

# General Program

General Program is the main part of the National Natural Science Fund. It supports scientists doing basic research on freely selected topics within the funding scope of NSFC to conduct innovative research and promotes a balanced, coordinated and sustained development of all disciplines.

Applicants should have the following qualifications:

1. Experience of undertaking basic research projects or other types of basic research;
2. Senior professional title or a Ph.D. title, or being recommended by two peers having senior professional titles.

Graduate students can not apply for General Program projects, but those in-service graduate students may apply through their employer if agreed upon by the supervisor.

Applicants should have good knowledge on the relevant research status in China and the world as well, can lead a research group to conduct innovative study, and the home institutions should have necessary experimental research conditions. Applicants should follow the guidelines to write proposals, and the proposed research should have important academic meaning and research merits, and have sufficient theoretical basis, new academic ideas, clear research objectives, specific research contents and feasible research schemes. The collaborative institutions for General Program projects should not exceed two, and the research period is 3 years in general.

In 2009, 10,061 General Program projects were supported, with a total funding of 3.30516 billion yuan and an average funding of 328,500 yuan per project, which is 36,000 yuan more than that in the previous year, and the average funding rate was 17.49%, 0.61% lower than that in the previous year (see the table below for detailed information). In 2010, NSFC will continue to limit the funding scale for General Program projects and make a proper increase of the funding intensity (350,000 yuan per project on average), to allocate more funding on innovative proposals, and give researchers strong support on free explorations in wide disciplinary areas. Applicants are advised to plan their budget according to actual needs and take account of the funding intensity in relevant departments of NSFC as well.

### Funding of General Program Projects in 2009

Unit: 10,000 yuan

Department	Applications	Approved				Funding rate (%)
		Projects	Funding	Percentage of the total (%)	Average funding per project	
Mathematical and Physical Sciences	3,702	1,009	35,308	10.68	34.99	27.26
Chemical Sciences	5,258	1,104	36,638	11.09	33.19	21
Life Sciences	25,014	3,981	118,128	35.74	29.67	15.92
Earth Sciences	3,963	954	42,000	12.71	44.03	24.07
Engineering and Materials Sciences	9,936	1,488	53,437	16.17	35.91	14.98
Information Sciences	6,323	1,085	33,977	10.28	31.32	17.16
Management Sciences	3,330	440	11,028	3.34	25.06	13.21
Total	57,526	10,061	330,516	100.00	32.85	17.49

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

## Department of Mathematical and Physical Sciences

Mathematical and physical sciences are the basic disciplines of natural science, and the precursor and basis for the development of contemporary science. Disciplines in mathematical and physical sciences have clear characteristics, such as big differences between disciplines, strong independence, and pure theoretical research (such as mathematics, theoretical physics, etc.) and experimental studies. Many disciplines belong to “mega-science”, such as high-energy physics, nuclear physics, astronomical physics, high temperature plasma physics, etc. They are very theoretical in studying deep level structures of matter and involving many frontier disciplines. The development of mathematical and physical sciences also supplies theories, methods and means to the development of other disciplines. Research findings in mathematics and physics play key roles in promoting the progress of both basic and applied scientific disciplines.

Mathematical and physical sciences have extensive interactions with other sciences, such as, mathematics 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 and earth science. As a result of extensive interactions with other disciplines, 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.

Therefore, the Department has always paid great attention to basic research, and will continue to increase its support to basic research that takes as its primary goals advancing the disciplinary development, promoting originality and meeting the needs of national long-term development and training talented researchers, as well as interdisciplinary research within the Department and across departments.

According to the strategic role of NSFC, namely, “supporting basic research, adhering to free exploration and playing a guiding role”, and 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 and has strengthened macro guidance in recent years. In 2010, the Department will continue to pay attention to the following aspects:

(1) To increase the support on fostering outstanding young talents. In 2009, the percentage of principal investigators under the age of 40 in General Program projects reached 34.99%. In the future, the Department shall further increase funding for young researchers so as to allow more young scientists get funding to conduct independent research.

(2) To put more emphasis on creative research and disciplinary development. Multi-level funding to suit the needs of research will be adopted. Funding will be given to studies on developing experimental methods and techniques that promote original innovation and have innovative ideas according to the actual needs, which can be up to 500,000 or 600,000 yuan per project. Applicants should pay attention to this policy.

(3) To strengthen macro planning and adjustment, and give preferential support to special areas so as to promote sustainable development in these areas. In 2010, preferential support will be given to the following areas:

- ( i ) Physical problems in new energy;
- ( ii ) Interdisciplinary problems related to mathematics and information science;
- (iii) Research and development of experimental methods and techniques with novel research ideas;
- (iv) Pre-research on scientific goals of large-scale national projects;
- ( v ) Reactor physics;
- (vi) Radiation protection and radiation physics;
- (vii) Integration and standardization of computational mechanics software.

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

**Funding for General Program Projects in the Last Two Years**

Unit: 10,000 yuan

Divisions	2008			2009		
	Projects	funding	Funding rate (%)	Projects	Funding	Funding rate (%)
Mathematics	231	5,840	29.88	256	6,480	27.71
Mechanics	224	8,340	25.45	243	9,182	25.77
Astronomy	39	1,635	30.00	49	2,145	29.34
Physics I	254	9,407	27.05	264	9,863	26.40
Physics II	178	6,468	31.01	197	7,638	29.49
Total	926	31,690	28.09	1,009	35,308	27.26
Average funding per project	34.22			34.99		

**Division of Mathematics**

According to the characteristics and trend of development of modern mathematics, the Division encourages original research on important issues and open problems in mathematics, and the development of new mathematical methods, models and theories. Interdisciplinary research among different branches of mathematics and application of mathematics in other disciplines are encouraged. This requires that applicants and their research teams have sound basis and capability of research. Research plan should be based on the deep understanding of the status in research, main problems and relevant research methods and available means. Through funding of projects, outstanding talents are to be fostered and research directions be adjusted and organized, so as to promote a sustained, steady, coordinated and overall development of mathematics. Applications for General Program by a single investigator or separated applications in the same research direction from the same research unit are not encouraged. Proposals from applicants having on-going NSFC projects will be strictly controlled in order to maintain a reasonable distribution of projects and appropriate funding scope.

For basic mathematics, the funding is aimed at maintaining research directions where China is advanced and research areas where China has comparatively large-scale research, promoting the development of research areas that are within the mainstream of international mathematical research but are still relatively weak in China, and encouraging interdisciplinary research among branches of mathematics.

The funding for applied mathematics and computational mathematics encourages topics having strong practical background and application. Applicants should pay attention to the development in life science, information science, materials science, environmental science, energy science and other disciplines closely related to the economic and social

development, have a good understanding of important scientific issues in these areas, and actively find cutting points intercrossing with these areas so as to promote the development of applied mathematics. When applying for this type of projects, please fill in the appropriate branches of mathematics in application code I, and the appropriate disciplines in application code II.

In order to promote interdisciplinary research with information sciences, the Department will continue to support, interdisciplinary research with information sciences in 2010. Please read the following information for details.

### **Interdisciplinary Research between Information and Mathematics**

In 2010, the Department of Information Sciences and the Department of Mathematical and Physical Sciences will continue to fund interdisciplinary researches that demand combined efforts from information science and mathematics. The funding will be about the same as that for General Program projects. The areas to be included are mathematical methods in modern computer science, mathematical methods in information security, information system and advanced control theory. It is encouraged (but not limited) to conduct interdisciplinary researches in the following areas:

#### **1. Theory and algorithm of integer representation of real numbers**

To design the theory and algorithms of integer representation of real numbers, and to realize by computer and give complexity analysis of the algorithm.

#### **2. Theory and methods of formalized representation of software systems**

To describe and represent, by using the formalization theory and methods, practical software system not only applicable to real time application software systems, but also to interactive, discrete event software systems.

#### **3. Theory and method of designing security software systems**

To verify both theoretically and practically the advantages of the theory, algorithm and system structures of typical software system (system software or application software) analysis, design and development for improving the safety performance of software systems.

#### **4. Theoretical studies on new software system structure**

To study, by addressing the contemporary needs of software application, the structure, theory and methods of the system structure of novel software and to give appropriate scientific characteristics in combination with practical software system.

#### **5. Theoretical studies on the validation of software systems**

To establish the theory and methods on the validation of software system development so as to ensure the validity of the developed software.

### **6. Theory and methods of formalized representation of practical engineering projects**

When applying for interdisciplinary projects, please mark “interdisciplinary studies between mathematics and information sciences”, and fill in the appropriate application code.

## **Division of Mechanics**

The Division of Mechanics mainly supports research on basic problems and methods in mechanics, and research in sub branches of mechanics such as dynamics and control, solid mechanics, fluid mechanics, biomechanics, explosion and impact dynamics. The Division supports, on the one hand, basic research projects that are on the frontiers of international research and have creative academic ideas, and on the other hand, those basic research projects that are closely related to the sustained development of national economy and society and national security and that promote the development of engineering and technology. The Division encourages experimental research using experimental facilities and key labs in China and advocates interdisciplinary research conducted by scientists from relevant disciplines.

Research on basic problems 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 dynamics and control should pay attention to the theory and methods of nonlinear dynamics, vibration and control of complex structures, dynamical modeling and analysis of problems involving the coupling of solid, flexible bodies and fluid, and reverse problems in dynamics and dynamical problems of non-smooth and multi-body systems. The Division encourages studies on key issues of dynamics and control problems in major engineering projects.

Applications in the area of solid mechanics should give more consideration to intercrossing with physics, materials science, information and biological sciences, and should be able to propose research topics in engineering application, expand basic theory of continuum mechanics, promote the development of multi-scale mechanics and multi field coupled mechanics, strengthen research on constitutive theory of materials at macro, meso and micro scales, strengthen theory, damage evolution process and failure mechanism, mechanical behavior of new materials, experimental measurement techniques and representation methods, high performance computational methods, structural optimization, endurance analysis and safety evaluations, damage of rock and

soil materials, prevention of geological disasters, etc.

Applications in fluid mechanics should pay attention to studies on the laws and mechanisms governing complex flows. The Division will continue to support studies on fluid mechanical problems in aerospace and aviation, ship and marine engineering, civil and hydrological engineering, and strengthen studies on fluid mechanical issues in energy, environment and other high-tech and advanced technology areas.

Applications for biomechanics projects should pay attention to mechanical problems related to human health and medical science, explorations on mechanical laws in life sciences and medical sciences, and strengthen studies on new theory, methods and technologies in biomechanics.

Applications on explosive and impact dynamics should closely focus on the safety issues of relevant engineering projects, pay attention to frontier areas, major national needs and interdisciplinary studies, and strengthen studies on the dynamic constitutive theory, failure mechanism and experimental techniques.

The Department of Mathematical and Physical Sciences continues to support studies on instruments, new experimental methods and techniques that have innovative ideas. Applicants should mark “experimental instruments” or “experimental techniques” in the application form. Support to computational software development focuses on playing the role of computational mechanics software in mechanical studies and engineering problems, and on supporting the integration and standardization research on independently developed computational mechanics software. Applicants should have relevant research background, and mark “computational mechanics software” in the application form.

## **Division of Astronomy**

The Division of Astronomy mainly supports research on astrophysics, basic astronomy and 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 used in astronomy, especially studies which are closely related to mega-science projects under construction in China. Interdisciplinary research is strongly encouraged so that research groups having special features and influence in international scientific communities can be gradually established. International cooperation and exchange, particularly those using

large and advanced facilities abroad for observation and research, will be given great attention and financial support.

In the General Program projects funded in recent years, we have achieved a good balance between astrophysics (including galaxies and cosmology, stellar physics 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 main force in astronomical research and more than half of all researchers are under the age of 40.

In 2010, in addition to strengthening continuous support on projects integrating theory and observation and projects conducted by young scientists, we shall give emphasis on interdisciplinary research with physics, space science, etc. Compared with the development in the world, research on planetary physics is rather weak in China, and should therefore be enhanced immediately. On the basis of funding the best ones, the Division encourages research on interdisciplinary studies with particle cosmology, celestial bodies in the solar system, and planetary systems in other galaxies, structure and dynamics of galaxies, 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 astronomical research units with a relative small scale.

In the next few years, the Division plans to give special support to pre-research around the research based on equipment that have already built or being built, and conceptual studies on new technologies that are urgently needed for large-scale telescope and space exploration, for example, LAMOST and FAST, etc. In 2010, it plans to give preferential support to research areas related to the scientific goals of LAMOST, i.e., research based on observation data from LAMOST, studies on star abundance, kinematics and physical process in different star families using low dispersion star spectrum samples in large samplings, studies on Galaxy structure and chemical evolutions, studies on large scale cosmic structure and formation and evolution of galaxies using large sampling low dispersion galactic spectrum data, studies on nuclear physical properties of active galaxies using large sampling low dispersion quasar spectrum data, and studies on multi band astrophysics and data processing and analysis methods related to LAMOST observations. Please mark “research for mega science project” or “new astronomical technology” in the application form.

## **Division I of Physics**

The funding scope of Division I of Physics covers research on condensed matter physics, atomic and molecular physics, optics, acoustics and new research areas formed between



these four disciplines and other disciplines.

According to the status and requirement of disciplinary development, it gives funding priorities on experimental methods and experimental techniques that have creative ideas, researches in new computational methods and software that are closely related to experimental physics and are of explorative types, and physical problems in new energy field. It pays attention to research on key basic physics problems serving national needs, and on physical concepts, physical methods and physical properties in new disciplinary areas.

In funding research on condensed matter physics, the Division pays attention to singular quantum phenomenon in electron related systems, quantum phenomena and quantum effects in various low dimensional and small-scale systems or devices that break the classical physical limit, and physical theory and experimental methods related to life science. Encouraged areas include basic physical problems in soft matters, structural and physical properties of surface, interface and membrane, physical properties of nano systems, advanced technologies and methods of device physics and nano structures, physical problems in the formation and preparation of new functional materials, and interdisciplinary problems related to condensed matter physics.

In funding atomic and molecular physics and optics, the Division pays attention to atomic, molecular and cluster structures and dynamical process, cold atomic and molecular physics and its application, complex interactions of atomic and molecular systems, interactions between laser and atoms and molecular, physical problems in ultra fast and extremely strong light conditions, propagation process of light in new media and its characteristics, quantum frequency markers, quantum information, principles and key techniques of precision atomic and molecular spectra and precision measurement, high resolution, high sensitivity and high precision laser spectrum and its application, and research on basic physical problems in micro nano photonics and surface plasma exciter. It encourages basic research on the generation, transmission, display and application of 3-D optical images. In addition, optical electronics as well as frontier physical issues in optical electronics are also important research areas.

