on cooperation pattern and realization mechanism and answer the question of how to start and proceed with economic cooperation. The findings will provide decision-making basis in promoting economic cooperation between Yunnan and South and Southeast Asia.

NSFC-Xinjiang Joint Fund

The second phase of the NSFC-Xinjiang Joint Fund is jointly established by NSFC and the Peoples' Government of Xinjiang Uygur Autonomous Region for the period from 2016 to 2020 to implement the guidelines of the National Working Conference on Scientific and Educational Assistance to Xinjiang. It aims at making full use of the guiding role of the National Natural Science Fund, attracting a number of talented scientists to work in Xinjiang, boosting the development of science and technology and the growth of scientific talents in the Region, improving innovation capabilities of universities and research institutes in Xinjiang and promoting the sustainable development of Xinjiang's economy and society.

In 2018, the NSFC-Xinjiang Joint Fund calls for proposals of "Fostering Program Project", "Key Program Project" and "Special Grant for Local Young Talents" in 4 priority research areas. For "Fostering Program Project", the average funding (direct costs) for each

project will be 600,000 yuan for 3 years; for “Key Program Project”, the average funding (direct costs) for each project will be 2.8 million yuan for 4 years. “Special Grant for Local Young Talents” supports researchers with good research achievements in Xinjiang to conduct innovative research within the scope outlined in the *Guide to Programs*. It supports up to 2 outstanding local young researchers under the age 45 in each research area, with a funding of 900,000 yuan (direct costs) for 4 years. The NSFC-Xinjiang Joint Fund is open to all Chinese researchers. It is a platform for providing scientific and technological assistance to Xinjiang. Qualified researchers are welcomed to apply for this fund according to the research scope and requirements listed in the Guide.

I. Agriculture, Biodiversity and Biological Resources in Xinjiang

1. Agriculture

- (1) Stress-resistant germplasm resources of main crops;
- (2) High-efficient use of water and nutrients in main crops and endemic plants;
- (3) Formation of good traits and flavor of featured fruits;
- (4) Mechanism for population expansion and biological invasion of invasive species;
- (5) Etiology and pathogenesis of major diseases of livestock and poultry.

2. Biodiversity and bioresources in Xinjiang

- (1) Physiological and molecular mechanism for adaptation to adverse environment of desert plants;
- (2) Impact of soil salinization on natural vegetation and improvement of saline-alkali soil;
- (3) Biodiversity and biological characteristics of pests and beneficial insects in oasis;
- (4) Biodiversity of macrofungi and the relations between macrofungi biodiversity and habitat;
- (5) Mechanism for species coexistence and community maintenance in special ecosystem.

II. Water Resources and Mineral Resources

1. Water resources

Proposals are expected to respond to the demand of guaranteeing water security in Xinjiang and conduct basic and applied researches on water resources and water environment.

- (1) Water resources transformation process in desert-oasis ecosystem and efficient use of water resources;
- (2) Optimized allocation and adaptive regulation for regional or river basin water resources;
- (3) Ecological effect of water-soil resources exploitation and major infrastructure construction in Central Asia;
- (4) Ecological effect and process of different water-saving irrigation models for agro-ecological system in arid area.

2. Mineral resources

Proposals are expected to respond to the demands of guaranteeing of security of national resources and building a mineral resources base in Northwest China, focus on advantageous mineral resources in Xinjiang and neighboring areas, conduct researches on

metallogenic mechanism and prognosis of the main mineral resources in the Region and environmental effect and remediation of mining explorations.

(1) Deep structure three-dimensional analysis, metallogenic mechanism and prognosis of major mining areas of Xinjiang;

(2) Key technology for ultralow permeability drilling in the Region;

(3) Environmental effect of mineral resources exploitation and green remediation for mining sites.

III. Population and Health

1. Epidemiology, pathogenesis, diagnosis, prevention and treatment of high-incidence zoonoses

2. Etiology, pathogenesis and intervention of obesity and related metabolic diseases in Xinjiang

3. Epigenetic mechanism, genotyping, targeted therapy and immunoprophylaxis of cervical cancer and hematologic tumors

4. Complex disease classification and intervention by Uyghur medicine

5. Epidemiology of cerebral palsy in Xinjiang

6. Molecular epidemiology of tuberculosis in Xinjiang and genovariation in drug-resistant tuberculosis

IV. Information Security

1. Multilingual content recognition and interpretation techniques based on multi-media information

2. Technology for multi-source data cognition, integration and analysis in public security domain

3. Biometric identification technology for public security

4. Information security in quantum remote teleportation

5. Video information processing technology for public security

NSFC-Henan Joint Fund

The second phase of the NSFC-Henan Joint Fund is jointly established by NSFC and the Provincial Government of Henan Province (hereinafter as NSFC-Henan Joint Fund) from 2016 to 2020. It aims at giving full play of the guiding role of NSFC, attracting and gathering outstanding scientists all over the country, solving the major S&T issues and key technology problems concerning the strategic development of economy, society and science and technology in Henan Province and its surrounding areas. It tries to attract, cultivate, and gather groups of scientific talents to the Province, enhance the independent innovation capability and international competitiveness of universities and research institutes in the province, and promote the sustainable development of economy and society of the province.

NSFC-Henan Joint Fund calls for proposals of “Fostering Program Project” and “Key Program Project” from four priority research areas in 2018. “Fostering Program Project” provides an average direct funding of 500,000 yuan per project for three years;

“Key Program Project” provides an average direct funding of 2.2 million yuan per project for four years. Any eligible scientists and technicians over the country are encouraged to submit applications in accordance with research scope and requirements listed in this *Guide to Programs*.

I. Biology and Agriculture

1. Key program projects

Proposals are expected to study, based on the main agricultural and forestry organisms in Henan, the mechanism and control of pests of major crop pests, control of crop traits such as wheat “small crops”, evolution of forest pests and diseases, evolution of special biological species, and adaptive mechanisms; healthy breeding, basic research on the development of livestock and poultry-derived antimicrobial peptides. Main research areas include:

- (1) Study on the occurrence and control of important diseases and pests of main crops in Henan;
- (2) Molecular mechanism of formation of good quality in wheat and maize;
- (3) The molecular basis of forest diseases in the province;
- (4) Molecular mechanism of regulation of yield-related traits in major “small crops” in Henan;
- (5) Basic research on nutrition and immune regulation of livestock and poultry;
- (6) Study on the biodiversity and formation mechanism of Taihang Mountains;
- (7) Genetic and molecular regulation mechanisms for important economic traits of multipurpose peony.

2. Fostering program projects

Proposals are expected to address the exploration, research, innovation, utilization, and genetic improvement theory and technological innovation of the important and characteristic agricultural bio-quality germplasm in Henan Province; the physiological, genetic, and molecular mechanisms of the formation of important agricultural biological significance; the development, epidemic and hazard of agricultural pests and the theory of green prevention and control; agricultural biological and environmental interaction and theoretical research on disaster prevention and reduction; plant cultivation resources and their utilization; research on farmland soil pollution restoration; the biological mechanism of efficient utilization of crop nutrients; research on pathogenic mechanism and prevention and control technology of major animal diseases; key technologies for food processing, preservation, storage, transportation, and quality safety control; genetic analysis of excellent livestock and poultry resources, nutrient metabolism of livestock and poultry, and their regulatory mechanisms

II. Population and Health

1. Key program projects

Proposals are expected to focus on high-blindness eye disease, esophageal cancer, schizophrenia, myasthenia gravis, acute myocardial infarction, AIDS and other high-risk and major diseases in Henan Province, explore the pathogenesis diagnosis, treatment and prevention mechanisms, and seek new targets for effective treatment, new drugs, as well as new prevention and control programs, carry out relevant basic and clinical basic research;

use Henan resources of Chinese medicine, carry out research on the characteristics of locally-produced Chinese medicine. Main research areas include:

- (1) The pathogenesis of immune eye diseases;
- (2) The key mechanism of esophageal cancer microenvironment affecting immunotherapy;
- (3) Genetic and environmental interactions and mechanisms in schizophrenia;
- (4) The pathogenesis and clinical intervention of myasthenia gravis;
- (5) Exosomes regulate the injury repair mechanism of myocardial infarction;
- (6) Basic research on prevention and treatment of myocardial cell injury after acute myocardial infarction;
- (7) Design, synthesis and mechanism of new anti-AIDS drugs;
- (8) Study on the production and mechanism of functional red blood cells;
- (9) Study on the external function and mechanism of Henan native herbs.

2. Fostering program projects

Proposals are expected to conduct research on the diagnosis, treatment and prevention mechanism of common diseases, major diseases and chronic non-infectious diseases in Henan Province; genetics and epigenetic mechanisms of drug resistance in malignant tumors; research and application of stem cells in related diseases; reproductive system, basic research and clinical basic research in the field of perinatal medicine; research on mechanisms of organ damage, repair and transplantation; pathogen transmission, variation patterns and pathogenic mechanisms; innovative drug design, synthesis, mechanism of action and application; research on the ecology, characteristics, and molecular mechanisms; prevention and treatment of major and difficult diseases with integrated Chinese and western medicine

III. New Materials and Advanced Manufacturing

1. Key program projects

Proposals are expected to focus on the effective utilization of Henan's native resources, science and technology and industrial development needs, research and development of magnesium alloy, aluminum alloy materials, battery catalytic materials, boron-based, copper-based materials, refractory materials, and other advanced materials, as well as the basic research on the manufacturing theory and method of the critical life of key components of high-end equipment. Main research areas include:

- (1) Research on fully degraded magnesium alloy vascular scaffold;
- (2) Study on coordination molecular-based high-efficiency fuel cell catalytic materials;
- (3) Study on preparation, structure and properties of boron-based materials;
- (4) Study on force-thermo-electricity matching copper matrix composites;
- (5) Research on strengthening mechanism and properties of wear-resistant molybdenum alloys;
- (6) Study on the design and manufacturing of the ultimate life of high-end equipment key components;
- (7) Research on energy-saving near-infrared ceramic coating refractories;
- (8) Basic research on preparation and application of plasma assisted deposition graphene thin films.

2. Fostering program projects

Proposals are expected to study: the physical and chemical basis and applied basis of the key technologies and organizational control of the design, preparation, compounding and modification of key basic materials such as new functionalized nanomaterials, organic polymer materials, inorganic non-metallic materials, non-ferrous metal materials, composite materials, new energy materials, superhard materials, etc.; the deep processing and resource recycling of non-metallic mineral products; the comprehensive utilization of heterogeneous heterostructure materials and salt resources; advanced precision forming or machining techniques; mechanical surface/interface functions design and performance control; theory, techniques, and methods for efficient and precise machining; new principles, new models, new systems, and new equipment for smart manufacturing; additive manufacturing, remanufacturing, and laser manufacturing; basic theory and technology of reliability manufacturing of core parts such as gears, bearings, electric spindles; basic theory and technology of advanced electrical equipment manufacturing and safe operation; key scientific issues of energy-saving technologies and equipment in high-energy-consuming fields.

IV. Electronic Information

1. Key program projects

Proposals are expected to meet the technical needs of smart monitoring, modern communications, network security, smart medical care, and new types of electronic devices, and to develop basic theories and key technologies for information technology. Main research areas include:

- (1) Online radiation temperature measurement theory and key technologies in metal treatment;
- (2) Research on endogenous security defense theory and method in cloud computing environment;
- (3) Research on behavior discovery and subject positioning of multimedia covert communication;
- (4) Bioinformatics study on early diagnosis of esophageal cancer;
- (5) Research on key technologies of self-drive high performance gas sensor.

2. Fostering program projects

Proposals are expected to study the trusted system and network security; big data parallel processing technology based on cloud computing; knowledge mining and intelligent analysis methods and technology based on deep learning; pattern recognition theory and methodology; machine vision and video theory and technology; network communication and computing collaboration theories and methods; internet of things and smart city perception technology; electromagnetic wave detection theory and new technology; geospatial information technology; new theories and methods for the transfer, fusion, and conversion of multisource information; systems for optical communication and optical sensor devices theory and new technology; new semiconductor materials and devices; nonlinear systems and systems optimization theory and new technologies; intelligent manufacturing related theory and new technologies; new software engineering theory and methods; and theory and method of intelligent optimization.

Joint Fund to Promote Cross-Straits Scientific and Technological Cooperation

The second phase of the Joint Fund to Promote Cross-Strait Scientific and Technological Cooperation is jointly established by NSFC and Fujian Provincial Government for the period from 2016 to 2020. It aims at making full use of the guiding role of the National Natural Science Fund, attracting and gathering scientists along the two sides of the Taiwan Strait to conduct S&T cooperation, solving major scientific issues and key technological problems mutually concerned by Fujian and Taiwan region, boosting the growth of scientific talents, improving innovation capabilities of the cross-strait economic zone and promoting the sustainable development of regional economy and social welfare.

In 2018, the Joint Fund calls for proposals of “Key Program Project” in 4 priority research areas. Average funding (direct costs) for each project will be 2.8 million yuan for 4 years. The joint fund is open to all Chinese researchers. Qualified researchers are welcomed to apply for this fund according to the research scope and requirements listed in this *Guide to Programs*.

I. Agriculture

1. Molecular mechanism of the formation of agronomic traits of important crops and horticultural crops in Fujian and Taiwan;
2. Mechanism of pest spread, pest damage and ecological prevention and control of pests for important crops in Fujian and Taiwan;
3. Genetic analysis and molecular breeding of important traits of main aquaculture species in Fujian and Taiwan;
4. Pathogenesis, prevention and control of diseases of important farmed animals (livestock, poultry and aquaculture species) in Fujian and Taiwan;
5. Identification and exploitation of effective components in featured plants and marine species in Fujian and Taiwan;
6. Biological basis for endemic tea processing in Fujian and Taiwan.

II. Resources and Environment

1. Pattern, process and environmental effect of forest ecosystem in Fujian and Taiwan;
2. Typical pollutant migration and transformation pattern, ecological effect and remediation for regional environment of Fujian and Taiwan;
3. Coupling mechanism of resources and environmental carrying capacity and development of Fujian and Taiwan;
4. Evolution process and resource & environment effect of typical marine ecosystem in Taiwan Strait;
5. Conservation of featured marine biological resources in Fujian and Taiwan and subtropical marine ranching;
6. Formation mechanism and environmental effect of major disasters in Fujian and

Taiwan.

III. New Materials and Advanced Manufacturing

1. Design, preparation and application of functional energy/information materials;
2. Materials for marine engineering equipment;
3. Surface and interface design, control and application for lightweight/high-strength alloy/metallic glass and rare earth materials;
4. Value-added utilization of biomass materials;
5. Graphene and graphene composites;
6. New theories and methods for precision drive/transmission system of industrial robot;
7. Manufacturing basis and forming mechanism of complex surface of brittle materials.

IV. Electronic Information

1. Micro-nano optoelectronic regulation technique and its application;
2. Theory and application of big-data based intelligent analysis and security early warning;
3. Theories and techniques of fast imaging and image processing for biomedical research;
4. Theory and application of dynamic monitoring and three-dimensional reconstruction;
5. Theory and application of fault diagnosis and reliability of large-scale information network;
6. Offshore and underwater wireless communication and network.

NSFC-Shandong Joint Fund

The second phase of the NSFC-Shandong Joint Fund is jointly established by NSFC and the People's Government of Shandong Province (hereinafter as NSFC-Shandong Joint Fund) from 2017 to 2021. It aims at giving full play of the guiding role of NSFC, attracting and gathering outstanding scientists all over the country, promoting the development of Shandong Peninsula Independent Innovation Demonstration Zone and the Yellow River Delta Agricultural High-tech Industry Demonstration Zone, solving the major S&T issues and key technology problems concerning the strategic development of economy, society and science and technology in Shandong Province and its surrounding areas. It tries to attract, cultivate, and gather groups of scientific talents to the province, enhance the independent innovation capability and international competitiveness of universities and research institutes in Shandong province, and promote the sustainable development of economy and society of the province.

NSFC-Shandong Joint Fund calls for proposals of "Key Program Project" from three priority research areas in 2018 with a direct cost of 3 million yuan per project for four years. Any eligible scientists and technicians over the country are encouraged to submit

applications in accordance with research scope and requirements listed in this *Guide to Programs*.