Much of the acoustic research in China is in application field, so the basic aspects should be strengthened. Therefore, the Division encourages fundamental acoustic research related to the major needs of national development. It is hoped that more proposals with innovative ideas will appear in areas of hydro-acoustics and marine acoustics, ultrasonic and acoustic effect, structural acoustics and vibrations, acoustic materials, acoustic information processing, noise and control, acoustic problems in information technology, etc.

## **Division II of Physics**

The Division mainly supports research on fundamental physics, particle physics, nuclear physics, nuclear technology and its application, accelerator physics and detectors, plasma physics and synchronized radiation methods.

Support to fundamental physics focuses on original studies in theoretical physics and interdisciplinary research between theoretical physics and other disciplines. Stress should be given to current research frontiers, especially to important theoretical physical problems that are closely related to experimental studies and raised from scientific experiments and from interdisciplinary considerations.

In the areas of particle physics and nuclear physics, the Division will focus its support on the research of physics issues related to large-scale experimental facilities that are in operation or those to be completed soon, and in particular, the combination of theoretical and experimental studies. In the next few years, a number of large-scale experimental facilities of international cooperation will be in operation successively. In conjunction with international cooperative projects centered on large-scale equipment, the Division will select some related proposals and give preferential support. 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 the development of nuclear technology, accelerator and detector, low-temperature plasma and synchronized radiation, it is hoped that fundamental problems can be drawn from the disciplinary development, national demands and through intercrossing with other disciplines, which can facilitate a deeper understanding of physical laws underlying the development of the discipline and at the same time have important prospects of application. Special emphasis is 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 (ion, neutron and electromagnetic fields) are key areas. In accordance with the key areas, more attention will be given to nanometer micro-beam, high power ion beam, strong current accelerators, plasma radiation source in accelerator and detector and plasma research, and all other advanced radiation sources of nuclear technology.

Concerning applications in nuclear fusion and plasma physics, more attention should 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 key physical problems in fusion studies and

computer simulation of various kinds of plasma will be stressed.

In order to ensure more efficient use of limited funds and research in a benign cycle of sustainable development in each field, the Division encourages researchers all over China to use large national facilities to conduct research, experimental studies with independent innovative methods of high resolution diagnosis and detection, and important for the development of accelerators and detectors, including the development of experimental facilities, detection and diagnosis devices. The Division will increase the funding according to the actual needs, and give priority to projects having more young scientists in the research team.

In 2010, the Department of Mathematical and Physical Sciences will make special arrangement in General Program in the specially funded areas to continue supporting researches on innovative instrument improvement, new experimental methods and technology, and reactor physics, radioactive protection and radiation physics. Please mark “experimental instruments and technology”, “reactor physics” or “radiation protection and radiation physics” in the application form.

## **Department of Chemical Sciences**

The Department of Chemical Sciences covers two first-grade disciplines (chemistry and chemical engineering) and is divided into five divisions (including seven disciplines): Division I for inorganic chemistry and analytical chemistry, Division II for organic chemistry, Division III for physical chemistry, Division IV for polymer science and environmental chemistry and Division V for chemical engineering. Chemical science is to study the change of matters and chemical reactions, and it is a core science which not only maintains close ties with but also intercrosses and permeates into other disciplines, such as materials science, life science, information science, environmental science, energy science, earth science, space science and nuclear science. Chemical engineering is to accomplish the transfer and conversion of matters and energy by making use of the principles of basic disciplines, and to solve scientific problems in achieving large-scaled production of chemical materials and products.

The mission of the Department is to promote the development of chemistry and chemical engineering, to strengthen original innovation in basic research so as to bring into full play its roles as core science in multidisciplinary research, to improve the overall quality and international status of chemical science and to foster creative talents and groups. The Department supports research of more types and patterns of molecules at different levels and controlling chemical reactions and processes, and encourages multi-level and multi-scale research proposals that take atoms, molecules, molecular aggregation and condensed state as well as those of complex systems as their objects of study. In order to bring the role of chemistry and chemical engineering into full play to address major

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scientific issues related to the national economy, social development, national security and sustainable development, it encourages research on chemical science and chemical engineering conducted in the fields of life, materials, energy, information, resources, environmental science and human health. As for the methods of study, it stresses the combination of ( i ) microscopic and macroscopic research, ( ii ) static and dynamic states, and ( iii ) theoretical research and empirical development of novel experimental methods and analytical technologies. It also encourages the introduction of latest theories, technologies and achievements from other disciplines, aiming at promoting the sustainable development of research in chemical science and chemical engineering by fostering innovation and interdisciplinary studies, and supports the emerging frontiers in research.

In 2009, the Department received 5,258 proposals from 556 institutions for Free Application projects, which accounts for 12.59% more than those in 2008. 1,104 proposals were funded. The success rate was 21% and the average funding intensity per project reached 331,900 yuan.

2010 is the final year of the Eleventh Five-Year Plan period. The Department will energetically promote high quality research in the fields of cutting edge science, lay stress on in-depth and systematic work, and give priority to those interdisciplinary research projects. It takes effective measures to support original creative researches with high risk.

### Funding for General Program Projects in the Last Two Years

Unit: 10,000 yuan

Divisions		2008			2009		
		Projects	Funding	Funding rate <sup>++</sup> (%)	Projects funded	Funding	Funding rate <sup>++</sup> (%)
Chemistry I	Inorganic chemistry	118+4*	3,920	20.33	126+6*	4,375	20.09
	Analytical chemistry	101+5*	3,373	20.70	112+5*	3,999	21.31
Chemistry II	Organic chemistry	175+9*	5,929	22.25	189+9*	6,748	21.24
Chemistry III	Physical chemistry	174+10*	5,931	23.65	195+10*	6,710	24.58
Chemistry IV	Polymer science	111+6*	3,837	25.27	124+6*	4,363	23.42
	Environmental chemistry	100+5*	3,301	20.96	112+5*	3,796	20.86
Chemistry V	Chemical engineering	172+11*	5,770	18.50	194+11*	6,647	17.52
Total		951+50*	32,061	21.44	1,052+52*	36,638	21.00
Average funding per project		32.03			33.19		

Notes: \* Projects of the Small Fund for Exploratory Studies.

<sup>++</sup> Success rate includes projects of the Small Fund for Exploratory Studies.

## **Division I of Chemistry**

Research projects supported by the Division fall into two disciplines: inorganic chemistry and analytical chemistry.

### **Inorganic Chemistry**

Key funding areas are studies of fundamental scientific issues in inorganic chemistry and focal applied basis regarding energy, environment, information, materials, and life sciences and so on.

In the studies of synthesis and preparation of inorganic chemistry, it is to develop new synthetic methods and approaches, to reveal new reaction mechanisms, to employ the concept of molecular design and crystal engineering on research related to the synthesis of new compounds and the aggregate state of matters, to emphasize studies on the assembly and composition of inorganic materials and to strengthen the research on relations between structure and property of functional inorganic matters as well as related applied research. Based on the basic theory and characterizing techniques of physical sciences, it is to develop the study of properties of inorganic compounds, materials and devices. In the interdisciplinary study of inorganic chemistry and life sciences, it is to highlight the chemical basis of biological effects of inorganic elements, especially research on inorganic chemistry of metal combined bio-macromolecules, inorganic bionic processes and bioinorganic chemistry beyond molecular level.

In recent years, research quality of inorganic chemistry in China has greatly developed. In the field of basic research, more and more scientists have paid attention to the creativity of research theme and have made outstanding achievements in some areas. In the field of applied basic research, applicants have emphasized the synthesis and assembly methods of inorganic materials, mutual relations between structure and property as well as creative academic ideas. However, there are still some problems as follows: The number of proposals for coordinated chemistry, molecular-based material chemistry and inorganic nano-material chemistry represents a large proportion of General Program projects funded by the Division, and the research contents mainly focus on synthetic methods and structural characterization, which need to deepen in the study of reaction process mechanism, relation and rule between the structure and property. More proposals are expected in regard to solid inorganic chemistry, especially those on function oriented synthesis and its applied research. As for the proposals of bioinorganic chemistry, more attention should be paid in mechanism study on biochemical process of metal ion or inorganic small molecule. Similarly, in radiochemistry, high quality basic research and fruitful achievements are to be promoted.

In 2010, applicants should focus on inorganic matters, develop inorganic synthetic

chemistry and assembly methods, pay more attention to combining theory with experiment, emphasize research on correlated regulations of structure and property of inorganics, meanwhile try to avoid similar focuses with those on-going Major Research Plan projects on nano-materials and crystal-state functional materials. Finally, proposals with creative ideas in the areas of solid chemistry, bio-inorganic chemistry and radiochemistry will be encouraged.

### **Analytical Chemistry**

Analytical chemistry is to study the component and structure of matters and to determine their chemical composite, content and distribution in time and space. It covers wide fields including many sub-disciplines such as spectrographic analysis, electrochemical analysis, chromatographic analysis, spectroscopic analysis (MS, NMR, etc), surface and interface analysis, inorganic analysis, organic analysis, biological analysis (including biochemical, cellular, immunization, affinity analysis, etc.), environmental analysis, pharmaceutical analysis (including Chinese medical herbs), food analysis, clinical analysis and legal medical test, characterization and analysis of materials, quality control and process analysis, instrument development, etc. as well as newly emerged micro-/nano-analysis, analytical chemistry of chips, image formation analysis, real-time analysis, *in vivo* analysis, *in-situ* analysis, on-line dynamic analysis, bionic analysis, chemo-informatics, bio-informatics, etc. The creative research related to the above areas, such as new principles, new methods, new techniques, new instruments, key devices and so on would also be supported.

At present, analytical chemistry is fast developing and has visible features. In recent years, the number of proposals submitted and projects funded has been highly increased. The features of proposals received in 2009 are as follows: ( i ) The systems studied are changing from simple system to complex one, focusing on “-omics” sample, living object, etc; ( ii ) More profound studies focus on unicellular and mono-molecule; (iii) Objects studied include living bio-substance, such as DNA, proteins, chiral drugs and environmental poisons, etc; (iv) Research outcomes have been extended from composition to function, structure, morphology and stereo-conformation, while chemo-metrics and chemo-informatics are more emphasized; ( v ) Guiding concept of research is no longer limited to the instrument analysis based on the tradition and simple principle, micro-/nano-technique and micro-fluidic techniques, bionic principles, etc, have been more and more considered as the direction of research.

Based on proposals received and projects funded in recent years, the tendencies of disciplinary development fall into: ( i ) To emphasize the research of methodology and the integration of methods in order to solve scientific issues at deep levels; ( ii ) To relate closely with the national security, national needs and economical development; (iii) To

strengthen the research on new techniques and methods of detection and diagnosis related to human health; (iv) To emphasize the development of instruments, including not only the development of whole set instruments, but also the improvement of key instruments, and upgrade of performance; (v) To stress the studies of mutual action, signal transformation and action mechanism of related materials; (vi) To bring into full play the major role of analytical chemistry in the studies of nano-function and nano-device; (vii) To pay attention to the development of pre-treatment technologies of samples.

## **Division II of Chemistry**

Research projects related to organic chemistry and chemical biology are supported by the Division. The research contents of chemical biology can be found in the guide of other related divisions.

Organic chemistry is a science which researches sources and components, synthesis and preparation, structures and properties, reaction and conversion, as well as functions and reactive mechanism of organic compounds. New theories, methods and reactions in organic chemistry have promoted not only the development of chemical science, but also its intercrossing with life science, materials science, agricultural and environmental science in a greater extent, which has further pushed forward the progress of organic chemistry. The features of current research in organic chemistry are as follows. The concept of organic molecular design, recognition and self-assembly is affecting many fields of natural science. Selective reaction, catalytic asymmetric synthesis in particular, has become a hot-point issue in the research on organic synthesis. Green chemistry is turning into an important strategic field of organic chemistry which is playing an important role in the field of optimizing utilization of resources and resolving environmental pollution. The intercrossing between organic chemistry and life science has provided new research methods and means for studying and recognizing complex phenomena in life systems. The intercrossing between organic chemistry and materials science has promoted the discovery, manufacture and utilization of new functional organic matters. Meanwhile, the discovery and application of new technologies have promoted the development of organic chemistry.

Continuously supported by NSFC, remarkable progress has been made in basic research of organic chemistry in China in such areas as metal-organic chemistry, physical organic chemistry, bioorganic chemistry, natural organic chemistry, asymmetrical synthesis and so on. In recent years, proposals related to physical organic chemistry, element organic chemistry, applied organic chemistry and organic analytical chemistry are fairly rare. In addition, proposals focusing on the studies of intercrossing areas with materials and life sciences should also be strengthened. Hereafter, the study of natural products should be

strengthened by finding out natural products with new structure and new function, developing synthesis of natural product with unique structure and important bio-activity discovered in China, and encouraging the development of new synthesis method. In the area of medicine and pesticide, the study of drug design based on molecular target, new precursory compound, seeking new target and relation between structure and activity should be encouraged. In the area of organic functional materials, more attention should be given to the study of molecular design, high-efficient synthesis and molecular assembly. Studies of super-molecular chemistry should stress molecular recognition, method of self-assembly and function of assembly. Moreover, research and application of new-type catalysts with high-efficiency and high-selectivity and reagents, as well as the study on chemical biology of active small molecule based on natural products should also be encouraged.

### **Division III of Chemistry**

Research projects related to physical chemistry and theoretical chemistry are funded by the Division.

Physical chemistry and theoretical chemistry form the theoretical foundation of chemical sciences. Their research contents become richer and are continuously extended, from mono-molecules, molecular aggregates to condensed states, from weak interaction between molecules to the formation of chemical bond and from simple system to complex system. Using techniques of physical chemistry and methods of theoretical analysis, it could gain information about molecular structure and dynamic change from ground states to excited states and from steady states to transient states. Research on physical chemistry has the following trends: the combination of macroscopic and microscopic studies, combination of bulk phase and surface/interface, combination of static and dynamic states, and combination of theory and practice. These trends have been furthered into the study on the regulation of chemical reaction and substance structure. As crosscutting and fusion of physical chemistry and theoretical chemistry with materials science, energy science, environmental science, life science and information science, many new disciplinary growing points have been generated. Physical chemistry has been playing a more and more important role in the development of chemistry and related sciences.