I. Geo-Sciences

1. Saline soil improvement in the Yellow River Delta

Soil salinization is the main factor that restricts the development of high-efficiency ecological agriculture in the Yellow River Delta. Based on the comprehensive treatment and utilization of saline-alkali land in the Delta, proposals are expected to research on the mechanism and key technologies for the improvement of saline-alkali land using technical methods such as engineering, agronomy, biology, and chemistry, and lay the foundation for ensuring food security and ecological security. Main research areas include:

- (1) The mechanism and key technologies of microbial improvement of saline-alkali land;
- (2) The mechanism of nutrient enhancement on saline-alkali farmland in the Delta;
- (3) Study on the mechanism, effect and regulation of soluble substances in the saline soil in the Delta;
- (4) Study on integrated management and technology model of water-fertilizer-salt integration in saline and alkaline land in the Delta;
- (5) Study on optimization of crop ecology and agroecosystem in saline and alkaline land in the Delta of formation of good quality in wheat and maize;

2. The ecological protection mechanism of Yellow River Delta wetland

The Yellow River Delta wetland has important ecological functions, but the ecological environment is fragile. Proposals are expected to focus on the development and utilization of the resources in the region and the protection of the ecological environment, and carry out the research on multi-scale ecosystems to provide scientific and technological support for the development and protection of wetlands in the Delta.

- (1) Study on ecological restoration mechanism of soil pollution in the Delta;
- (2) Restoration of degraded ecological system of plantation in Delta;
- (3) Study on wetland degradation and ecological protection mechanism in the Delta;
- (4) Study on the reconstruction of typical estuarine ecosystem and its effects on resources and environment in the Delta.

3. Shandong offshore environment and ecology

Focusing on the major needs of offshore marine ecology and environmental protection and marine development in Shandong Province, proposals are expected to conduct in-depth studies on the marine geological environment, the evolution of coastal ecosystems and disaster prevention and control, and provide scientific support for the ecological development of the offshore environment and the rational development of resources in Shandong Province. Main research areas include:

- (1) Characteristics, dynamic mechanism and environmental effects of topography and geomorphology evolution in the Yellow River Delta;
- (2) Behavioral processes and environmental effects of the coastal belt and coastal pollutants in Shandong Province;
- (3) Human activities affecting the sea environment and ecological processes and their regulatory mechanisms;
- (4) Study on the occurrence and control mechanism of typical disasters in Shandong

Coastal Zone;

- (5) In-situ real-time monitoring technology of marine ecological environment.

II. Marine Materials, Marine Engineering and Marine Equipment

1. Marine materials

Various types of materials in the marine environment serve the basis for marine development and protection. Proposals are expected to focus on the needs of key basic materials for engineering construction and resource development in the marine environment, to carry out basic research on the design, preparation, and application of new materials for marine engineering equipment, marine engineering construction, marine monitoring, and resource utilization, and to effectively solve the bottleneck that constrain the development of marine equipment and the development of marine engineering and the use of marine resources. Main research areas include:

- (1) High-performance metal materials and their marine environmental adaptability;
- (2) Design and preparation of high-durability marine engineering materials;
- (3) Marine anti-corrosion and anti-fouling materials and their applications;
- (4) Marine analysis sensor instrument key materials;
- (5) Desalination low-pressure high-efficiency membrane materials and components.

2. Marine engineering

The complex and varied marine environment has brought huge challenges to the construction of marine projects. Proposals are expected to focus on the needs of marine engineering construction in Shandong Province, and carry out research on the basic application of modern engineering technology in subsea tunnels and coastal engineering. Main research areas include:

- (1) Subsea tunnel construction and operation safety technology;
- (2) Coastal engineering environmental disasters and countermeasures for disaster prevention and mitigation;
- (3) Efficient construction and control of deepwater oil and gas wellbore;
- (4) Marine structural safety and risk analysis.

3. Marine equipment

The level of marine development equipment reflects the strength of the nation's marine development. Proposals are expected to focus on the major demand for marine equipment and the development of key common technologies, such as offshore oil and gas exploration, efficient use of marine renewable energy resources, and seawater desalination, and provide support for mastering marine development and marine resource utilization equipment core technologies, and break through the bottleneck of independent design and manufacturing. Main research areas include:

- (1) Key technologies for offshore oil and gas exploration platforms;
- (2) Deep sea carrying and operating equipment;
- (3) Key technologies for manufacturing deep ocean flexible pipe;
- (4) Seawater desalination core device and equipment;
- (5) Key technologies for renewable marine energy capture, supply, and transmission.

III. Information Science

1. System modeling and control

System modeling and control is the core of efficient use of inspection/observation data and data drive. Proposals are expected to focus on the major requirements for system modeling and control technologies in marine development, observation and computation applications, and conduct research on the application of marine ecological environment modeling and analysis, core systems and algorithms for information processing systems, and realize intelligent, accurate and real-time marine observation and development activities. Main research areas include:

- (1) Analysis and forecast of fractal theory of ocean information;
- (2) Theory and technology of core control system for underwater operating robots;
- (3) Super-computing model and key algorithm based on ocean applications;
- (4) Key models and key algorithms for application of big data and artificial intelligence in offshore oil and gas exploration and development.

2. Information sensing and exchange

Information sensing and exchange as well as sensing technologies are the core technology components of marine equipment. In response to major needs in marine monitoring, marine instrumentation, and other aspects, proposals are expected to research on underwater acoustic array signal processing and marine environmental sensor acquisition and transmission, and provide scientific and technological support for improving the marine equipment technology and ocean observation capabilities. Main research areas include:

- (1) Water acoustic energy conversion and array space-time processing technology;
- (2) Deep-sea submersible environment perception, navigation and path planning;
- (3) New sensors in marine environment;
- (4) Underwater equipment data acquisition and transmission technology;
- (5) Complex marine geological environmental information detection technology.

NSFC-Liaoning Joint Fund

The NSFC-Liaoning Joint Fund is jointly established by NSFC and the Liaoning Provincial Government for the period from 2015 to 2019. It aims at making full use of the guiding role of the National Natural Science Fund, attracting and gathering a number of talented scientists, solving major scientific issues and key technological problems in the industrial development of Liaoning, improving its innovation capabilities and promoting the revitalization of the old industrial base.

In 2018, the NSFC-Liaoning Joint Fund calls for proposals of “Key Program Project” in 4 priority research areas. Average funding (direct costs) for each project will be 2.5 million yuan for 4 years. The NSFC-Liaoning Joint Fund is open to all Chinese researchers. Any qualified researcher all over the country is welcomed to apply for this fund according to the research scope and requirements listed in this *Guide to Programs*.

I. Advanced Equipment Manufacturing

Proposals are expected to respond to the development demands of equipment manufacturing industry of Liaoning, focus on typical products such as large-scale power transmission and transformation equipment, large construction machinery, high-end numerical control machine and aeronautical equipment, conduct basic research on

innovative product design theory and method to improve the indigenous innovation capacity of high-end equipment manufacturing industry in the province.

Priority research areas:

- (1) Mechanism for sealing failure of ultra-high voltage transformer;
- (2) Theory and method for structural and multifunctional collaborative optimization for additive manufacturing of hypersonic vehicle;
- (3) Theory and method for dynamic precision design for precision machine tools;
- (4) Thermal/mechanical coupling mechanism and regulation in oversized roller bearing processing;
- (5) Mechanism of large centrifugal compressor vibration and intelligent diagnosis;
- (6) Real-time perception and intelligent regulation of the running state of high-speed heavy-load permanent magnet transmission equipment;
- (7) Structure and microstructure defect control for super massive complex components of titanium alloy;
- (8) Theory and method for 3D laser printing of high-performance complex-structure sand mould;
- (9) Scheduling and optimization of material handling system for integrated circuit equipment manufacturing.

II. New Materials

Proposals are expected to respond to urgent need for new materials of high-end equipment, new energy technology and featured industries in Liaoning, focus on technologies of advanced structural materials including high-quality steel, superalloy, high-performance fiber, amorphous materials, membrane materials and boron-containing materials, and promote the upgrading of material technology and industry.

Priority research areas:

- (1) New technology of iron-coke composite for low carbon steel manufacturing;
- (2) Phase transformation and microstructure regulation of ultra-high strength steel plate for automobile;
- (3) Structure and property regulation of boron containing inorganic materials for nuclear industry;
- (4) Sponge-like porous membranes for vanadium flow battery;
- (5) Rheological forming and dynamic mechanical behavior of amorphous composite;
- (6) New dicing technology for ultra-thin silicon wafer;
- (7) Aggregation structure and properties of bio-based polyamides PA56.

III. Information Technology

Proposals are expected to respond to the development demand of information technology industry of Liaoning and focus on topics of cognitive wireless networks for intellectual manufacturing, internet of vehicles and industrial information security. Applicants are encouraged to conduct researches on theories and key technologies of dynamic cognition of radio-frequency spectrum resources, mechanism for interaction between mobile environment and multi-modality network and multi-dimensional regulation for industrial information security to promote the indigenous innovation of industrial internet service in Liaoning.

Priority research areas:

- (1) Key technology of cognitive wireless network in manufacturing and logistical process;
- (2) Intelligent group decision-making theory and method for connected vehicle;
- (3) Method and key technology for multi-modality medical image recognition and analysis;
- (4) New method and new model for intelligent regulation of urban transportation and regional logistical system scheduling;
- (5) Methods and key techniques of collaborative translation;
- (6) Basic theories and key techniques of engineering design of machine tools and outsourcing management of product data.

IV. Agriculture

Priority research areas:

- (1) Mechanism of aquatic animal diseases in northern sea region;
- (2) Epidemiology, pathogenesis, prevention and control of major diseases of livestock and poultry;
- (3) Forest biodiversity in Liaoning and exploitation of forest biodiversity;
- (4) Storage and processing of marine products in Liaodong Bay;
- (5) Genetic basis for important traits for machinery harvest of corn.

NSFC-Zhejiang Joint Fund for the Integration of Industrialization and Informatization

The NSFC-Zhejiang Joint Fund for the Integration of Industrialization and Informatization is jointly established by NSFC and the Zhejiang Provincial Government for the period from 2015 to 2019. It aims at attracting and gathering talented scientists across the country, solving major scientific issues and key technological problems related to the integration of industrialization and informatization in the social, economic and scientific & technological development in Zhejiang National Demonstration Zone of Integration of industrialization and informatization and neighboring regions, and promoting the scientific and technological development and the building of talent teams in the region.

In 2018, the NSFC-Zhejiang Joint Fund for the Integration of Industrialization and Informatization calls for proposals of “Key Program Project” in 5 priority research areas. Average funding (direct costs) for each project will be 2.1 million yuan for 4 years. The joint fund is open to all Chinese researchers. Qualified researchers are welcomed to apply for this fund according to the research scope and requirements listed in the *Guide to Programs*.

I. High-End Industrial Automation

Proposals are expected to respond to needs of the integration of industrialization and informatization in medical and pharmaceutical industry, chemical engineering, papermaking,

clothing, equipment manufacturing, etc., focus on “saving manpower by using machines” and “intelligent factory”, give emphasis to basic theories and key technologies in the advancement of industrial automation, improve the application of automatic, intelligent and network-based systems in enterprises, and facilitate the transition from “Made in Zhejiang” to “Created in Zhejiang”.

Priority research areas:

Intelligent control and optimization of running process of coal-fired power plant.

II. Industrial Cyber-Physical System

For the reason that Zhejiang has numerous small and medium enterprises and industrial data is dispersed and characterized by heterogeneity, uncertainty, correlative coupling and complexity in spatial and temporal distribution, proposals are expected to respond to the needs of industrial transformation and upgrading and acceleration of industrialization-informatization integration in the province, conduct researches on basic theories and key technologies of industrial cyber-physical system, and comprehensively improve the intelligent level of industrial production of Zhejiang.

Priority research areas:

1. Basic theories and key techniques for information integration of ocean observation network;
2. Key technology of infrared integrated sensor chip for food quality monitoring;
3. Theories and key techniques for integral design of reconfigurable high-performance 5G millimeter wave front end;
4. Key technology of marine communication based on constellation system of mobile communication satellite;
5. Mechanism and key technology of software-defined networking for real-time and reliable information transmission.

III. Intelligent Manufacturing

Proposals are expected to address the needs of transformation and development of manufacturing industry in Zhejiang, focus on a broad range of industries such as equipment manufacturing, light industry, textile, chemical engineering, medical industry, electric power, building materials, metallurgy, automobile, shipbuilding, logistics, etc. Proposals are encouraged to develop high and new technologies, take the integration of industrialization and informatization as the means, give emphasis to key theories and technologies of intelligent manufacturing such as network-based collaborative design, manufacturing and service, intelligent industrial robot, intelligent equipment, intelligent basic components, etc., and push forward the upgrading of equipment manufacturing industry in Zhejiang by promoting digitized, network-based and intelligent production process, components and equipment products.

Priority research areas:

1. Key technologies for online monitoring and safe operation of industrial gas turbines;
2. Forming process and property manipulation for resin-based carbon fiber composite component;
3. Design and manufacturing of on-site hydrogen production system for fuel cell;

4. Lean production for inorganic nonmetallic materials and precise manipulation of product property;
5. Key techniques of intelligent design and manufacturing of high-end bearing and reliability of bearing;
6. Design of positioning and directive system and navigation system for surgery robot;
7. Theory and method of aerodynamic optimization based on numerical simulation of aircraft;
8. High frequency and low power consumption soft magnetic material.

IV. Smart City

Proposals are expected to respond to the major needs of the building of smart cities and the sustainable development of cities in Zhejiang, focus on basic theories and key techniques of smart city for which major breakthroughs are strongly needed, use internet, big data and other information and communication technologies to improve the decision-making and city management, build up the smart city management and service network systems based on big data, cloud computing and the Internet of Things, and provide technical support to the industrialization in smart city.

Priority research areas:

1. Intelligent analysis technique and method for medical image;
2. Key technology of intelligent monitoring and protection of urban forest resources.

V. Smart Ocean

Smart Ocean is an important strategy for Zhejiang to perceive the ocean, utilize marine resources and protect the ocean. Proposals are expected to respond to the needs from the development of National Marine Economy Demonstration Zone of Zhejiang Province, focus on new theory, technique and approach for marine environmental protection, marine resource exploration, marine detection and intelligent processing of marine information, and provide S&T support to marine resource exploitation, marine disaster forecast and ocean environmental protection.

Priority research areas:

1. Key technology for treatment and emergency control of large scale offshore oil pollution;
2. Marine seismic monitoring and networking technology;
3. Technology for intelligent aquaculture in deep sea;
4. Space-ocean-ground integrated communication network in archipelago.

NSFC-Shanxi Joint Fund for Coal-Based Low-Carbon Technology

The NSFC-Shanxi Joint Fund for Coal-Based Low-carbon Technology is jointly established by NSFC and the Shanxi Provincial Government for the period from 2015 to

2019. It aims at attracting and gathering talented scientists across the country, solving major scientific issues and key technological problems of coal-based low-carbon energy in Shanxi, promoting S&T development and talent team building in the region.

In 2018, the NSFC-Shanxi Joint Fund for Coal-based Low-carbon Technology calls for proposals of “Key Program Project” and “Fostering Program Project” in 5 priority research areas. For the “Key Program Project”, the average funding (direct costs) for each project will be 2.9 million yuan for 4 years. For the “Fostering Program Project”, the average funding (direct costs) for each project will be 700,000 yuan for 3 years. The joint fund is open to all Chinese researchers. Qualified researchers all over the country are welcomed to apply for this fund according to the research scope and requirements listed in the *Guide to Programs*.

I. New Materials

1. Key program project

- (1) Preparation of high-performance carbon fiber/resin composite;
- (2) Microstructure regulation and heat processing of super stainless steel;
- (3) New theory and method of structure-property controlled forming for high-strength and ductility complex magnesium alloy component.

2. Fostering program project

Priorities include: basic researches on high value-added carbon-based materials and its application in energy devices, optoelectronic devices, thermal management components, high power density electronic components and environmental materials; basic researches on the design of new magnesium alloy, aluminum alloy and titanium alloy materials, new theories and methods of shape and property-controlled forming of high strength and ductility alloy components; basic research on new techniques and theory of reduction of heavy rare-earth elements in high-performance rare-earth permanent magnet materials; and basic research on new stainless steel and nickel alloy materials for rigorous complex corrosive environment.

II. Energy Conservation and Environmental Protection

1. Key program project

- (1) Separation and exploitation of multi-pollutants from coke oven gas;
- (2) Recycling of coal-based solid waste;
- (3) Recycling of low concentration coal bed methane and coke oven gas.

2. Fostering program project

Proposals are expected to target at problems in energy conservation and environmental protection in coal mining and utilization and the development of resource-based industries and respond to technical demands of high efficient energy utilization, comprehensive utilization of waste gas, waste water and industrial residues, carbon emission reduction and pollutant control. Priority areas include morphological evolution, monitoring and control of pollutant, resource recycling, big data of high efficient use of renewable energy.

III. Coal Machinery

1. Key program project

- (1) Basic theory and key technology for precise guidance of tunnel boring machine;
- (2) Basic research on intelligent super excavator for mining;
- (3) Key digital component for underground high water-based hydraulic pressure system.