Among the proposals received and funded by the Division, studies by Chinese scientists on theoretical chemistry, structural chemistry, photochemistry and molecular dynamics have been recognized by international scientific communities and have become competitive research directions. Catalysis chemistry is one of the most active sub-disciplines in physical chemistry. The international impact and competitive capacity of Chinese basic research in this area are enhanced in recent years, and the number of



applications in the area of catalysis occupies one third of the total in the Division. Studies on electrochemistry and colloid and interface chemistry emphasize the intercrossing with materials and life sciences, of which some studies have formed their own features. The number of proposals received and funded remains basically stable. Research areas of chemical thermodynamics (including thermo-chemistry and solution chemistry) have been broadened owing to the intercrossing with life science and materials science, and employing microcosmic research means in these areas becomes a new developing trend. It has become a new growth point that uses the theory and experiment methods of physical chemistry for solving major issues in life sciences. However, the number of proposals is relatively rare in the areas of dynamic structure, new methods of spectroscopy and solution structure, which need more attention by applicants.

The Division wishes that applicants give play to the discipline's professional knowledge, focus on scientific frontiers and national goals, and emphasize creative, systematic and foresighted studies. The Division encourages wide intercrossing with other disciplines for developing new concepts, theories and methods. In the selection of research topics, applicants should emphasize the areas of basic studies with important theoretical significance and potential for application, such as energy, environment, medicine, etc. Meanwhile, the Division invites researchers of other disciplines to apply for interdisciplinary projects, but requests that they should stress the scientific problems correlated with physical chemistry in their proposals.

## **Division IV of Chemistry**

Research projects supported by the Division fall into two areas: polymer science and environmental chemistry.

### **Polymer Science**

Polymer science deals with the synthesis, molecular structure, chain structure, aggregation structure, properties and functions of polymers as well as their processing and utilization, and takes synthetic polymer, bio-macromolecules and super-molecular polymer as its objects of study.

In the field of polymer chemistry, major research directions are as follows: ( i ) research on the methodologies of synthesizing various polymers, polymerizing reaction with controllable structure, molecular mass and distribution of products, and biological synthesis of macromolecules; ( ii ) chemical reaction process involving polymers, paying great attention to the study of polymers synthesized by non-oil resource, and polymers with new structure, such as super-molecular polymers, hyper-branched polymers or dendrimer and their stereochemistry.

In the field of polymer physics, important directions are to advance new concepts of condensed state physics of polymers, to improve the studies of structure and dynamic evolution, to obtain a deeper understanding to crystal phenomena, liquid crystals and glassy states, to stress the studies of aggregation state in the process from single chain to shape-forming processing, to pay attention to the studies on the characterization of new structure and the relation between structure and property, the structure of polymers in restricted space, structures and properties of surface and interface, nano microstructure and size effect of polymer, morphology, relation of structure with physical property; to enhance the studies of polymer solution and rheology; and to develop simulated methods of theoretic computation of polymers, especially the study of simulated method related multi-scale.

In the field of functional polymers, major directions are: ( i ) polymers with electric, optic and magnetic properties; ( ii ) polymers correlated with biology, medicine and pharmacology; (iii) functional polymers for adsorption and separation, catalysts and reagents, sensor as well as those related with molecular recognition; and (iv) polymers related with new energy and environment.

In recent years, proposals for the following research areas are not enough: methodologies of polymeric reaction and structural characterization. When selecting research subjects, applicants should pay more attention to the development of disciplinary frontiers and try hard to extract important fundamental scientific problems derived from industrial practice, instead of following blindly hot subjects while ignoring subjects attached with less attention and basic scientific issues unresolved at present in the discipline. Meanwhile, a clear statement of scientific issues to be studied should be given, emphasizing the scientific value and avoiding a too broad theme in the proposal.

### **Environmental Chemistry**

Environmental chemistry contains the following branches: environmental analytical chemistry, environmental pollution chemistry, pollution-control chemistry, pollution ecological chemistry, environmental theoretical chemistry, regional environmental chemistry and the relation of chemical pollutants with human health. Research on environmental chemistry has been developed rapidly by the aid of comprehensiveness and intercrossing with other disciplines. Now, environmental chemistry is playing an increasingly important role in moving forward the frontiers of basic research, solving national major environmental problems and so on. Since 2008, the Discipline has added two more codes: local environmental chemistry and chemical pollutants and health, so as to be able to reflect the development trend of environmental chemistry in recent years.

Environmental chemistry is mainly to study the existence, behavior, evolving ways, trends and effects of chemicals, special pollutants in various environmental media, as well as chemical principles and methods of controlling them. Recently, the number of proposals has been increasing year by year. Research contents are continuously deepened from macrocosmic rule to microcosmic mechanism, and the creativity and systematization are also continuously enhanced. But there are certain problems in some proposals. Applicants are expected to try their best to focus closely on certain scientific issues, avoid simple repetition, and describe as clear as possible their technical ways.

Based on the proposals accepted, major research orientations include: ( i ) identification, new analytical principles, methods and technologies of pollutants; ( ii ) environmental chemical behavior and microscopic mechanism of pollutants in multi-media system, and evolutionary process and mechanism of regional environmental qualities; ( iii ) technologies and principles of controlling air pollution, renovating polluted water bodies and soils, and technologies and reusable principles of treating solid waste substances; ( iv ) application and safety of nano-materials used for pollution controlling; ( v ) influence of chemical pollutants on environment and human health, and ( vi ) relations of structure/effect and dose/effect of pollutants and forecast model of environmental pollution.

Moreover, research on basic scientific issues of environmental process and mechanism and bio-effectiveness of chemical pollutants, as well as their low dosage exposed and complex effect, etc. are also encouraged.

## **Division V of Chemistry**

Research projects funded by the Division cover two areas: chemical engineering and industrial chemistry.

Research on chemical engineering and industrial chemistry focuses on the motion, transfer, reaction and interrelation in the physical, chemical and biological conversion processes of matters. Its tasks are to recognize the phenomena and rules of transfer of matters in the conversion processes and its effect on the reaction and properties of products, to study technologies, flow chart and equipment for the clean and high effective conversion of substances, and to establish theories and methods of design, scale-up and regulation and control for use in industrial production. Specific new ideas, concepts and methods as well as their application in chemical engineering and technology should be

emphasized greatly.

In recent years, extracting key scientific issues from complex industrial systems and gradually forming systematic theories and key techniques have become a major developing trend of the discipline. A lot of new changes are revealing in research, mainly orienting ( i ) from the measurement and correlation of macro-properties to observation, measurement and simulation of micro-/meso-structure, interface and multi-scales, more attention on the optimization and regulation of structures, reinforcement of processes and scale-up rules; ( ii ) from common systems to uncommon and extreme processes, and (iii) from chemical processing engineering to chemical product engineering.

Under the guidance of the national goals and social needs, the Division will give preferential support to the studies of basic theories and key practical technologies in chemical engineering and industrial chemistry, which aims at enhancing the overall national comprehensive strength and creative ability. Particular focuses include the followings. ( i ) Great efforts shall be made to explore frontier subjects in new and high technologies of chemical engineering and newly emerged disciplines and to emphasize the crossing of multi-disciplines, specially from which to extract problems related to chemical engineering, so as to promote the development and creation in scientific ideas and technical means. (ii) Systematic basic research and accumulation should be enhanced for key technologies in chemical engineering related to the national economy and people's welfare, so as to gain systematic understanding on the laws, to develop and consummate the theories on the discipline, and to play the guiding role in basic research.

Research areas encouraged include basic chemical engineering data measuring, computation and simulation, multi-phase flow and transfer processes, separation and purification engineering, process of chemical reaction, system engineering and chemical engineering, inorganic chemical engineering, fine organic chemical engineering, bio-chemical engineering and food chemical engineering, chemical engineering and energy, chemical engineering and materials, chemical engineering and metallurgy, chemical engineering and environment and chemical engineering and resources.

## **Department of Life Sciences**

The funding in the Department of Life Sciences covers studies involving areas of resources, environment, agriculture, population and health, etc. In recent years, with the support of NSFC and unremitting efforts made by Chinese scientists, life science research has witnessed important progress. The number of research papers published by

Chinese scientists in international authoritative journals is increasing and Chinese basic research in life sciences is stepping forward gradually.

### Funding for General Program in the Last Two Years

Unit: 10,000 yuan

Divisions		2008			2009		
		Projects	Funding	Funding rate <sup>++</sup> (%)	Projects	Funding	Funding rate <sup>++</sup> (%)
Division I	Microbiology	123+12*	3,963+96*	20.18	153+12*	4,785+96*	21.63
	Botany	116+11*	3,696+88*	22.84	134+11*	4,186+88*	23.27
Division II	Ecology	104+12*	3,321+96*	20.10	120+11*	3,755+88*	21.06
	Forest science	108+11*	3,445+88*	23.15	122+11*	3,821+88*	21.04
Division III	Biophysics, biochemistry and molecular biology	108+12*	3,442+96*	20.80	130+11*	4,080+88*	22.78
	Cell biology	83+11*	2,691+88*	22.33	103+11*	3,221+88*	21.88
	Genetics and developmental biology	114+12*	3,647+96*	18.81	129+12*	4,044+96*	20.29
	Immunology	108+12*	3,444+96*	17.67	127+12*	3,992+96*	20.14
Division IV	Neuroscience and psychology	132+13*	4,224+104*	17.77	158+13*	4,943+104*	16.98
	Biomedical engineering	148+14*	4,739+112*	18.10	177+14*	5,541+112*	17.54
Division V	Agriculture science	310+18*	9,891+144*	20.37	374+18*	11,690+144*	20.35
Division VI	Animal husbandry and veterinary science and aquatic science	174+14*	5,565+112*	18.69	204+15*	6,396+120*	16.94
	Zoology	85+10*	2,709+80*	25.33	105+10*	3,293+80*	27.45
Division VII	Physiology and pathology	301+21*	9,417+168*	15.31	348+21*	10,902+168*	13.97
	Preventive medicine and hygienics	194+15*	6,207+120*	19.30	230+14*	7,204+112*	19.66
Division VIII	Basic clinical medicine I	307+25*	9,496+200*	12.02	333+26*	10,416+208*	9.91
Division IX	Material medica and pharmacology	143+14*	4,567+112*	16.10	164+14*	5,170+112*	15.46
	Traditional Chinese medicine and Chinese material medica	245+20*	7,499+160*	14.05	272+21*	8,503+168*	11.88
Division X	Basic clinical medicine II	288+23*	8,924+184*	12.93	318+23*	9,946+184*	11.39
Total		3,191+280*	100,887+2,240*	16.87	3,701+280*	115,888+2,240*	15.92
Average funding per project		29.71(31.62**)			29.67 (31.30**)		

Note:\* Projects of Small Fund for Exploratory Studies.

\*\* Average intensity of General Program projects in three years.

++ Funding rate includes projects of Small Fund for Exploratory Studies.

The Department of Life Sciences received 25,015 proposals for General Program projects in 2009, 3,568 (or 16.64%) more than that in the previous year. Of which, 24,065 were accepted and 3,981 projects were funded, including projects of Small Fund for Exploratory Studies, with a funding rate of 15.92% (accounted by the accepted proposals, and all the data below are also calculated by the number of proposals accepted) and the average funding intensity is 296,700 yuan per project. Among which, there are 3,701 3-year General Program projects (compared with 3,191 projects in 2008), the funding rate is 14.80% and the average funding intensity is 313,000 yuan per project (316,200 yuan in 2008). In the near future, the Department will comply with NSFC's funding policy of controlling the funding scope moderately and enhancing the funding intensity gradually to further increase the funding for General Program projects. It is hoped that the home institutions of applicants pay close attention to the research quality, try to control the number of applications, and improve the research standard gradually. The funding of General Program projects will reach 350,000 yuan per 3-year project in 2010.

Moreover, NSFC has established the Department of Health Sciences from the existing Department of Life Sciences, a big adjustment has been made on the former subjects setting, so applicants should read the *Guide to Programs* carefully, and select proper application codes in coupled with each science division. In the future, the Department will continue to accept studies of population and health on the configuration, structure, function concerning human cells, tissues, organs and systems, and studies of common and basic scientific problems aiming at immunity, procreation, development, caducity, stem cells and tissue engineering of life sciences. Detailed contents should be read from the *Guide to Programs* for each science division in the Department.

The Department always insists and strongly encourages researches with innovative academic thoughts, techniques and approaches, particularly those with original innovation ideas and having the capacity of prompting the development of related disciplines, and gives high emphasis on new theories, hypotheses and intercross of subject applications proposed on the background of research over a long period of time. The Department will pay due attention to important frontiers and new emerging subjects in life sciences in the future, and to the proportionate and harmonious development of various disciplines in life sciences.

The Department encourages scientists to take part in the systematic and innovative work centering on key problems of long-term research, attaches great importance to project management at later stage, implements the policy of linking performance with funding, and gives preferential consideration to applicants with good performance in their previous projects under equivalent conditions. It encourages substantial international cooperative research, and encourages outstanding researchers abroad to come back and undertake their research in China. But, it occurred in recent years that some institutions

make project applications for overseas scientists who could not conduct full time research in China. Therefore, the Department reminds those units in particular that such applications should follow the requirement of the *Regulations on the National Natural Science Fund* and NSFC's administrative regulations strictly, and the qualification of every applicant within the institution should be carefully examined.

## **Division I of Life Sciences**

The funding scope of the Division covers two subjects of microbiology and botany.

### **Microbiology**

The Division supports scientific research in microbes, principally the study of fungus, bacteria, archaea, virus and other microbes in species resource, taxonomy and evolution, physiology and metabolism, heredity and development, the influence of microbes to their environment and the host, and related scientific problems.

The kernel aspects of current microbe research are resources of microbe species and genes, the structure and function of microbe cells and molecules, the essence of physiology and genetic phenomena, the community and ecological function, the interaction of microorganisms with other organisms and non-living environment, etc. The Division supports systematic studies on basic biology of model microbe, applied microbe and microorganisms of pathogen on the above aspects and fields. Modern life sciences and techniques, including the development of “Nome research”, play an important role increasingly in microbiology, and also establish a solid basis for the development of functional genomics of microbe during the post-genome era. The Division will continue to pay attention to the functional genomic study of microbe, keep its forerunner position in the field of life sciences, and also continue to give preferentially propriety to middle aged and young applicants who study classic taxonomy of fungus and taxonomy of prokaryotic microbes.