2. Fostering program project

Proposals are expected to respond to the demand of safe, highly efficient, environmental friendly and intelligent mining, focus on key equipment and production process such as mining, excavating and transportation, and conduct basic researches on new intelligent transmission devices and its monitoring, diagnosis, control and manufacturing, to provide theoretical foundation and frontier techniques to the development of intelligent coal machinery.

IV. Coal and Coal Bed Methane Mining

1. Key program project

- (1) Occurrence mechanism and mining of coal bed methane in Shanxi;
- (2) Multi-scale characteristics of reservoir of medium rank coal bed methane in Shanxi and the mechanism for interaction between methane reservoir and fluid;
- (3) Occurrence characteristics and metallogenic regularity of lithium, gallium, and other coal-associated minerals in Shanxi;
- (4) Accumulation mechanism of coal bed methane in abandoned mines in Shanxi.

2. Fostering program project

Proposals are expected to respond to the demands for safe, green and high-efficiency mining of coal and coal bed methane in Shanxi, focus on geologic and geo-microbiological basis of coal and methane formation and new theories, methods and techniques for precision prospecting and mining.

V. Ecological Restoration of Mining Area

1. Key program project

- (1) Monitoring and early warning of ground deformation disaster in large combined open-underground mining area;
- (2) Remediation mechanism for heavy metal contaminated soil in arid and semi-arid mining area;
- (3) Security monitoring and disaster prevention and control for high-speed transportation facility in coal mine goaf of Qinshui;
- (4) Mechanism of ecological damage and degeneration caused by coal mining in large-scale mining areas of Shanxi;
- (5) Mechanism of biodiversity restoration and ecological function maintenance in mining areas of arid and semiarid regions.

2. Fostering program project

Proposals are expected to focus on the ecological degeneration caused by long-term and high-intensity coal mining and to conduct basic researches on the following topics: mechanisms of surface crack expansion and slope damage induced by coal mining, mechanisms of carbon capture and soil organic matter increase in reclaimed mines, the soil-microorganism-vegetation interaction mechanism and effects in reclaimed mines, the influences of microorganism on soil nutrient cycling in reclaimed mines, optimization and

regulation of the structure and function of restored ecosystem in mining areas, temporal-spatial evolution and driving mechanism of ecosystem services in typical mining areas, and spontaneous combustion mechanism of high-sulfur and combustible coal waste dump and flame retardant mechanism.

NSFC-Guangdong Center for Big Data Research

NSFC and the Guangdong Provincial Government jointly set up Center for Big Data Research in 2016. It aims at making full use of NSFC's guiding role, data and computation resources in Guangdong Province, to promote the development of big data development.

This project focuses on smart city construction, targets at areas of smart traffic, smart medicine and health, smart security, smart disaster prevention, smart finance, smart education and smart management, and gathers talents all over China to solve major scientific and technological issues in big data research.

This project will be based on Tianhe-2 supercomputer, emphasizing on interdisciplinary research and collaboration, and encourage cooperation with universities and research institutions in Guangdong Province.

Application for the following areas will be accepted.

I. Center Project

In 2018, NSFC plans to fund center projects in the following 4 areas with direct cost of 20 to 30 million per project for 4 years.

Applicant should be academic leader in the area and have good organizing and coordinating ability, and can play a leading role in the project. PIs in the main research direction should be very active in research. The applicant should be a PI in one of main research directions.

Research content should cover all research directions in the area. Research targets and contents should be closely related and supportive to each other. Research team members should be well balanced in size. Collaborating organizations should be properly arranged according to the actual needs.

Area One: Basic algorithm and supporting environment for big data analysis and processing based on supercomputer.

To meet the need of big data applications, the proposal shall integrate basic algorithms of big data analysis and processing, develop original computation method and algorithm in new types of distributive parallel computing environment, provide approach to use operation platform for big data analysis and processing programming, set up parallel computing based on Tianhe-2, and provide online services to external clients. Main research areas include:

1. Basic algorithm and theory of big data computation

Develop basic algorithm for basic computation problems of big data, such as basic computation in statistics, generalized multi-body problems, graph computation, large scale algebraic computation, etc. At least 5 basic algorithms are developed through research.

2. Core algorithm and theoretical analysis of big data analysis

Study core algorithm and distributive and parallel technology, using data modeling

and computation, reveal structure, trend and related models, design at least 5 core algorithm of big data analysis for distributive parallel computation environment, such as clustering algorithm, sorting algorithm, correlation algorithm, etc.

3. Core algorithm and theoretical analysis of big data processing

Study core algorithm and distributive and parallel technology, using data modeling and computation, find structure, trend and related models, design at least 5 core algorithm of big data processing for distributive parallel computation environment, such as searching, inquiry, sequencing, comparison, origin tracing, transfer and deduction, etc.

4. Core algorithms and theoretical analysis of big data privacy protection

To address the issue of big data privacy protection, the core strategies of big data privacy protection and distributed parallel implementation algorithms and their distributed parallel implementation technologies are studied. Big data processing core algorithms, such as searching, querying, sorting, comparison, etc., realize data processing through algorithms based on computational logic. Study and design more than 5 core algorithms for efficient and highly scalable large data processing for large-scale distributed parallel computing environments, and study and analyze the correctness of these algorithms, etc.

5. Supporting environment for mixed programming and optimization of parallel algorithm for big data computation

To build and implement an efficient and easy-to-use programming environment for big data analysis and processing, based on the Tianhe-2 supercomputer, to study the parallel programming model for big data analysis and processing, to provide computational features, resource requirements, and full abstraction of runtime dynamic execution behavior, fully exploit multi-level parallelism, design an easy-to-use hybrid parallel programming framework, and to research into key technologies for distributed parallel support environments for large data analytics processing tasks, including resource dynamic load balancing and efficient task scheduling methods, distributed parallel execution mechanisms, efficient data transfer and I/O mechanisms support efficient execution of algorithms on supercomputers. Designing and optimizing big data for the structure of large-scale heterogeneous parallel computer systems.

6. Big data analysis and service platform and demonstration based on Tianhe-2 supercomputers

Build a basic algorithm database for big data calculation and a core algorithm library for big data analysis and processing based on the Tianhe-2 supercomputer platform and the research results from 1 to 5; design a service support platform for big data analysis and processing to support the online computing service functions to achieve efficient operation of big data analysis and processing applications; provide verification and demonstration of platforms and algorithms through 1 or 2 big data analyses and processing demonstration applications.

Area Two: Key technologies of early warning and forecast of regional sea-land gas environment based on big data.

In order to respond to global and regional climate and environmental changes, and to meet the needs of the forefront of scientific development of the Earth system, key technologies and algorithms for coupling the application of large-scale data integration of atmospheric and marine environments with traditional numerical simulation methods are studied to construct a region-based four-dimensional space-time big data Disaster and Environment Intelligent Early Warning and Forecasting System. To deploy a comprehensive

application demonstration system by taking the Guangdong, Hong Kong, and Macao Bay Area as a typical area on the Tianhe-2 supercomputer to raise the awareness of the major disasters of the land and sea gas environment and the monitoring forecast ability.

1. Research on theory and technology of regional atmospheric numerical prediction based on big data

Research and design of high-resolution mesoscale regional numerical forecast theory and methods combined with big data analysis techniques, including parametric application of big data in atmospheric numerical model, artificial intelligence based parameterization optimization, estimation of observation sensitive area, observation error Debugging, optimization of the assimilation application scheme, scale fusion techniques for the approaching and medium-term forecasts, etc. To conduct research into more than five new high-scalability big data calculation algorithms that solve the fusion problem of big data and atmospheric numerical prediction, and established the feasibility, convergence and error controllability theories of these algorithms.

2. The early warning of the offshore marine environment forecast and maritime safety guarantee

Focusing on the reanalysis of historical observations and numerical simulations of big data, the high-resolution ocean-atmosphere coupling model based on big data processing technology is to be studied to reveal the physical mechanism of the interaction of sea air and wave currents in the process of typhoon development and understanding of marine meteorology, form the mechanism of disasters, and establish the intelligent maritime early warning and security system. Three highly scalable algorithms for optimizing and improving ocean-atmosphere coupling using big data are studied and proposed, and the rationality and feasibility of these algorithms in practical applications are verified.

3. Study on flood warning and forecasting based on big data technology and land surface process model

Based on road surface big data, research into and develop big data driven high-resolution land surface process model technologies, such as coupling of core process simulation and big data analysis and processing, verification of algorithm correctness, theoretical analysis of coupling process, real-time simulation of land flood disasters, etc. Five highly scalable algorithms for optimizing and improving land surface models using big data should be studied and proposed, and the rationality, effectiveness, and feasibility of these algorithms in simulation and disaster warning should be verified.

4. Regional climate and environment intelligent warning based on data analysis

To integrate fundamental basic data such as geography, environment, and socioeconomics to conduct regional climate change scenario simulation studies, including coupling methods for multi-source and multi-scale data and multiple models, human activities and urban environmental issues, real-time, high-precision forecasting and early warning of pollutants, etc. More than five highly scalable climate-related fields for big data and deep learning algorithms should be designed, and to establish a quantitative assessment of these algorithms.

5. Atmospheric ocean big data service platform and demonstration based on Tianhe-2 supercomputer

Based on the Tianhe-2 supercomputer platform and 1 to 4 research results, a large ocean data service platform is expected to be constructed. Build a core algorithm library for big data mining and assimilation algorithms for atmospheric oceans, provide online parallel

visualization services for atmospheric ocean data, and support ultra-high resolution numerical forecasting systems. Through the application and research results of sea-level gas big data in 1 or 2 demonstration areas, the platform and algorithm should be verified and demonstrated.

Area Three: local financial security intelligent warning and prevention system based on big data

To prevent and resolve the major real needs of regional systemic financial risks in Guangdong Province, proposals are expected to integrate local financial big data and build an intelligent early warning and prevention and control system for local financial security, make major breakthroughs in the analysis of local financial big data integration and the dynamics of local financial system operations, monitoring, early warning of regional systemic risks, and prevention and emergency response mechanisms.

1. Research on the complex network characteristics of local financial system based on big data and its regional systemic evolution law

Proposals are expected to analyze the complex network characteristics of local economic and financial systems and their relationship with regional systemic risks according to financial big data, to explore the evolutionary rules and transmission mechanisms of regional systematic risks in the system, to analyze the formation mechanism of extreme events in local financial systems, and design emergency mechanisms. The study should focus on the prominent local financial security issues in Guangdong and other regions, including local debt, internet finance platforms, shadow banking, real estate bubbles, high leverage of state-owned enterprises, various types of local financial institutions and exchanges that violate regulations, bonds and bonds across markets, and overseas financial shock and other local financial innovations.

2. Integrated analysis of local financial big data and key technologies supported by supercomputing platform

Proposals are expected to integrate government, enterprise and network open source data, financial system data, and multi-source heterogeneous data in the construction of smart cities, study efficient algorithms for local financial analysis applications, and design and implement multi-sources based on Tianhe-2 supercomputer. Build a data analysis integration application platform, which includes local financial security big data integration program interface (supports multiple programming languages), provides six types of high-performance general-purpose big data analysis algorithm library, and a high-performance parallel computing scheduling management system.

3. Constructing an intelligent monitoring and early warning system for local financial operational dynamics and regional systemic risks

Proposals are expected to, by means of the computing power of the Tianhe-2 supercomputer, build an intelligent monitoring and early warning system for local financial operations. In accordance with the complex network characteristics of local financial systems, use the local financial big data to construct a complete daily monitoring index system, and develop a local intelligent local financial security monitoring system. Establish an intelligent early warning system, an early warning system for anomalous events, and emergency mechanisms for emergencies, and provide macroeconomic indicators and risk management for government and financial regulatory agencies based on the rapid responses achieved with the help of the computational power of the Tianhe-2 supercomputer.

4. Constructing “scenario-response” regional systematic risk intelligent

prevention and control system

Proposals are expected to use the Tianhe-2 supercomputer's superior capacity to build an artificial financial system, through system experiments to invert the existing risk scenarios of the local financial system, and carry out system calibration; analyze a number of possible future risk scenarios, and study the formation mechanism and transmission mechanism of regional and systematic risks; and explore feasible countermeasures and verify its effectiveness in the artificial financial system.

5. Local financial security decision application platform

Proposals are expected to construct a local financial decision-making application platform supported by smart finance, with the help of the Tianhe-2 supercomputer platform, based on the research results of 1 to 4, especially the integration of 3 and 4 local financial security intelligent early-warning and prevention and control systems. To play an exemplary role on outstanding local financial issues, provide decision-making and decision-making scenarios for local financial security monitoring, early warning and policy formulation.

Area Four: smart traffic basic theory and key technologies based on big data

Proposals are expected to, with the focus on the "high-efficiency, green, and sharing" new and sustainable urban traffic development model and based on the National Supercomputing Guangzhou Center Tianhe-2 supercomputer, make breakthroughs in the full-time traffic data association and knowledge aggregation and urban traffic trip pattern mining. With basic theory and key technologies such as evolutionary analysis, modeling and decision-making of complex transportation systems, and implementation of demand awareness, autonomous collaboration, and intelligent decision-making for tens of millions of people traveling, the integration and demonstration applications of urban transportation supported by big data are expected to be promoted.

1. Cross-time traffic data association and knowledge fusion

Aiming at the characteristics of large areas of traffic big data, spatial and temporal scales spanning large and dynamic sparsity, proposals are expected to study the expression and modeling methods of multi-source heterogeneous traffic big data, consistent fusion and quality enhancement methods of traffic big data, and large-scale cross-domain knowledge, map learning theory and calculation methods. Proposals should break through the space-time multi-granularity and heterogeneous traffic data consistency method and data quality assessment and enhancement method above PB scale, and realize the dynamic construction and real-time query algorithm of tens of millions of entities' traffic knowledge maps.

2. Exploration and evolution analysis of the urban traffic trip law

Aiming at the dynamics, randomness, and multi-behavioral characteristics of urban transport system, proposals are expected to study the internal correlation mechanism of traffic elements and traffic characteristics, urban residents' travel law mining and forecasting methods, and the time evolution trajectory and feedback evolution model of travel rules to achieve urban traffic laws. The dynamic corrections and improvements should be implemented to realize the real-time processing, feature extraction, and rule knowledge mining of millions of travel trajectory data on the Tianhe-2 supercomputer, and to create an urban traffic big data visualization analysis platform.

3. Traffic environment coupling modeling and decision optimization

Aiming at the separation of traffic system operation and environmental benefits, proposals are expected to study a variety of traffic and environmental dynamic coupling

mechanisms under various traffic conditions, analyze comprehensively the traffic flow, energy consumption, and safety risks on the Tianhe-2 supercomputer platform, research on real-time perception, identification, prediction, impact analysis and emergency response of big data-driven traffic and environmental events, system-based collaborative decision-making and intelligent control based on traffic and environmental conditions, vehicle-network data, road traffic detection data, and environmental monitoring data, etc. Realize the regulation and optimization of traffic and environmental dynamic decision-making and integration of road network nodes above 10,000.

4. Traffic group intelligence perception and autonomous coordination service

Aiming at the problem of large capacity and the idleness and utilization of transport facilities in cities, proposals are expected to study the theory and method of group travel model, multiple resource fusion and configuration optimization in open networks, and the theories and methods of the emergence of group intelligence in human-vehicle-road interconnected systems, to establish a mechanism for autonomous human-computer collaboration services, integrate community wisdom, optimize the allocation of resources and services, and realize the awareness, integration, and self-service of millions of people on the Tianhe-2 supercomputer platform.

5. Integration of urban traffic coordinated technology and comprehensive application demonstration based on big data

Proposals are expected to design a typical urban integrated planning system, develop a multi-scale, on-line simulation platform for urban traffic systems for large-scale road networks, and implement simulation and assessment from policies, planning, traffic subsystems to individual information service systems, and collect the research results of traffic data processing and analysis. Relying on the Tianhe-2 supercomputer to conduct actual verification and application demonstration in more than two typical urban areas, and to implement demand awareness, autonomous coordination, and intelligent decision-making for tens of millions of groups.

II. Key Programs

In 2018, NSFC plans to fund key program projects in the following 5 research directions with the direct funding of 4 to 6 million per project for 4 years. Collaborative institutions should not exceed 2.