It can be seen from the proposals in recent years that the research level of microbe has a rapid improvement in China. In basic research areas, there are more and more scientists paying attention to innovative issues, and actively promoting their research to meet the international standard. In applied basic areas, there are more and more applicants to select topics having possibilities of achieving independent intellectual property, and innovative academic thoughts and research methods. However, the following main problems still exist:

- (1) To regard the genome research of microbe in general, but lack the mechanism reveal to physiology and genetics based on such ground;
- (2) There are more basic applied studies on pathogenic biology, but lack of deep and systematic research on the basic biology of pathogen, and also lack of extensive study to

the taxa of pathogen;

(3) There are inadequate systematic and continuous researches in most of the proposals, and lack of substantial interdisciplinary study and international exchange and cooperation. This becomes the main bottleneck for the development of this subject;

(4) There is a severe shrinkage in the taxonomy of prokaryotic microorganisms, and the full time researchers are getting fewer. Vigorous support will be given continuously to the exploration of innovative basic research through funding projects, and scientists are encouraged to carry out research in the weak fields of microbe study in China.

In 2010, proposals should take microbe as their research object, and intercross with other subjects but not deviate from the main theme of microbe. Otherwise, they will be denied. For example, the Division encourages the filtration, anabolism and regulation of microbe active substances, but typical research on the activity analysis of such compounds will be not funded. The interaction research between microbe and the host is favored, but physiological and immunoreactions researches of microbe as intimidate inbreak from outside to the host are not to be supported.

## **Botany**

The Division supports projects of basic and part of applied basic research on plants as their object. It mainly covers studies in taxonomy and phylogeny, evolution biology, morphogenesis and establishment, plant growth, breeding and development, energy and substance metabolism, adaptation to environment, resources botany (including plant chemistry and natural product chemistry), and other projects concerning the exploration of new techniques and methods in botany.

It can be seen from the applications accepted and funded in recent years, the development of each subject in botany is unbalanced. There are relatively more applications in plant phylogeny, plant incretion, growth and development and fastness physiology, and the research level are relatively high. Systematic and creative research should be further strengthened henceforth. The evolution biology is coruscating livingness driven by the rapid development of genome, and the research is getting large in width and depth, so the Division will encourage studies of key scientific problems concerning plant origin, break out, and evolution deriving from new point of view, and from new experimental materials. The funded projects in classic plant taxonomy have cultivated and stabilized relatively young taxonomy research groups nationally, the Division will continuously give preference to these fields, and encourage applicants to carry out species revision of certain families and genus on the world wide range. Since the research on plant resources is comparatively week, the Division will encourage multidisciplinary synthesis research, especially the intercrossing with ecology, genomics, metabonomics and bioinformatics, pay attention to the key scientific problems during the process of introduction and plant germplasm protection, advance the effective protection and utilization of our national



plant resources, and actively encourage researches on new instruments, techniques and means which will promote the study of botany.

In order to speed up the balanced development of botany, the Division will encourage applicants to put forward particular scientific problems based on the predominance and long-term research basis of their own, and increase the funding to young scholars with creative thoughts. The policy of linking performance with funding will be highlighted, and applicants with excellent fulfillment of former funded projects of NSFC will be given moderate preference to.

Since the application code changed in 2008, there are fewer applications for some subjects, such as paleobotany, biological nitrogen fixation, respiration, water physiology, mineral elements and the metabolism, organic synthesise and transportation, physiology of seed, plant embryogenesis, plant introduction and acclimatization, plant germplasm, hydrophytes and resources, etc. Applications with good background in such fields are encouraged.

It can be seen from applications before that there are certain deficiencies in application preparation and writing, such as less novelty on research topics, vague and general explanations on argument, weak in logicity, research contents being not closely connected with the theme, the design and technique route being not specific, feasible and without enough accumulation, etc., so it is hoped that the quality of applications can be improved gradually, and long-term and systemic study can be regarded.

## **Division II of Life Sciences**

The Division supports the research subjects of ecology and forest science.

### **Ecology**

Ecology studies the interaction between organisms or between organisms and the environment. It plays an important role in resolving the national ecological problems that are conspicuously increasing. The subject covers studies in 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, soil ecology, conversation biology and restoration ecology, evaluation of ecological safety, etc.

In recent years, an obvious progress has been achieved in ecological study in China, but the overall quality of fundamental ecology needs to be improved, innovative researches need to be regarded, and repeated tracing should be avoid. The Division will strengthen its support to applications with strong innovative ideas, multidisciplinary research and

new growing subjects, give preference to proposals closely connected with the national ecological and environmental problems, especially researches hopefully with breakthrough in new theory and method, and encourage basic research with long-term observation and experiment of field work, and researches on landscape and regional scope.

In 2009, there was a major increase of applications in the fields of plant physiology, interaction of species, forest ecology, land ecosystem, globe change and pollution ecology. But in some other fields, applications were less comparatively, such as in ocean ecosystem and globe change, insect population ecology, insect behavior ecology, animal population ecology, etc.

The main reasons for applications failed to be supported in ecology are as follows:

- (1) Wide research scope, overfull contents and ambiguous definition;
- (2) Lack of creativity and repetition of other's work;
- (3) Imprecise experiment plan, and inexplicit description of research approaches, techniques and methods;
- (4) Undefined scientific ecological problem in applications of multidisciplinary study and combined macro and micro ecology study.

In 2010, applicants should pay attention to the follows:

- (1) On topic selection, applicants should grasp the new development of related research both at home and abroad, and select key scientific themes with clear ecological issues on the basis of existing research, regional investigations should combine the theoretical exploration with national need, and molecular techniques should resolve scientific problems which can not be solved with normal ecological methods;
- (2) To emphasize creativeness and avoid repetition of others' work;
- (3) To avoid having too much and ambiguous research content;
- (4) To stress the scientific aspect and feasibility of the research route and approach.

### **Forest Science**

The Division supports research targeted at forests and woods, such as forest cultivation, health care, utilization and sustainable management, the development and grow and heredity improvement of trees, basic research of gardens, plantation, soil and water conservation and desertification control, etc.

There are two obvious characters in the basic research of forest. One is to meet the national demands, so applicants should pay more attention to the important and key scientific problems in the forestry practice. The other is that research needs a long period of time since most of the research objects belong to perennial woody plant, so to carry out systematic and in-depth studies is especially concernment. The Division will continue

as before to regard and support basic research of important and kernel fields on the restoration of forest vegetation and sustainable development, the development and growth and heredity improvement of trees, efficient utilization of forest resources, health care and interactions of forests with environment, encourage interdisciplinary study and promote the development of forest basic research by taking full advantage of techniques and achievements of molecular biology, material science, space and information science, encourage scientists carrying out research in the fields of figure forestry, multi-service function of forest, high-value-use of forest biomaterials, resolving mechanisms of the growth and development of forest and wood with whole genome of model wood species, in order to meet the national needs, be on the international front line or hot spot, and participate in international competition.

In recent years, there is a rather rapid development and a tendency of well growth of basic research on forest. But there exist obvious problems in the project application and implementation: ( i ) Scientific issue is not closely connected with the major national needs of forestry, especially without enough concentration on basic kernel scientific problems based on explaining and resolving important practical matters; ( ii ) There exists partially the phenomenon of tracing, imitating and chivy blindly, or adhering to modern techniques and methods for applications; ( iii ) Continuous, systematic and in-depth research needs to be intensified; ( iv ) There are fewer applications in the traditional aspects such as forest management, forest soil and forest pathology that show a tendency of shrinking; ( v ) Important basic scientific problems in some important fields such as forest cultivation and economic forests have not been exacted and put forward. In the future, the Division will stress more on the concrete scientific issues and innovation of academic thoughts, highlight the policy of linking performance with funding, encourage continuous, long-term and in-depth study, and give certain preferential support to some shrinking fields.

In 2010, applicants should pay attention to the following: ( i ) The topic selection should be based on adequate investigation, research contents should reflect the academic value and practical significance; ( ii ) To concrete specific scientific problems, bring forward research hypothesis, establish particular research route and method, and incarnate creativeness; ( iii ) To ensure the research contents with pertinence and necessity, give explicit existed accumulation and fulfilled contents, and avoid attending to every aspect and not in-depth study of key scientific problems; ( iv ) To provide detailed and specific research design so as to distinguish the feasibility of the project; ( v ) To make the theme simple, specific and clear, and to avoid vague and empty by all means; ( vi ) To represent the existed accumulation of studies, other productions representing the level of research group, detailed order of authors for research achievements, especially for articles, patents and awards, and the corresponding authors; ( vii ) To fill in the most

proper application code according to the research objects and contents.

### **Division III of Life Sciences**

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

#### **Biophysics, Biochemistry and Molecular Biology**

The Division mainly supports studies on the structure and function of biological macromolecules, the interaction between macromolecules, the effect and role of the physical environment to organisms, and so forth. The subject of biological macromolecules, especially the structure and function of protein, is a key field of this discipline. Judging from the contents of applications received in recent years, it can be seen that protein crystallography, including researches on the structure and function of protein complexes, has a preferable basis and in-depth research. Biological macromolecules and the interaction between protein-protein attract a lot of proposals with important significance. There are comparatively excellent applications in nuclear biochemistry, the structure and function of biomembrane, transmembrane signal transduction, etc. Proposals in the structure computing and theoretical forecasting of large biological molecules and bioinformatics have well reflected the character of disciplinary intercrossing. Proposals in proteomics are inadequate in depth, and there is a slightly weak basis in the applications for glycobiology and environmental biophysics. Researches on bio-effect and functional mechanisms of ionization and the electromagnetic radiation to organisms are still concentrated on the cellular or individual level. Applications on bioacoustics and biophotonics are few, and there is a wide range covered by new techniques and methods in biophysics and molecular biology, but applications with actually new techniques and methods in such fields are few.

The funding emphasis of the Division in the future is as follows:

- (1) To encourage and support projects including the structure computing and forecasting of large biological molecules, protein crystallography, nuclear magnetic resonance spectrum, bio-mass spectrometry, electronic microscope, etc., biological study of 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;
- (2) To encourage and support applications of interaction between macromolecules during the signal transductions of cells, for instance, the interactions of proteins of important linkage on the core signal pathway and route, new component appraisal and discovery in signal transduction network, exploration of the structure and function of signal transduction pathway and network;
- (3) To encourage and support researches concerning the biochemical mechanisms of covalent modifications of histone methylation and acetylation, and functional

mechanisms of histone modification in chromatin remodeling process;

(4) To encourage and support studies on the function and regulation mechanisms of RNA in various life processes of activity;

(5) To encourage applications with new methods and ideas from mathematics and information sciences, and to carry out researches on bioinformatics, systems biology or integrative biology;

(6) To support and encourage moderately applications of polysaccharide and glycoconjugates;

(7) To give moderate encouragement and support to applications on the mechanisms of environmental physical factors to organisms at cellular and molecular levels, and research on the effect to organisms in micro gravity conditions;

(8) It is a challenged direction for the high resolution spatial structure study of membrane protein. So the Division will encourage structural biology study of membrane protein, and stress the structure and functional study of membrane protein and interaction between membrane protein and membrane lipid.

## **Immunology**

Immunology is a branch to study the structure and function of immune system. The scope of support covers such areas as molecular and cellular immunity, immune response, tolerance and modulate, immune genetics, breeding immunology, mucosal immunology, vaccinology, antibody engineering, etc. The research contents include scientific problems of basic rules and mechanisms of immunology in immune recognition, immune response and immune tolerance/immune adjustment, etc.

The following fields are the current main directions of immunology: the formation mechanisms of immune systems, the constitution of immune organs and cells, the mechanisms of formation process and co-adjustment of different immune cells and subgroups, the structural identity of antigen and immune recognition, the relation and mechanisms of immune response, the substantial basis of immune cells structure to receive the signals from outside and to recognize the antigen, the cellular and molecular mechanisms of Innate immune responses, the cellular and molecular mechanisms of Acquired immune response, the mechanisms of functional regulation and signal transduction of immune cells, mechanisms of migration process and localization of immune cells, cellular and molecular mechanisms of the formation of immune memory, and the manufacture of bacteria, single antibody, cytokines of genetic engineering, etc. The Division will support systematic studies of immunology in the above aspects, and actively encourage and support proposals with new concepts and new techniques by using modern biology, so as to understand thoroughly the complex structure and function of immune system, and to promote and develop the study of immunology.

It can be seen from applications in recent years that the standard of immunology research

in China has experienced a rapid increase. More and more scientists have paid attention to the creativeness of selected topics, have actively advanced the linkage of individual research with international standard, and have regarded more heavily to the innovation of academic thoughts and research methods. But main problems still exists as: ( i ) Many applications are concerned descriptively and lack of mechanisms exploration; ( ii ) Many applications only study currently known hotspots by ectypal research model, only a few proposals have new discovery and put forward reasonable scientific problems based on their own results of pre-experiment to form scientific hypothesis and the research design to prove them; (iii) Some applications have repetitive contents, single technical route and lack of promethean experimental system, and less research is on the long-term accumulation of the same direction to form typical features; (iv) Lack of model laboratory animals and substantial subject intercrossing have become the main bottleneck for the development of this discipline. The Division will continue to vigorously support creative studies and intercrossing studies thorough funding, and encourage scientists to carry out immunological study by using model animals.

### **Biomechanics and Tissue Engineering**

This discipline is an intercrossing subject of life sciences with other disciplines and the funding scope covers biomechanics, biomaterials and tissue engineering. It usually studies the relationship of structure and function of normal and pathological mammal tissues by the principle and methods of life sciences, renew, maintain and improve tissue function through the composite developing substitute by cells and scaffolds materials, and the quantitative analysis and application related study of problems in life sciences by using mechanic principle and methods.

The study of tissue engineering and biomaterials mainly concentrates on the basic research of regeneration of tissues and organs, and damage rehabilitation as its final aim. Among them, tissue engineering covers research related to bone, cartilage, tooth, muscles, tendon and skin, as well as cardiovascular tissue, nerve, liver, kidney, etc., to accomplish the tissue repair and function regulation by means of inducement differentiation of stem cells, *ex vivo* expansion and tissue construction, and cell assemblage of matured cells. The study of biomaterials covers biocompatibility, surface treatment, gene delivery modification and degradation characteristics of biomaterials and related scientific problems. The study of biomechanics and rheology mainly focuses on mechanical characteristics and mechanisms, mechanical imitation and model establishment of certain systems and organs, and the related studies in cell-sub cell-molecular levels. The Division encourages systematic and multidisciplinary applied basic research in the above areas, the study of inter influence and effect between cell an biomaterials, surface modification of materials, biocompatibility and the study of safety appraisal, the combination study between biomechanics, biorheology, cytology and molecular biology, and stresses the study of the coupling of mechanics-biology (chemistry) and the influence

of various mechanical environment to organisms.

In recent years, there has been an obvious progress in biomechanics and tissue engineering in China, more and more scientists have given advert to the innovation of research topics, have published their research in international influential journals, and have given more regard to the protection of independent intellectual property right and to the application of national and international patents. But it can be seen from the applications that some main problems still exists: research being not adequately systematic and continuous, multidisciplinary intercrossing only staying in exterior but not in the reality, insufficiency combination of working teams with teams in fundamental biology background that affected the creativeness and feasibility of the proposals, etc. In the future, the Division will support the exploration with creativeness through funding, and encourage the cooperation of multi subjects and applications of intercrossing study.

In 2010, the Division appeals that applications in biomechanics and tissue engineering should reflect the intercrossing study of multi subjects, for example, the interaction study between cells and materials, but the special study of cell development will be not funded. It will encourage the biomechanics and rheology study on tissues, organs and cells, but not on signal transduction and metabolize route study irrespective with mechanics.

## **Division IV of Life Sciences**

The funding scope of the Division covers two subjects: neuroscience, cognitive science and psychology, and physiology and integrative biology.

### **Neuroscience, Cognitive Science and Psychology**

This discipline is one of the most rapidly developing fields in life sciences, and addresses the relations between brain and behavior. The research of this discipline is to study the normal functions like the formation of nerve system, consciousness, attention, working memory, learning and memory, language, etc., at multi-levels from molecules, cells to computing network and psychology by using colligate methods of applied of life sciences, physics and information sciences. Psychology is a branch of science to study human spiritual world by means, methods and techniques of natural science, and the essence of human cultural activity belongs to the study of psychology.

The main aspects supported in neuroscience cover molecular neurobiology, cellular neurobiology, developmental neurobiology, system neurobiology, sensory systems neurobiology and computing neuroscience (including neural engineering and brain-computer interface study). Cognitive neuroscience covers the brain structural and nerve basis of cognition, learning and memory, attention and consciousness, cognition

language and cognition simulation, etc. The main areas of psychology include cognitive psychology, social psychology and physiological psychology which study the behavior of mental activity and physiological basis. Developmental psychology concerns the development of the whole life, especially the development rules of psychological activities of enfant and the elder. Juvenile delinquency and cyberspace addictiveness are one of the focuses of the social concern and have been studied in recent years. The funding areas of engineering psychology include organizational behavior and ergonomics. In the future, the Division will continue to stress the synthesis study of multi-disciplines and multi-levels to higher cognitive functions and the neuron mechanisms of human brain from the angle of gene-brain-behavior-cognition. The Department of Life Sciences will continue to give preferential support to psychology, especially to applications submitted by young psychologists.

It can be seen from the proposals and projects funded that there are fewer applications actually representing cooperative research with multidisciplinary and multi-institutional aspects although it has been a common understanding for the study using synthesized motile-subjects methods. Moreover, there is an obvious convergence tendency of selected topics for funded projects. There is much support in some comparatively well based fields, such as perception (include ache, vision, hearing), living and Apoptosis mechanisms of nerve cells, but less support in the fields concerning the development, damage, repair of nerve system and movement regulation.

It has been a new peculiarity in the research of psychology by means of various measures of neuroscience, such as modern imaging techniques and gene sequencing. The comprehensive research approach of behavior, imaging and genetics has become a popular research model in psychology. The topic selection possesses Chinese characteristics, including the effect of culture to the basis of social cognition processing like aesthesia, count, self-referential processing, empathy, etc., the study of nerve mechanisms of unique Chinese language processing, and the interpretation of nerve mechanisms by using nerve imaging techniques. What should be strengthened is to accumulate long-term environmental data of typical population and to explore the influence of genetics and environment on the formation and development of cognitive ability with new techniques and from new a point of view. The Division will continue to promote the combination of nerve imaging techniques and cross-cultural psychology, and to impel actually the combination of different research groups crossing nations and cultures.

### **Physiology and Integrative Biology**

Physiology is a branch which studies the principles and phenomena of normal life activities, and the functions of every composition of organisms. The research objects of this discipline start from the simplest microorganisms to the most complicated human



body. Therefore, physiology is not only one of the most important basic sciences interpreting life phenomena, but also the important basis of biology and medicine. The main funding scope covers cell physiology, systems physiology, integrative physiology, caducity and biorhythm, nutrition and metabolize physiology, exercise physiology, special environmental physiology, comparative physiology, human anatomy, human tissue and embryology, and integrative biology.

Cell physiology studies at the cellular level the physiological function of cell membrane and sub structure, cell metabolism and the mechanisms of cell interaction, such as the substance transport mechanisms of cell membrane, potential changes, ion permeability changes, the structure-function relations of every tissues, cell ultra-micro structure, and the biosynthesis process, mechanisms of excrete and action of various hormones of endogenous active substances. Systems physiology studies the effect and function of tissues and organs as a unit of itself in life activities, and the mechanisms of regulation and action of various micro-environments to its function. Integrative physiology and nutrition and metabolize physiology study the physiological process and functions in the whole individual level, such as regulation and adaptation, stress and compensation, adjustment of nerve, incretion and immunity, regulation of hematopoiesis and metabolism, nutrition and metabolism, equivalence and adjust of water and electrolyte, and other physiological processes. Aging is not only an important physiological process and phenomenon of organisms developing after adult to death gradually, but also closely connected with many human diseases. Aging study is one of the basic and important problems in life science. Aging studies the molecular basis of cell aging and death, the initiation mechanism of cell aging, genetics mechanisms, mitochondria injury mechanisms, and the relationship between free radical and aging, etc. The study of aging has reached the cellular and molecular levels from the whole individual level and organ level. Exercise physiology studies the function and mechanism of physiological process related to factors of exercise, such as cell regulation, tissue and organ, system and individuals, and the physiological process of adaptation to exercise of cell, individuals and organ, and the changes of individual structure and function during the exercise and under the impact of exercise. Special environmental physiology studies the physiological function and regulation mechanisms for the adaptation and compensation of molecules, cells, tissues, organs and individuals to the environment change under special conditions. Comparative physiology studies the physiological characteristics and development rules of phylogeny and ontogeny at different stages and different environmental conditions by comparative method. It will pay attention to exploring how the life activity adopts to the environment change, and to providing a scientific theoretical basis for the study of human physiology and for the practice of medical treatment and medication by using the experimental data of physiology or organ physiology from some mammals closely contiguous to human body.

Along with the fulfillment of human genome project, the coming of functional genomics provides an unprecedented opportunities and challenges for the development of physiology. More and more attention in modern physiology will be paid to the utilization of various biological techniques and methods to study the normal physiological functions of various molecules, cells, tissues and organs of organisms, and the reciprocity relation between different cells, tissues and organs, meanwhile, modern physiology also gives attention to the integrative physiology by the exertion of modern experimental methods under the whole individual status to explore the function of every part of the body, and the internal relationship. It has provided a powerful strut for the study of physiology due to the rapid development of life science research, and the broad intercrossing and penetration among subjects, and the application of new techniques will also promote the research development of physiology further to a higher level.

## **Division V of Life Sciences**

The funding scope of the Division covers three subjects: genetics, bioinformatics, cell biology, and developmental biology and reproductive biology.

### **Genetics and Bioinformatics**

Genetics mainly studies three aspects including the essence, transfer and realization of genetic information. One important approach in life sciences is to study various life phenomena by using the strategy and methods of genetics. At present, it has been the mainstream by using the Genetic variation methods to study problems in life sciences.

The main funding scope of this subject covers plant genetics, animal genetics, microbe genetics, human genetics, epigenetics, gene expression and regulation, bioinformatics, etc.

Among applications in recent years, the main part is the identification and research of gene function. The Division encourages studies of gene function appraisal by fully utilizing acquired valuable genetic resources. The important thing is to accurately analyze phenotype at first, and then to study whether the phenotype is determined by new genes. There are more applications in gene expression and regulation and epigenetics, and the peer review result is relatively ideal, therefore, more proposals are funded, especially the study of non coding RNA genes, gene methylation, histone methylation, acetylation, etc. The Division suggests that applicants should pay attention to the combination of researches on the express regulation of gene and related biological significance.

Regulating mechanism research of non coding RNA is a new area of RNA study, it is also the youngest and most active hotspot of modern biology, and the important content is to

study the gene structure of non coding RNA genes and the mechanisms of gene express regulation.

In modern genetic studies, large scale data output represented by genome sequencing has changed the traditional biological research methods focused on one point or one side, to grow from one specific problem to the whole picture and getting the same significance from data driven to hypothesis driven. Therefore, for the study of genomics and bioinformatics, the Division encourages, on the one hand, new techniques and method researches which will be used to develop large scale data analyses, or to dig rules of biological significance through large scale data analyses, and on the other hand, the target related research starting from specific scientific problems. Besides, the Division will encourage applications by using different species, especially species with whole genomic sequencing, including model organisms (yeast, nematode, drosophila, zebra fish, mice, primates, Arabidopsis, rice, etc.), to carry out research through genome comparison, to explore gene evolution, epigenetic mechanism evolution, non coding RNA, etc. Bioinformatics is an active field, so the Division will give support to it in preference.

In 2010, the Division will continue to regard the gene isolation and characterization by using animal and plant genetic resources, mechanism studies on important gene function, and multidisciplinary studies on information characters of genome function and structure, comparative genomics, gene interaction network, etc., based on methods of bioinformatics and computing biology.

### **Cell Biology**

Cell biology is a basic branch that deals with the study on the rules and mechanisms of life activity of cells. Modern cell biology mainly focuses on the molecular, cellular and individual levels to reveal the structure, function, phenotypes and regulation mechanism within organisms, and to highly value systematic research by using different new techniques and methods to subtle molecular regulating mechanisms and complicated regulating network of various life activities of cells in time and space.

Research areas supported in cell biology mainly include cellular and organelles structure, components and their assemblage mechanisms, cytoskeleton and molecular motors, cell signal transduction, cell cycle, differentiation and polarity of cells, movement of cells, extra cellular matrix, communication between cells, vesicle transportation (include endocytosis and exocytosis), respiration and metabolism of cells, aging, death of cells, and other new technologies and methods used in cytology.

Researches on the structure and function of cells are still the main aspects to be supported. It is encouraged that applicants present mutually connected 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 life activities of cells. The highlight will be given to studies of cell aging, death, autophagy, the multiplication and differentiation of cells, the migration of cells, etc., by using model cells or model animals. Research on the regulation of non coding RNA to cell function and the molecular mechanism of cells anti-adversity is encouraged.

Among the applications accepted in 2009, fewer are in the areas of cell aging, death and cell migration. Those areas are important in cell biology and there have been certain foundations in related researches in China. So, the Division will give preference to applicants who present their proposals with scientific problems from their previous research on these aspects. Cell autophagy is one of highly regarded aspects in recent years. It participates in the growth and development of cells, differentiation, response of cells to environment stress, also takes part in the response to innate immunity and adaptive immune, and plays an important rule in the maintaining of the inner environment stability of the body. The Division encourages applications based on the previous researches and condensed explicit problems.

In 2010, the Division will continue to stress researches on the functional and mechanical issues, highlight the utilization of various new research techniques and methods in the study of cell biology, 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 network control.

### **Developmental Biology and Reproductive Biology**

Researches on developmental biology are conducted mainly at tissue, organ and individual levels. It covers the occurrence and growth of germ cells, recognition of gametes and fertilization, formation and configuration of embryo, the occurrence, development, maintenance and regeneration of tissues and organs, somatic nuclear reprogramming and nucleus-cytoplasmic interaction, etc.

The Division will value highly researches to realize the development process at molecular level. It is hoped that applicants will set up their own experiment systems at first, and then carry out pertinence research by means of genetic methods on the basis of observing the phenomena affecting the development process. So, the Division encourages applicants to conduct integrated researches on new components of signal transduction, non coding RNA and various epigenetic modifications, with the regulation function of targeted important development processes and their relationship with tissue and organogenesis.

Modern developmental biology emphasizes on the study *in vivo*, the continuity of

development and dynamic process of change, the molecular mechanism study and the multidisciplinary study. Those aspects represent the characteristics of developmental biology. It is hoped that applicants will pay attention to these aspects in the actual research, and also think over those factors in the applications.

Model organisms play a very important role in the developmental biology. In recent years, the number of laboratories conducting studies by using drosophila, zebra fish, nematode, etc., is increasing. It should be emphasized that different model systems should be used for different scientific issues. It has been some years for Chinese scientists to carry out researches by using amphioxus, herein considering the evolutionary position of amphioxus and the features of itself. If condition permits, applicants are encouraged to carry out developmental study with amphioxus through establishing adequate research methods, approaches and systems for characteristic research. In the applications of developmental biology, it is specially required to develop and establish new creative methods, approaches and systems in the study.

The research scope of reproductive biology covers main areas such as gonad development, embryo implantation, reproductive hormone, embryonic stem cells, etc. The main contents of study involving the network regulation of mass signal pathway are the origin, migrate and regulation mechanisms of primordial germ cells, the establishment and fate determination of germline stem cell, the primordial follicle formation, the follicular/oocyte development, maturation and ovulation, the function maintenance of germ cells, and aging.

In recent years, the study of embryo stem cell has been highly regarded. The division pattern of embryo stem cells, the keep of totipotency and the interaction with its micro environment, and the directed differentiation have become the hotspots. The born of iPS techniques will lay a foundation for the intending stem cell relevant research on the one hand, and on the other hand, will open up a new route to the mechanism study of cell reprogramming.

Developmental biology and reproductive biology are the important fields of life sciences. It is very important for applicants having a former research basis to determine the scientific problems and research contents, and to elucidate clearly in the depiction of justification.

## **Division VI of Life Sciences**

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

## **Basic Agriculture and Crops**

The Division mainly supports basic and applied basic researches targeted at systems of crops-environment. The research emphasizes on the rules of crop growth and development, interaction of crops with environment, genetic improvement of crops, and production and related problems which cover the subjects of basic agriculture, crop cultivation and farming system, physiological ecology of crop, germplasm resources, genetic breeding of crops and crop seed science.

The followings are the kernel aspects of crop science: the study of germplasm and gene resources of crops, genetic and molecular mechanisms of important crop property, interaction between crop and environment, crop super high-yield theory, rules of resource utilization, and quality control of crop seed and yields. The Division will support researches guided by scientific problems comprising in the great demand of national food security, environmental protection and sustainable development in the above areas. Meanwhile, by targeting to the future scientific frontiers of crops and the national demands of agriculture industry, the Division will actively support basic research areas formed from the combination of genomics, proteomes and crop science, such as crop gene resources, transcriptomics, protenomics, metabonomics, structural biology, molecular breeding and molecular ecophysiology. The Division encourages studies on crop information science which combines information techniques, computing biology, systems biology with crop science.