Area Five: research on basic theory and key technologies of education big data analysis and application

Centering around China's ambition to build its talent pool, proposals are expected to focus on the development strategy of "integrating innovation and convergence of information technology and education" and "building educational culture big data" in China. Aiming at big data in education management, educational content, educational means, education methods and education evaluation and other key issues in the entire process of education, gathering a wealth of education data, relying on the Tianhe-2 large-scale computing platform, study the basic theory and key technologies for the analysis and application of educational big data on macro, meso, and micro perspectives to realize the scientific education management decision-making, individualization of educational content and teaching methods, and the precise development of educational evaluation. Construct a large-scale public education big data service platform for specific subject areas through the

integration of key technologies based on the Tianhe-2 supercomputer. This area contains the following five research directions from the perspectives of basic theory, technology and demonstration platform:

- 1. Research on big data driven theory and method of computational pedagogy;**
- 2. Research on acquisition, management and knowledge construction of education big data;**
- 3. Research on precise teaching evaluation and learning behavior prediction based on big data;**
- 4. Research on construction method of interactive personalized teaching environment based on big data;**
- 5. Research on the construction method and technology of education big data public service platform based on Tianhe-2 supercomputer.**

NSFC-Shenzhen Robotics Research Center Project

The NSFC-Shenzhen Robotics Research Center Project is jointly established by NSFC and the People's Government of Shenzhen Province (hereinafter as Robotics Research Center Project) from 2016 to 2020. It aims at giving full play of the guiding role of NSFC, attracting and gathering outstanding scientists in the robotics research areas all over the country, jointly solving the cutting-age issues and key technology problems in robotics research, and promotes the sound and rapid development of robotic industry.

The Robotics Research Center Project calls for proposals of "Key Program Project" in 2018 from the following priority areas with an average direct cost of 3 million yuan per project for four years. Any eligible scientists and technicians over the country are encouraged to submit applications in accordance with research scope and requirements listed in this *Guide to Programs*.

I. Research on Robotic Basic Components and Basic Software

In accordance with the basic needs of the development of the robot industry, proposals are expected to carry out basic research on the scientific problems from the design, manufacturing and control of basic components such as the driver, reducer, controller, sensor and terminal execution, etc.; research on the supporting software such as platform software, databases, cloud computing platform required for the study and application of robot. Main research areas include:

1. Key technologies and realizations of robotic drive and transmission integrated joints;
2. Robot dexterous hand key technology;
3. The key technologies of robot autonomous positioning and obstacle sensing devices;
4. Robot intelligent electronic skin key technology;
5. Key technologies for robot audiovisual information processing chip;

6. Key technologies for cloud platform for robot community intelligence.

II. Research on Robot Common support Technique

Proposals are expected to study the common support technology of robot system integration and application based on the aspects of robot perception, human-computer interaction, decision making and execution control. Main research areas include:

1. Key technologies for robot rotating mechanism coupling;
2. Human movement recognition theory and method in dynamic environment;
3. Robot speech understanding, human-computer interaction theory and system implementation;
4. Service robot knowledge learning and verification;
5. Key technologies for positioning and navigation of indoor mobile robots.

III. Research on Industrial Robots

Aiming at the strategic requirements of high-tech manufacturing industries such as electronic information, intelligent equipment and new energy in Shenzhen, proposals are expected to study the key technologies for industrial robots with flexible operation configuration to meet the needs of new manufacturing mode that is customized, flexible, accurate and rapid, thus promoting the popularity of industrial robots.

1. Key technologies of intelligent planning and control for grinding and polishing robots;
2. Key technologies for industrial robots for the 3C industry;
3. Multi-industrial robot coordination control method;
4. Key technologies for industrial robots for the construction industry.

IV. Research on Medical Rehabilitation Robot

To meet the wide range of needs for intelligent robots in the medical service in Shenzhen, proposals are expected to focus on research of rehabilitation, surgery and other service robots. Main research areas include:

1. Wearable motion assisted robot key technology;
2. Key technologies for surgical and diagnostic robots;
3. The key technology of in vivo diagnosis and treatment robot.

V. Research on Special Robot

To meet the wide range of needs of machines in place of human beings under special conditions, proposals are expected to study the robots needed in aerospace, marine engineering, energy and power, and disaster prevention and reduction; study the unmanned aircraft/ship/car; or focus on cutting-edge science and new special robot, so as to enhance the human ability to fulfill tasks and explore the unknown. Main research areas include:

1. Key technologies for marine robot perception and decision;
2. Multi-arm coordination theory and key technologies for space robots;
3. Rotary wing variable structure UAV key technology;
4. Unmanned vehicle cluster control and collaborative key technologies;
5. Key technologies of robots for cold source maintenance of nuclear power;
6. Key technology for micro-nano operation robot.

Tianyuan Fund for Mathematics

Tianyuan Fund for Mathematics is a special fund designed to integrate collective wisdom of mathematicians, explore funding method that suits the unique features of mathematics, and make China strong in mathematics. This fund supports researchers to conduct research according to the features and need of mathematics department, foster young talents, promote academic exchange, optimize research environment, spread mathematical culture and thus strengthen innovation for China in mathematics. The fund mainly provides the following 6 types of funding in the year 2018.

1. Tianyuan center of mathematics

The main objective of the Tianyuan Center of Mathematics is to set up a platform for cooperative research and academic exchange. Focusing on several topics and interdisciplinary areas, foster research talents through various types of academic activities, and promote research in various branches of mathematics and interdisciplinary studies in China.

This project aims at frontier areas and important directions in mathematical research, and supports various academic exchange activities all over China. Applicants can choose project titles on their own and are supposed to include the significance, scope, plan, and background of the proposed activity, and possible collaborators in the application.

NSFC plans to fund 4 projects in 2018, including re-application and new applications (1 or 2 projects). 1 extended funding project will be funded with 12 million yuan for 4 years. The others will be around 3 million yuan per project for 1 year.

2. Tianyuan exchange programs

The exchange program support high level academic exchange activities. It aims at promoting in-depth exchange and cooperation on hot spot of mathematical research. Each program should invite world renowned mathematicians, in the form of lectures, workshop and discussion sessions.

The program should be organized by 3 to 5 organizers, who should be world-famous mathematicians in the area. Applicant should be a full time mathematician working in China, and have written consent of all organizers. Each program may only invite up to 50 participants and the duration is limited

to 1 week.

The applicant may decide the topic of the application, and provide detailed information such as scientific significance, contents and objectives of exchange, and the time table and name list of the participants. The funding will be 300,000 yuan per project.

3. Tianyuan visiting mathematicians program

This program aims at promoting a balanced development of mathematical research in China by supporting talented young mathematicians in less developed regions in China to work with leading mathematicians in the country. The hosting institution should have good mathematical background.

Requirement on application:

(1) Joint application. Application should be submitted jointly by the visiting mathematician and the host. The visiting young mathematician should be from less developed regions and born after Jan. 1, 1979, and the host mathematician should be national famous mathematician with international prestige. The applicant should provide details such as scientific significance, contents and objectives of exchange. The visiting time should not be less than 9 months;

(2) Please include a letter of promise as a supplement to the application. The letter should include the terms such as salaries, working conditions and evaluations;

(3) Please include an agreement as a supplement to the application. The visitor and host should sign the agreement on contents, funding and sharing of the right of intellectual properties.

The funding will be 200,000 yuan per project for the host and 100,000 yuan per project for the visitor.

4. Mathematical summer schools and training workshops for young teachers

The summer schools offer high-quality core basic courses for mathematical postgraduate students and young teachers so as to consolidate mathematical basis for postgraduate students and young teachers. Summer school has three types of theme, namely, basic mathematics, applied mathematics and statistics.

The training workshops are for young teachers in the western and northeastern regions of China for improving their capability in mathematical research and education. Training workshops will be focused on two themes, one for teachers with mathematical major and another for teachers with non-mathematical major. Either of teachers training workshops may be

organized in the mid-west or the northeast in the country.

The application should include titles and contents of the courses, number of teachers and students.

The funding will be 600,000 yuan per project.

5. Special lectures on mathematics, high level workshops

Special lectures are organized for postgraduate students focusing on one or several related themes so as to introduce frontier topics in mathematical research. Lectures could include basic courses and special courses with relatively large number of audience lasting for 3 weeks. Application should provide teaching outline, contents and list of the lecturers.

High level workshop programs mainly support research groups of high level and excellent mid aged and young mathematicians to sponsor workshops on clear topics and important international mathematical issues. At least one review paper should be published after the workshop, and proceedings or papers are highly recommended.

Each project will be funded with 200,000 yuan.

6. Mathematical culture and knowledge dissemination

This category of funding provides supports for publications of popular mathematical books, including domestic and translated foreign books, so as to raise the interests of primary and middle school students in learning mathematics and understanding of mathematics by the public; the publication of national influential journal related to mathematical culture, dissemination of mathematics, mathematical education and mathematical modeling, so as to improve journal quality and impact on the public; the important national activities of mathematical dissemination by universities, research institutes, science associations and mathematical society above provincial level.