It can be seen from the proposals in recent years that there is an increase in applications with basic problems on topics meeting the nation agricultural demand and an obvious increase in intercrossing studies around basic agricultural issues, and that the distribution of home institutions of applications shows a pattern of diversification. However, problems still exists as follows: ( i ) On the basic research, there is a common regard to crop genome research, but not enough reveal on the mechanisms of physiology and genetics on this basis; ( ii ) On the topic selection of basic applied research, attention is paid to tracing international hotspots, but not close combination with practical issues of national agricultural production; (iii) Systematic and continuous studies are weak; (iv) The writing of applications is not normative.

In 2010, the application codes are adjusted. Applications for agriculture (crop science) should take crops as their research objects, and the intercrossing with other subjects should not depart from the principal object -- crop, otherwise they will not be accepted. The Division encourages close combination of new theory and techniques with traditional methods, laboratory work and field experiment, and gives preferential support to systematic and continuous research. The Division does not fund applications with research objects like agricultural animals, forest and woods, and model plants of *Arabidopsis thaliana*.

## Food Science

Food science is an intercrossing subject which studies food property, factors causing food degeneration, principles of making process by integrating and using theories of basic science of biology, chemistry, physics, medicine and engineering, etc., and modify food to meet the public requirement. In order to meet the needs for the development of national food science production, and promote the development of basic research of food science, the Department has set up the subject of food science in 2010, and has publicized the application code in accordance.

Food science mainly supports basic and applied basic researches with food and its stuff as research objects, it essentially studies physics, chemistry, biochemistry, nutrition and safety properties of food and foodstuff, principles of food storage processing, and the theory and methods enhancing the nutrition value of food and security. The main scope of funding covers basic food science (food biochemistry, food nutrition and food inspection), basic food processing (food fats and oils processing, sugar manufacture, meat processing, egg processing, fruit and vegetable processing, food fermentation and brewage, food baking processing, flavoring foodstuff, food additives, beverage and cold drink, etc.), food processing techniques (food storage and fresh keeping, food machinery, by-products of foodstuff processing and their recycle). Along with the progress of human being and social development, the study of food, nutrition, health and the related storage of farm products, fresh keeping and security, the engendering mechanisms of animal products trait, gene regulation, molecular nutrition, proteomics and the impact of gene expression environment on health has become a hotspot.

Analyzing applications in the storage, fresh keeping and security of farm products from the former agricultural discipline, and the processing of animal products, processing and fresh keeping of aquatic products and animal food science from the former animal husbandry and veterinary sciences and aquatic science, it can be seen that applicants have paid attention to secreting scientific problems by combining with production practice, research has been deepened to some extent and there is a tendency of multi-subject intercrossing, but problems still exist obviously such as ( i ) lack of creativeness on the whole, or seeking the creativeness one-sidedly, but ignoring the feasibility and foreground of application; ( ii ) departing from basic and applied basic researches, and containing too much technical development, and (iii) weak in systematic and continuous endeavors.

In 2010, the Division will mainly fund basic and applied basic researches by using food or foodstuff as its objects, give preferential support to studies on important scientific problems restricting the production development, continuous and systematic research with high creativity, and substantial multidisciplinary studies.

## **Division VII of Life Sciences**

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

### **Plant Protection**

The Division supports basic and applied basic researches on plant protection, mainly including plant pathology, agricultural entomology, other pests of agriculture, plant chemical protection, biological prevention and cure, quarantine of agricultural pests, invasion biology, etc. Plant protection mainly studies plant diseases, plant insect pests, farm weeds, agricultural rats and the recognition of pests, biological features and developmental rules, jeopardize and damage, mechanisms of disaster, and the strategy of prevention and control. New theory and methods of modern life sciences, information science and other basic sciences are blending to various aspects of plant pest checking, supervision, prediction and control, and have promoted the development of plant protection. On one hand, the mechanisms of pest disasters can be deeply promulgated by using molecular biology and information techniques at the microscopic level, and on the other hand, the approaches and strategies of pests control can be explored that are conducive to the increase of comprehensive production ability of agriculture, the protection of biodiversity, control of environmental pollution, and the saving of resources by using the principles and methods of ecology and systems engineering at the macroscopic level.

In 2010, part of the application codes has been adjusted. Applications of plant protection should focus on crop pests, carry out research on the forecast and prediction of pests, prevention and cure of plant diseases, pathogenic mechanism, agriculture insect and pest prevention, plant quarantine and invasive biology, biological control, chemical control, and crop resistance to diseases and insect pests. It is encouraged to concrete scientific problems from agricultural production practice, to study the mechanisms of reciprocity of crop-pest-environment (or natural enemy and pathogen) at the microscopic or macroscopic level and scientific problems of the occurrence and disaster rule of pests, check and forecast, and the process of prevention and control. The close combination of new theory and methods with traditional methods, and laboratory work with field experiment is encouraged. Preferential support will be given to the continuous and systematic research. The Division supports applications which study crop pests as its object, and the prevention and control of pests as its scientific purposes. Applications beyond that will not be funded by the Division.

### **Horticulture and Plant Nutrition**

In horticulture, the Division will mainly support the origin and classification of fruit trees, vegetables and horticulture crops, the evaluation of germplasm resources and utilization,



growth, development and physiological metabolism, genetic improvement, response to the environmental changes and related scientific problems. Currently, important research areas of horticulture cover the evaluation of germplasm resources of horticulture crops, gene excavating and using, mechanisms of quality formation and regulation, responding mechanisms to non-living adversity and regulation, cause of continuous cropping obstacles and regulating mechanisms, and mechanisms of rootstock-scion interaction of fruit trees and other horticulture, its influence to the scion development, and the formation of disadvantage factors of horticulture production and its regulating mechanisms, etc. In recent years, the number of applications on horticulture is increasing rapidly, the intercrossing of multi subjects is more obvious, and the quantity and quality of articles published are improved evidently. But main problem still exists: ( i ) There are more transplanting and tracing researches, lack of previous accumulation of study, not enough creativeness and systematic study; (ii) there are fewer applications having scientific problems raised from the national horticultural production development, the topics being too big and research contents being nimity.

Plant nutrition mainly supports scientific issues concerning the process and regulation of crop nutrition, which covers the heredity of plant nutrition, physiology of plant nutrition, manure and fertilizer science, nutrient resources and recycling, crop-soil interaction and regulation, etc. Currently, the important research fields cover the germplasm and gene resources of plant nutrition, mechanisms of plant activating, absorbing and utilizing soil nutrition, the interaction process of plant-soil-microbe and nutrition regulation, etc. In recent years, China's basic research on plant nutrition has made certain influence internationally, and scientists have paid attention to the selection of research topics by combining the practical issues in the national agricultural production and to the creativeness of academic thoughts and research methods. But main problems still exist as follows: ( i ) Quite a number of applications attach much attention to the molecular biology study of plant nutrition, but less to the in-depth study on the mechanism of physiology and genetics of plant nutrition; (ii) Highlights are giving to the mechanisms of individual plants to activating and utilizing soil nutrition under intimidate conditions, but less to the in-depth study on the nutrition efficient use under intensive condition; (iii) Basic research forces in nutrition resources and fertilizing study are relatively week.

In 2010, the application codes have been adjusted partly. The Division will encourage scientific issues raised from the national agricultural production or agricultural industry development, and close combination of new theory and methods with traditional methods, and give preference to the continuous and systematic researches. In horticulture, the Division will support proposals taking horticultural crops as their research objects, and production yield, quality, fastness and security as their research goals. Otherwise, they will not be funded by the Division. For applications of plant nutrition, the Division encourages studies on the genetic, physiological and molecular mechanisms of nutrient

efficient utilization of crops, and the interaction of regulation of crops-soil-microorganism, and supports excellent applications in the areas of “muck and fertilizer science” and “nutrition resources and recycling”. The Division does not fund applications using forest and model plant *Arabidopsis* as its research objects.

## **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 is the discipline studying the life phenomena and rules of activity in animal morphology, taxonomy, physiology, behavior and evolution. The application of research techniques of molecular biology, bioinformatics and computer techniques has enriched the research contents on zoology. The cell and molecular basis of animal phylogeny, co-evolution and morphological evolution, animal behavior and adaptable evolution have gradually become the hotspots. Research on animal taxonomy, zoogeography and resource exploitation, and conservation biology has been deepened and integrated unceasingly. Experimental zoology has acquired the recognition.

Applications in the last three years show that proposals occupy about 24.72% for taxonomy, the major portion of all applications, 15.52% for animal resources and conservation, 13.29% for animal genetics and evolution, and 12.18% for animal physiology, respectively. Applications in the above fields are not only good in number, but also have their own research features in some aspects and occupy certain position internationally. It can be seen from peer review and panel evaluation that the themes, designs and even the creativeness of academic thoughts of the proposals have been improved greatly, but problems still exist. For example, some applications ignore the depiction of justification for the projects and feasibility demonstration of technical routes. Some applications are too simple about their early experimental accumulation or without detailed progress of previously finished projects. A number of proposals set very extensive contents, very high objectives or improper topics, and overstress the number of published papers but ignore the quality. The budget of funding is impractical in some proposals.

In the future, the revised study of typical taxon of animals still remains the main contents of classical taxonomy funded. Studies of animal phylogenetics and biogeography focused on evolution, and the process and evolution genomics are the key frontline at present. The Division will encourage researches on cell development, comparative physiology, adaptive physiology, animal behavior, the establishment of model animals, etc. Support will be strengthened to researches on the biodiversity, conservation biology of

endangered animals, sustainable utilization of important resource animals, relevant biology research of important alien invasive species and biosafety. Basic zoological research on specific species in China and areas of fragility needs to be encouraged continually.

The Division encourages theoretical and methodological exploration and research according to animal resources and regional features in China, with the application of new techniques and means. Substantial interdisciplinary studies will be encouraged.

### **Animal Husbandry and Grassland Science**

Animal husbandry is a branch of science to study the growth, development, feeding and breeding of domestic animals, and the utilization of animal products. Grassland science is a branch of science to study how to obtain good quality and higher yield forage grass, while the pasture conditions are to be maintained, and the grass and production efficiency of livestock to be increased. The Division supports basic research on livestock, poultry, grass, silkworm and bee as its objects, including germplasm resources, physiology and metabolism, genetics and breeding, nutrition and feedstuff, behavior and welfare, products processing and the interaction study of livestock, poultry, grass, silkworm and bee with their environment.

Applications accepted and funded in the last three years refer to every area of this discipline, among which, heredity breeding of livestock and animal nutriology are not only having more proposals, but also having formed their research characteristics in some aspects, and progressed along the front line of the international level. More and more applicants give regard to the creativeness of topic selection, actively conduct cooperation and exchange at home and abroad, and give more regards to the studies with probability possessing independent intellectual property. But problems still exists, for example, not enough original creativeness, seeking innovation one-sidedly, the topics being too big, contents being excessive, and lack of enough concentration on key scientific problems. For some applications, the connection between topics, research contents and goals is not strong and the research keystone is not prominent.

In the near future, the Division will pay more attention to innovation and subject intercrossing, strongly support studies with probability acquiring new discoveries, thoughts and techniques, and give high regard to non-consensus proposals with real creative thoughts and high risk.

The main research aspects in animal husbandry currently include excellent gene excavation of national typical domestic animals and their functional genome, molecular breeding, reproduction and development model, their molecular mechanisms of regulation, new theory and methods related to molecular nutrition, and the interaction of

animal husbandry development and its environment. In the near future, the Division will give more regards to the study of excellent gene excavation of national typical domestic animals and their functional genome, basic research on agricultural animals and genetic breeding of grazing, encourage intercrossing study with priority to this subject, and give moderate preference to the study of grassland science, sericulture and apiculture.

In 2010, applications should fall into the Division's funding scope in animal husbandry and grassland science, and interdisciplinary studies with other subjects should take animal husbandry and grassland science as the main research aspect.

### **Veterinary Science**

Veterinary science takes animal diseases as its objects of research, with emphasis on the basic studies of animal diseases, zoonoses, most common diseases and comparative medicine.

The applications accepted and funded in recent years refer to every area of this discipline, among which, physiological biochemistry of livestock, veterinary immunology, clinical veterinary and veterinary epidemiology are not only having more proposals, but also having a number of important achievements of international influence, for example, the explanation of pathogeny and epidemiological characteristics of highly pathogenic avian influenza, foot-and-mouth disease (FMD) and Porcine Reproductive and Respiratory Syndrome (PRRS), etc. More and more applicants pay attention to the creativeness of topic selection and actively advance their research to the international standard. But problems still exist. Some applications come from the production practice or trace the international hotspot, they do not have enough concentration of scientific problems, resulting in the deflection to application or in the absence of original creativeness. Some applications do not have systematic and continuous work, and lack substantial subject intercrossing and international cooperation and exchange. Some proposals in animal epidemic diseases stress too much on pathogen, but ignore researches on immunology and experimental zoology which play an important role in the prevention and control of important domestic animal diseases.

In the near future, the Division will pay more attention to the infectious and immunological mechanisms of important animal pathogen (like TB disease, Brucellosis and new occurred infectious diseases), to basic research relating to dairy cow metabolic and toxic diseases, and molecular mechanisms of animal pathology estate formation, and meanwhile, continue to give mighty support to exploratory applications with high creativeness, and encourage applicants to conduct research in the weak fields of veterinary in China.

In 2010, the Division requires the applications to be within the funding category of this

subject, and intercrossing studies with other subjects should take this discipline as its main research body. Applicants are reminded that the application for experimental studies of highly pathogenic animal bacteria should be strictly abided by related decrees and regulations, meet the basic requirement of carrying out studies with animal pathogenic microbes.

### **Aquatic Science**

Aquatic science studies the basic rules of growth, breeding, genetics, development, physiology and immunology of aquatic economic animals and plants, and their related breeding ecology, nutrition, control of diseases and pests, utilization and protection of aquatic resources, etc. The main scope of funding in this discipline covers basic aquatic biology, genetic breeding of aquatic organisms, aquatic resources and conservation, nutrition and feed science of aquatic organisms, aquatic breeding, immunology and control of diseases and pests, breeding and fishery engineering, and new techniques and methods of aquatic biological research. Due to the application of modern biological science and techniques to the aquatic science, basic theory of aquatic science bears the tendency of in-depth development vertically and subjects intercrossing horizontally.

In recent years, quite a number of applications have been accepted and funded in immunity and control of diseases and pests of aquatic organisms, aquatic basic biology, aquatic resources and conservation, and genetic breeding of aquatic organisms, and relatively in-depth studies have been conducted in important economic traits of aquatic animals, molecular characters of important pathogens and their pathogenesis, etc. They have formed their own research characters and superiority in some aspects. It can be seen from peer review and panel meetings that there is an obvious improvement for the creativeness of academic thoughts of proposals, but some common problems still exist. The topics turn to be conservative and lack of original innovation. The themes are not in accordance with research contents, and research contents are dispersed without enough concentration of scientific problems. Many are just repeating or tracing others' work, and some are overestimating their research significance and unknown results.

In 2010, the Division requests applicants in aquatic science to stand on the research fields of this subject, to aim at the frontline and to grasp the important requirement of production. It encourages subject intercrossing with aquatic science as the main body. For other common problems, applicants should follow correctly the requirement put forwarded by the Department of Life Sciences in the *Guide to Programs*. The areas encouraged in this subject this year cover the genetic rules and functional genome study of important economic traits of breeding varieties, pathogenesis of important pathogen and spread route and the immune mechanisms of host, molecular basis and regulating mechanisms of reproduction and development of chief breeding organisms, the development of aquatic bio techniques and key techniques for further study, the

interaction of breeding with the ecological environment and resource conservation, nutrition physiology of aquatic organisms and multiplication and utilization of aquatic food organisms, etc. The Division encourages international cooperation, exploration and innovation, and basic and applied basic researches apt to the national situation.

## **Department of Earth Sciences**

Earth science is one of the fundamental sciences concerning the understanding of the Earth. Taking the earth system and its components as research subjects, earth science explores the phenomena, processes and thereafter the mechanism, evolution and causality of these processes and their interactions, to promote the understanding of the Earth and to help solve the major problems of resource supply, environmental protection and hazard mitigation for human habitation and sustainable development by providing the scientific basis and technical support. The spirit to explore the mystery of the Earth, the increasingly immense needs rooted from the utilization of resources for the social economic development and the improvement of life quality for environmental protection and natural hazard prevention have always been the driving force for the development of earth science. Disciplines included in earth science are geography, geology, geochemistry, geophysics and space physics, atmospheric science and oceanic science.

Academic disciplines are fundamental units of the human knowledge system. They play important roles in the creation, communication and spreading of knowledge. The development of sub-disciplines of earth science is the core and basic factor for the progress of earth science. General Program projects promote the balanced and harmonized development for all disciplines of earth science, inspire original innovation and broaden the frontier of research. Understanding the spirit of exploration, unpredictability and durability of basic research, the Department pays special attention to high risk, interdisciplinary and frontier research. Scientists are encouraged to face the most challenging scientific issues and to carry out adventurous research work.

In 2009, the Department received 3,963 proposals for General Program projects from 527 institutions. Among them, 954 were funded, with a success rate of 24.1% and a total budget of 420 million yuan. For General Program projects, 558 (58.5%) are from universities and 373 (39.1%) from research institutes. The PIs of 643 projects (67.4%) are younger than 45. There are 90 interdepartmental and interdisciplinary projects, and the proportion of interdisciplinary projects supported by different divisions of the Department is even higher. Small Fund for Exploratory Studies with a term of 1 year is set up for highly exploratory, innovative and highly risky projects or projects with uncertainty. Altogether, 17 proposals were approved as the Small Fund projects in 2009 and 3.06 million yuan were allocated.

The criteria for the selection of General Program projects in 2010 are as follows:

- (1) Innovation and academic value of the overall research approach;
- (2) Research ability of the applicants;
- (3) Rationality, thoroughness and feasibility;
- (4) Availability of necessary research basis and conditions.

While encouraging the exploration of new scientific issues, attention should also be given to the weaker disciplines. Because cutting edge science and interdisciplinary projects have become the fertile soil for innovative ideas and indigenous innovation, special care should be provided to those applications on interdisciplinary studies during the selection of projects. Under the same condition, preferential support will be given to those applicants who have a good accumulation of previous studies and accomplishments of high-quality obtained in their recently completed projects and who apply to continue their studies. Applicants are required to address the relation between the proposed research work and their accomplished projects. The trend of globalization of basic research is becoming more and more apparent. By acquiring and sharing research results and experience of international scientific community and using the research means, apparatus and information of developed countries, it would be most likely for our research to reach the international advanced level at the earliest possible time. Support to the interdisciplinary proposals in the field of human health will continue to be strengthened, especially the proposals on “endemic diseases correlated with the Earth environment”. While stabilizing the success rate for proposals, the intensity of individual grants will be increased in 2010.

### Funding for General Program Projects in the Last Two Years

Unit: 10,000 yuan

Divisions		2008			2009		
		Projects	Funding	Funding rate <sup>++</sup> (%)	Projects	Funding	Funding rate <sup>++</sup> (%)
Division I	Geography (including soil science and remote sensing)	256+6*	11,271	20.39	301+5*	12,260	19.99
Division II	Geology	206+8*	9,805	30.79	230+2*	10,987	28.09
	Geochemistry	83+3*	3,764	27.39	87+3*	4,177	28.39
Division III	Geophysics and space physics	96+4*	4,582	30.96	111+2*	5,119	27.97
Division IV	Marine science	106+1*	4,665	24.32	115+1*	5,222	23.06
Division V	Atmospheric science	86+5*	3,914	25.56	93+4*	4,235	25.39
Total		833+27*	38,001	25.20	937+17*	42,000	24.07
Average funding per project		44.19 (45.07**)			44.03 (44.50**)		

Notes: \*The number of projects of Small Fund for Exploratory Studies for 1 year.

\*\*Average amount for individual projects with a term of 3 years (not including Small Fund for Exploratory Studies projects).

<sup>++</sup>Success rates include the projects of Small Funds for Exploratory Studies.

## **Division I of Earth Sciences**

The funding fields of the Division include physical geography, human geography, soil science, remote sensing and geographical information system, and environmental geography.

The funding goes to researches aiming at the understanding of the developing processes, the spatial/temporal heterogeneity, and the interaction of human and natural elements on the Earth's surface. The interaction and spatial heterogeneity of natural environmental elements, especially the evolution processes on different spatial/temporal scales, gain more attention in physical geography. Human geography explores the spatial structure and distribution of different human elements and the driving mechanism. As the linkage of natural and social sciences, human geography emphasizes on the natural background of the spatial structure of regional human elements, and its interaction with human sciences. Landscape geography focuses on the pattern and structure under natural and human synthetic actions of the Earth's surface, especially the synthesis function scaling. The evolution of human-earth relationship since Quaternary period, especially in historical period, is emphasized in the field of environmental change and prediction, while more attention would be paid to proxy indicators' comprehensive contrast and contemporary process of environmental change in high resolution and short time scale, to accumulate theories, methodologies and basic data for the prediction of future environmental changes. Soil science is an independent discipline aiming at the pedogenic processes and spatial distribution pattern of soils, the chemical/physical/biological mechanisms of soil function changes under human intensive use, and the rational utilization and scientific management of soil resources. More emphasis is given to the inter-cycling of soil matter and its interaction with soil organism, as well as the dynamics of soil environment and soil quality. Geographical information science is defined as the science of obtaining, treating, managing, interpreting, analyzing and expressing the geographical spatial/temporal information on the Earth's surface, supported by modern technologies such as RS, GIS and GPS. As a special and independent branch of geography, environmental geography pays more attention to the ecological and environmental effects of important construction projects, emission of greenhouse gases, and the formation, transformation and heterogeneity of pollutants. Natural disasters and risk research, as a new field, should pay more attention to the risk assessment of natural disasters, and the environmental impacts of public security. Besides, renewable resources evolution, natural resources assessment, regional sustainable development and other relative areas would also be supported.

Terrestrial surface is the place where the interaction among the hydrosphere, biosphere, atmosphere, pedosphere and lithosphere happens most frequently and concentrated. The application of the theory of earth system science in research is thus the key for



interpreting the complex system of terrestrial surface. The expansion of geographical researches to both microcosmic and macrocosmic scales leads to the innovation of methodology and technology. It is a trend in geography to use the methodology and technology of data collection and data analysis from other related fields for reference, which promotes the development of geographical research.

In 2009, the Division received 1,531 applications for General Program projects, among which 306 projects were supported with a total funding of 122.60 million yuan. Compared with those in 2008, 44 more projects were supported and the success rate decreased from 20.39% to 19.99%.

## **Division II of Earth Sciences**

The funding areas of the Division include geology, geochemistry and environmental geology.

### **Geology (including environmental geology)**

Geology (including environmental geology) is the knowledge system about the composition, structure and evolution of the solid earth. The task of modern geology is not only to elucidate the materials that construct the Earth, the mechanism controlling the transition of matters and the history of the environment and life evolution recorded by these matters, but also to reveal the agents and processes which modify the surface of the Earth. Our knowledge of geology can also be useful for the human society to explore and utilize energy, water and mineral resources and to understand the relationship between geological processes and human community.

The introduction of plate tectonic theory has brought about revolutionary changes to our understanding of the Earth. The complexity of the continental dynamics is further raising new themes for the advancement of plate tectonic theory. The development of mantle plume theory in recent years has closely linked the deep activities and surface phenomena of the solid earth.

The enhancement of abilities to obtain and analyze data has become a major driving force to promote the development of geological science. The improvement of analytical precision for terrestrial materials has enhanced our ability to determine the composition and evolution for the Earth's specimen. The utilization of seismological technology, remote sensing technology and satellite observation of the Earth has deepened our understanding of the structure of the Earth. GIS and GPS technologies have improved the quality of geological mapping and are realizing the real time monitoring of plate motion, earthquake and volcanic activities. Computer simulation has made possible for the analysis, simulation and predication of important geological processes. Crust drilling

techniques and high-temperature-pressure experimental technologies have also greatly promoted the development of geology.

Profound changes have taken place in the research subjects, models and methods of geological science owing to the emerging new framework of earth system science and the strong demand to serve social and economical sustainable development. The concept and rationale of multisphere interactions and interface processes have been strengthened. The role of geology has evolved from its traditional function of disclosing the records of the Earth's history to the prediction of the Earth's future environment, due to the improving capability to obtain critical data. The theory on the formation and exploration of the mineral resources and fossil energy, the environmental changes under the intervention of human activities, as well as the mitigation of geological hazards have been major challenges to geologists. New interdisciplinary fields, such as geobiology, are emerging due to the close correlations between geological science and life science established by the discovery of the critical role of life activities in the geological processes.

The geological program encourages characterized proposals based on the abundant materials and data recently acquired and accumulated by the geology-related agencies and institutions. Field and site observations are emphasized. Multidisciplinary approaches, such as the application of the concept, theory, technology and methodology of mathematics, physics, chemistry as well as biosciences, are encouraged to attack geological issues. International collaboration, which may combine the privileged local geological features with global scientific views, is encouraged to promote the progress of geological theories. Young scientists, especially newly graduated researchers are encouraged to submit proposals to benefit their research career.

In 2009, 824 proposals for General Program projects were received and 232 were funded, with a success rate of 28% and an average amount of 474 000 yuan per grant. The distribution pattern of the funded projects among main research fields is as follows: projects in paleontology, stratigraphy and sedimentology account for 17% of the total funds, projects in mineralogy, petrology, volcanology, economic geology and geomathematics for 23%, projects in petroleum geology and coal geology for 10%, projects in structural geology, Precambrian geology and regional geology for 13%, projects in Quaternary geology and environmental geology for 16%, and projects in hydrogeology and geo-engineering for about 21%.

The predominant defects in the proposals in 2009 are as follows: The proposed title is too broad to be supported by a General Program project, the raised arguments fail to focus on the scientific frontier or be poorly addressed, research contents fail to state the scientific significance clearly, thus failed to demonstrate the necessity for the research work to be granted, and key issues to be attacked are vague due to defectively designed scientific

and technological approaches. In some proposals, the description of research methods and technological outlines is very general and there is a lack of essential feasibility on key approaches.

## **Geochemistry**

Geochemistry is a subject to study the chemical composition, chemical interaction and chemical evolution of the Earth and the astronomical objects. Its principal theories and methods of the elemental, molecular, and isotopic tracing and dating systems are applied to specifically study the regularities of partition and distribution, centralization and decentralization, migration and transformation of chemical elements and substances in both various spheres of the Earth in its history and epigeosphere system of the Earth influenced by human activities. The current researches concerning geochemistry consist mainly of the following.

- (1) Its main research objects have been developed from the components and their chemical interaction of the interior of the Earth to the interaction among various spheres and various boundaries. Attention has been paid to not only the combination of the macro study on the deep process and the internal structures of the Earth and the recognition on its geochemical characteristics and special and temporal evolution by using high resolution and high sensitivity methods, but also the wedding of the researches of plate tectonics with those of chemical geodynamics.
- (2) The environmental and biogeochemical processes of the surficial system of the Earth have increasingly become important fields of geochemistry, due to their specificities in recognizing chemical evolution mechanisms of the earth system.
- (3) For the geochemical research methods and techniques, the static semi-quantitative description has been given way to the dynamic quantitative modeling, which highlights the 4D temporal and spatial evolution of the research objects.
- (4) Attention has been paid to not only the reconstruction of long timescale palaeogeological events, but also the short timescale geological events and the projection of future geological movements.
- (5) In researches on the interaction of environmental change and supergene movement, attention has been paid to the superimposition of natural process and artificial impacts, and to the combined researches on chemical and biological interactions.

The strategic principles for funding research projects in this subject are to promote the harmonized development of various geochemical branches, to encourage researches on the fundamental theories of geochemistry and establishment of models, to support researches on frontier areas including the origin and evolution of planets and the Earth, the change and variation of ecological environment, and the origin and evolution of lives, and to pay attention to the fundamental researches on mineral resources, energy resources and water resources which have important application potential, and geological hazards,

and to encourage interdisciplinary researches of environmental, ecological, biological and earth sciences on the basis of geochemistry.

In 2009, 28.4% of the proposals applying for project funding under the General Program in geochemistry (including projects of Small Funds for Exploratory Studies) were supported, with an average funding of 474,000 yuan for each research project (excluding projects of Small Fund for Exploratory Studies). In the past two years, projects supported under the General Program in geochemistry include about 50% projects for environmental geochemistry and biogeochemistry, about 30% for ore deposit geochemistry, organic geochemistry, petro-geochemistry and isotopic geochemistry, and about 15% for isotopic geochronology, trace element geochemistry, experimental geochemistry, computing geochemistry, cosmochemistry and comparative planetology. There is no obvious variation among the funding percentage of proposals for various sub-disciplines of geochemistry.