The grants by Tianyuan Fund are all for direct cost and have no overhead, with duration of no more than one year.

Special Fund for Research on National Major Research Instruments

The Special Fund for Research on National Major Research Instruments aims to encourage and foster the exploratory research and development of instruments with creative ideas, and major research instruments and equipment with original creative ideas, which should be based on frontier of science and national needs and guided by scientific targets, so as to provide new means and tools for scientific research and enhance indigenous innovation in China.

Projects funded by the Special Fund for Research on National Major Research Instruments comprise of departmental recommendation projects and free application projects.

Funding for Projects of Special Fund for Research on National Major Research Instruments in 2017

Unit: 10,000 yuan

	No. of applications	No. of awards	Direct cost	Average funding for direct costs
Departmental recommendation	52	5	32,821.98	6,564.40
Free application	591	83	58,977.91	710.58

The funding period for projects of the Special Fund for Research on National Major Research Instruments is 5 years, and in general the number of collaborating institutions in one project should not exceed 5.

1. Funding scope

(1) Research and development on indigenous scientific instruments and equipment with originality and important roles for exploring science frontiers.

(2) Research and development on scientific instruments for discovering new phenomena, revealing new laws, verifying new principles and acquiring new data on the basis of breakthroughs in core technology and integrated

innovation.

Besides, free application projects of the Special Fund for Research on National Major Research Instruments are also encouraged to target development of new scientific instruments with potentials of applications in broad areas.

2. Eligibility and requirements for application

(1) Eligibility for applicants:

(i) Have the experience of conducting basic research;

(ii) Have senior professional position (title).

Post-doctors, postgraduate students, researchers without home institutions, and researchers whose home institutions have not been registered at NSFC are not eligible for application.

(2) Requirements:

(i) For free application projects in 2018, applicants may submit research proposals via their home institutions. The budget cap for direct costs is 10 million yuan per project.

(ii) For departmental recommendation projects in 2016, the following departments are entitled to recommending projects of the Special Fund for Research on National Major Research Instruments: Ministry of Education, Chinese Academy of Sciences, Ministry of Land and Resources, Ministry of Industry and Information Technology, Ministry of Environmental Protection, Ministry of Agriculture, National Health and Family Planning Commission, China Earthquake Administration, State Administration for Quality Supervision and Inspection and Quarantine, China Meteorological Administration, State Oceanic Administration, China Academy of Engineering Physics, Equipment Development Department and Logistic Support Department of Central Military Commission. In 2018, the budget for direct costs of the departmental recommendation projects of the Special Fund for Research on National Major Research Instruments should be no more than 10 million yuan per project.

3. Notes on application

(1) Applicants are advised to read this *Guide to Programs* carefully and prepare research proposals in accordance with the Outline of Preparation of Applications of the Special Fund for Research on National Major Research Instruments. Please choose the “Special Fund for Research on National Major Research Instruments” from the funding categories, and choose “free application” or “departmental recommendation” under the subcategory of funding. Applicants are advised to clarify the details if they are carrying out projects which have some links with the current application. Explanation of the similarities and differences in research contents between the ongoing project and

the current application should be presented.

(2) For applicants and participants with senior academic positions (titles), the number of applications plus ongoing projects of the Special Fund for Research on National Major Research Instruments as well as the Special Fund for Research on National Major Research Instruments administered by the Ministry of Science and Technology should not exceed one in total.

(3) Projects of the Special Fund for Research on National Major Research Instruments are funded by way of cost reimbursement, so applicants are advised to make their budget requests in an objective and practical manner according to the real costs of the development of instruments.

Appendix

Contact Information of NSFC Departments and Bureaus

Department		Tel	Department	Tel	
Department of Mathematical and Physical Sciences			Division VIII	Animal Husbandry and Grassland Science	62327194
Division of General Affairs		62326910		Veterinary Science	62327194
Division of Mathematical Sciences		62327178		Fisheries	62327194
Division of Mechanics		62327179		Zoology	62326914
Division of Astronomy		62327189	Department of Earth Sciences		
Division I of Physical Sciences		62327181	Division of General Affairs and Strategic Planning		62327157
Division II of Physical Sciences		62327182	Division I	Geographical Sciences	62327161
Department of Chemical Sciences			Division II	Geochemistry	62327158
Division of General Affairs		62326906		Geology	62327166
Division I	Inorganic Chemistry	62327170	Division III	Geophysics and Space Physics	62327160
	Analytical Chemistry	62327075	Division IV	Marine Sciences	62327165
Division II	Organic Chemistry	62327169	Division V	Atmospheric Sciences	62327162
Division III	Physical Chemistry	62327172	Department of Engineering and Materials Sciences		
Division IV	Polymer Science	62327167	Division of General Affairs		62326884 62326887
	Environmental Chemistry	62327173			
Division V	Chemical Engineering	62327168	Division of Materials Science I	Metallic Materials	62328301
Department of Life Sciences			Division of Materials Science II	Inorganic Non-metallic Materials	62327144
Division of General Affairs		62329190		Organic Polymer Materials	62327138
Division I	Microbiology	62329135	Division of Engineering I	Metallurgy and Mining	62327136
	Botany	62329135	Division of Engineering II	Mechanical Sciences and Manufacturing	62327098
Division II	Ecology	62327197	Division of Engineering III	Engineering Thermal Physics and Energy Utilization	62327135
	Forestry	62329321	Division of Engineering IV	Architectural Engineering, Environmental Engineering and Civil Engineering	62327142
Division III	Biophysics, Biochemistry and Molecular Biology	62327213	Division of Engineering V	Hydro Science and Marine Engineering	62327137
	Biomechanics and Tissue Engineering	62327213		Electrical science and Engineering	62327131
	Immunology	62329240		Department of Information Sciences	
Division IV	Neurosciences	62329352	Division of General Affairs and Strategic Planning		62327146
	Psychology	62329352	Division I	Electronics and Information Systems	62327147
	Physiology and Integrative Biology	62329352	Division II	Computer Sciences	62327141
Division V	Genetics and Bioinformatics	62329117	Division III	Automation Sciences	62327149

Department		Tel	Department		Tel
Division V	Cell Biology	62329117	Division IV	Optical Information Devices	62327143
	Developmental Biology and Reproductive Biology	62329170	Department Management Sciences		
Division VI	Agricultural Infrastructure and Crop Sciences	62326918	Division of General Affairs		62326898
	Food Sciences	62326918	Division I	Management Science and Engineering	62327155
Division VII	Plant Protection	62327193	Division II	Business Management	62327152
	Horticulture and Plant Nutrition	62327193	Division III	Macro Administration and Policy	62327151
Department of Health Sciences			Bureau of Planning		
Division of General Affairs		62328991 62328941	Division of General Affairs		62326980
Division I	Breath, Blood	62327215	Division of Programs		62327230 62325557
	Cycling	62328559	Division of Talent Fostering		62328623 62325562
Division II	Digestive, Urinary, Endocrine, Eye, ENT, Oral sciences	62329153	Division of Interdisciplinary Sciences		62327015 62328484
Division III	Neurological, Psychiatric, Geriatric medicine	62327198	Bureau of Finance		
Division IV	Reproductive, Perinatal, Neonatal, Medical Immunology	62326924	Division of Budgeting		62326585 62328485 62326460
			Division of Fund Accounting		62326760 62328485 62327225
Division V	Medical Imaging, Biomedical Engineering, Special medicine, Forensic Medicine	62329131	Bureau of International Cooperation		
Division VI	Medical Microbiology and Infectious Diseases, Movement Disorders, Trauma, Burns, Surgery, Severe Acute Medicine, Laboratory Medicine, Rehabilitation Medicine	62327195	Division of Planning		62329743
			Division of Asian, African and International Organizations Affairs		62326998 62325449
			Division of American and Australasian Affairs		62325540 62325377
Division VII	Oncology I	62327207	Division of European Affairs		62325309 62327014
Division VIII	Oncology II	62329157	Office for Hong Kong, Macao, and Taiwan Affairs		62326934
	Skin, Preventive Medicine, Science Endemic, Occupational Medicine, Radiology	62327212	Service Center of Administrative Affairs		
Division IX	Pharmacology	62327199	General Office		62327218
			Department of Publication		
Division X	Traditional Chinese Medicine, Integration of Traditional Chinese Medicine and Western Medicine, Chinese Materia Medica	62328552	General Office		62327204
			Sino-German Center for Science Promotion		
			Operator		82361200