The common deficiencies shown in the past failed proposals include:

- (1) Applicants only emphasized the importance of the research area, but did not explain the innovation of research ideas and scientific values of the proposals;
- (2) Applicants set long-term targets which are clearly not achievable in the funding period and did not state short-term goals explicitly;
- (3) Applicants selected important research subjects, but failed to identify innovative scientific problems to be solved;
- (4) Detailed research plans were either not provided, or the plans were not in accordance with the proposed targets;
- (5) Applicants focused on the application of new techniques and methods, but did not clearly explain scientific questions they intended to solve;
- (6) Applicants tended to pursue the full span of research methods and experimental techniques, but failed to provide specific effective methods for solving relevant problems;
- (7) Applicants failed to demonstrate the feasibility of crucial techniques which are to be applied in the proposal study.

## **Division III of Earth Sciences**

The funding scope of the Division includes geophysics, space physics and geodesy.

### **Geophysics**

Direct observation and theoretical studies on the basic physical fields of the Earth, e.g. seismic, gravity, magnetic field, heat flow, etc., are not only essential for effectively understanding and further protecting the Earth, but also the foundation for scientific breakthroughs of geophysics. Moreover, theoretical studies on geosciences have

significantly facilitated the development of exploration geophysics, which makes great contributions to both the national security and the economical development. Fundamental researches and application-oriented researches in these fields will be encouraged.

### **Space Physics**

Rapid progresses in space physics have been made in recent years, specifically in multi-level energy transport 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. These progresses set up the foundation for rapid development of space weather. Proposals dealing with scientific problems in these fields are to be encouraged so that breakthroughs may be fostered.

### **Geodesy**

In recent years, aeronautics, astronautics and geodesy have witnessed rapid development due to significant improvement of the precision and spatial resolution of observation and relevant theories of data-processing, and thus have become one of the most important branches of geophysics. Researches based on such development, including the development of the observation system, model and theory of data-processing, are encouraged through the General Program.

In 2009, 404 proposals for General Program projects in geophysics and space physics were received and 113 were supported, with a success rate of 28% and an average funding of 453 000 yuan per project. In addition, 2 projects of Small Fund for Exploratory Studies were funded with an average funding of 180 thousands yuan per project. The funding is distributed in the following major research areas: geodesy (20%), solid-earth geophysics (35%), exploration geophysics (15%), space physics (29%) and experiment and facilities (1%). The funding of General Program projects has been steadily growing in recent years.

The major problems in the proposals in 2009 include partial deviation from the international hot research topics, insufficient summary of the research background, unfocused research objectives, lack of discussions on the feasibility of the research plan and key methods, and irrelevant or wrong reference citations.

In recent years, the Division financed more innovative projects, which results in fruitful achievements. In the near future, encouraging innovative ideas and cultivating team leaders will still remain the major task for the Division. Besides continuous support to fundamental research, more efforts will also be given to new growth and pioneering studies, specifically the breakthroughs of well-defined difficult issues. Support will be inclined to the 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, and the theory of seismic wave propagation. 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.

Fundamentally, 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. Because geophysics covers a wide range of scientific interests, researchers from all branches of natural/social sciences are welcome to make applications.

## **Division IV of Earth Sciences**

The main funding areas of the Division cover marine science and polar science.

### **Marine Science**

Marine science is a discipline concerning all kinds of natural phenomena and processes of the oceans as well as their changing rules. The research objects include not only the colossal sea water but also estuarine and coastal zones, the interface between the ocean and the atmosphere, the interface between sea water and sediments, and the lithosphere of the seafloor. As the foundation for marine science development, mathematics, mechanics, physics, chemistry and biology have been interpenetrating and intercrossing with marine science. New and high technologies, such as space technology, information technology, biotechnology and deep-diving technology, have been continuously applied to marine science. New disciplinary frontiers formed in this way, which have been and will also be a major driving force for the future development of the marine science, have also been funding areas of the Division.

Marine environment is an integral system in which various affecting factors exist simultaneously and interact with each other, therefore, interdisciplinary and synthetic researches are currently becoming the trends of marine science development. While strengthening the research within regional scopes, marine science has been also synchronously expanding toward global and international perspectives. A series of influential international research plans on marine science have been formulated, which are precipitated by globally pressing issues such as climate change, resources, environment, etc. Therefore, extensive international cooperation is coming forth, impelling the fast and in-depth development of marine science. In addition, the continuous advances in marine exploration technology, Lab analysis technology and marine information process technology have greatly enhanced the ability to acquire data

and information through both *in-situ* and remote-sensing observations. This has become a key impetus for the development of marine science today.

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. Therefore, the Division encourages scientists to participate in the open voyage to conduct surveys and observations in the coastal seas and the northern South Sea, meanwhile to share cruise time with other voyages, to obtain more continuous, systematic and comprehensive data. It encourages scientists to conduct *in-situ* observation and laboratory analysis using new technologies and methods with focus on the scientific themes to be investigated, and provide technical support for exploiting new research fields and gaining new achievements. In order to promote a balanced development of China's marine science, it also encourages scientists to take advantages of existing cruise plans of other agencies to do research on deep ocean.

In 2009, 503 proposals for General Program projects on marine science were received, and 116 were supported, with a success rate of 23% and the average funding of 450 000 yuan per project. Similar to the past few years, most proposals are from sub-disciplines of physical oceanography, biological oceanography, environmental oceanography, and marine geology, which together account for approximately two-third of the total submitted and funded proposals. The number of funded proposals has little change in the fields of marine chemistry, estuarine and coastal research, ocean engineering, marine monitoring and investigation, and marine remote sensing. However, the number of proposals in marine physics (including acoustics, optics and electromagnetics) is relatively small and hence receives the least share of funding. Indeed, it is also an important funding direction in marine science.

Compared with previous years, the average quality of proposals submitted in 2009 saw an improvement, especially remarkable in the project topic selection and design. The main deficiencies of the submitted proposals are reflected in vague description of what specific questions to be investigated and how to solve the questions, in other words, the proposals are lack of clear-cut scientific questions, while the importance and relevance to the national demand are relatively well described. Some proposals repeated old problems and old methods with a lack of creativity.

To meet the demands of research projects in ocean observation, NSFC starts the pilot projects of open ship-time sharing for the first time in 2009. An additional form of ship time application should be attached to the proposals of 2010 if needed. The ship time application is required to describe the contents, plans and expected data outputs of the proposed observations in detail. Applicants are suggested to pay close attention to the bulletin and announcements for cruise time in 2010.

## **Polar Science**

Polar science is a discipline studying various natural phenomena, including the processes and changing rules peculiarly in the polar regions 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.

Over the past few years, great progress has been achieved in international polar research. However, it is still the weakest sub-field in earth science. New trends of polar research are featured by aiming at the current key scientific issues on global change and sustainable development, breaking boundaries of traditional disciplines to conduct synthetic study of 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 develop research by focusing on key scientific issues such as global change and sustainable development in connection with existing research. The success rate of application is 25.5% in 2009.

## **Division V of Earth Sciences**

Research areas supported by the Division include meteorology, atmospheric physics, atmospheric environment and atmospheric chemistry.

Atmospheric science studies various phenomena and their changing regulations occurring in the atmosphere so as to serve the mankind.

In recent years, with the introduction of 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, while the response of the atmosphere to the changes will result in simultaneously important and direct impact on the ocean, terrestrial surface, ice and snow and the ecosystem on the Earth. The atmosphere plays an important role in the interaction among different spheres of the earth system, and the interaction of the atmosphere with other spheres regulates the whole behavior of the earth system. Therefore, the present atmospheric science focuses on the study of dynamical-physical-chemical process within the atmosphere, and at the same time pays more attention to research to find out the essence of the atmospheric change with the comprehensive studies on the interaction between hydrosphere, lithosphere, cryosphere, biosphere, human activities and global climate, the regulation of



climate system and theories and methods of climate change prediction, regulating techniques and measures against local weather, 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, as well as on the interaction of different spheres, the comprehensive, integrated and systematic studies of various processes, the model development, the combination of different methods such as observation, analysis, theory, simulation and prediction, the issues of global climate and environment change and its impacts, prediction and adaptation, the optimization of human life-supporting environment and human orderly activities, and the interdisciplinary research providing a scientific basis for the human impact and sustainable development of social development.

In 2009, the Division received 382 proposals for General Program projects and 97 got funded (including 4 for Small Fund for Exploratory Studies in one-year execution). The approval rate is 25.39% and the average funding intensity is 437,000 yuan per project (180,000 yuan per project for Small Fund for Exploratory Studies and 443,000 yuan per project for others).

In 2010, the Division will continually encourage, through its General Program, ( i ) proposals for exploratory and original basic studies, ( ii ) studies of various phenomena, processes and mechanism occurring in the Earth's and planetary atmosphere, the substance interaction as well as the physical, chemical and biological processes of energy exchange between the atmosphere and other spheres by applying new ideas, methods, achievements, advanced devices and technologies of mathematics, physics, chemistry, biology and information science, ( iii ) applications related to disastrous weather, atmospheric physics, atmospheric chemistry, atmospheric environment, atmospheric detection and remote sensing and stratosphere, and mesosphere research areas, ( iv ) applications related to data analysis and research on China's related large scientific experiments and science plans being initiated, conducted or already completed, as well as large observation network established, ( v ) applications related to the study using satellite remote sensing and other data, and ( vi ) research of climatic change and its relevant extreme synoptic and climatic events, and research on new theories and methods of weather forecast and climate prediction.

## **Department of Engineering and Materials Sciences**

Both engineering and materials sciences necessarily and significantly underlie the importance of national security, the improvement of people's living standard and the sustainable development of the society and economy. Aiming at frontier science and

## General Program

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meeting the national strategic demands of the social and economic development as well, research in the fields of engineering and materials sciences should pay full attention to scientific creativity and innovation, especially original creativity and innovation with independent intellectual property rights, in order to raise China's international competitiveness in science and technology and to achieve a sustainable development of the society.

The Department will continue to strengthen its support to interdisciplinary areas and the exploration of frontiers and encourage original innovation, integrated innovation and re-innovation based on the absorption and digestion of existing knowledge, while considering the common features in the fundamental research of engineering and materials sciences. At the same time, the Department will pay attention to key scientific issues resulting from engineering application, especially those researches with such great significance that the industrial development can be promoted and international competitiveness be raised.

### Funding for General Program Projects in 2009

Unit: 10,000 yuan

Divisions		Projects	Funding	Funding rate (%)
Division I of Materials Sciences	Metallic materials	136	4,878	15.70
Division II of Materials Sciences	Inorganic materials	171	6,136	15.70
	Polymer materials	129	4,635	15.34
Division I of Engineering Sciences	Metallurgy and mining science	142	5,119	14.81
Division II of Engineering Sciences	Mechanical engineering	304	10,938	15.06
Division III of Engineering Sciences	Engineering thermo-physics	130	4,686	15.59
Division IV of Engineering Sciences	Civil engineering and environment	263	9,374	14.23
Division V of Engineering Sciences	Hydraulic science	118	4,234	14.32
	Electrical engineering	95	3,437	14.46
Total		1,488	53,437	14.98
Average funding per project		35.91		

In 2009, the Department received 9,936 proposals for General Program projects, which is an increase of 18.81% compared with that in 2008, and among them, 1, 488 were supported, with a total funding of 534.37 million yuan. The average funding is 359,100 yuan per project and the success rate is 14.98%.

Attention should be paid to the following issues:

(1) Proposals that meet the urgent needs of national economic construction and sustainable development of the society will be encouraged. The Department will support preferentially basic research with significant 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 property rights.

(2) Interdisciplinary research will be encouraged at different levels, especially cross-cutting research in life science, information technology, energy engineering and environmental science. Applicants should put forward new conceptions and ideas as creative as possible with specific scientific issues.

(3) The Department will continue to maintain the higher success rate in Young Scientists Fund to encourage young researchers to put forward independent understanding in their areas, and preferentially support applications by young scientists with new ideas and good background of international cooperation.

(4) If applicants are not very familiar with the application codes, please contact relevant divisions in order to avoid the wrong submission of applications.

## **Division I of Materials Sciences**

The Division mainly supports basic researches on metals, alloys and metal matrix composites. In their proposals, applicants should give specific description and convincing analysis in the merits of essential scientific problems and pertinent creative ideas to which a sound reasoning should be presented, targeting either at the international cutting-edge areas or at promoting the development in relevant areas that meet the national demands.

The funding spectrum of the Division covers broad areas, including the compositions, microstructures, phases, surfaces and interfaces, scales effect, impurities and defects in metals, alloys, metal matrix composites, intermetallic compounds and metal-like materials and their influence on the mechanical, physical and chemical properties and performance, basic issues in the processing of metallic materials, strengthening and toughening, deformation and fracture, phase transformation and alloy design, fundamentals in energy materials, environment-friendly materials, biomaterials and recyclable metallic materials, the interaction mechanisms of metallic materials and environment, damage, functional degradation and consequent failure mechanism and relevant fundamentals, theoretical fundamentals on metallic materials, and the development of theoretical methods, calculating methods, modern analysis and test methods incorporating basic and applied basic researches of metallic materials.

The Division will continue to support basic research with creative ideas in all aspects in the funding spectrum specified above. New ideas revealing basic mechanism will be encouraged with respect to the Key Program areas supported in recent years. The Division also encourages and supports cross-disciplinary and multi-disciplinary research in which metallic objectives and materials science should be the mainstream, especially

in such areas as energy, information and biology. The Division will continue to prioritize those well-established research groups and institutions with good infrastructures in the field of metallic materials science and engineering. It will also continue to encourage and support young researchers to put forward creative thoughts and ideas, and to encourage and support researchers to carry out deeper research based on their previous good work.

In 2009, the Division received 1,410 proposals in total, which is an increase of around 20%. Through peer review and panel evaluation, 136 General Program projects were granted, with a success rate of 15.70% on average and a funding of 360 000 Yuan per project. It is noticed that proposals kept the leading place in such areas as metastable metals and alloys, functional materials, surface engineering and corrosion. It is hoped that researchers pay attention not only to the frontiers and hot areas, but also to other fundamental issues with scientific merits and creative ideas, especially those common key issues beyond material systems. In addition, some attention should be paid to the new understanding of classic issues in basic materials. Applications in the field of composites and surface engineering should be improved in focusing scientific problems and proposing unique ideas. Applications in cross-disciplinary research should focus on issues within the funding spectrum of the Division.

## **Division II of Materials Sciences**

The Division mainly supports fundamental researches on inorganic non-metallic and organic polymer materials.

### **Inorganic Non-metallic Materials**

The Division supports fundamental and applied researches which focus on inorganic non-metallic materials. With the development of material design theories, fabrication and characterization technologies, many novel materials have been discovered, including ceramic superconductors, smart ceramic materials, new energy materials, bio-medical materials, nano-materials and so on, which have greatly stimulated researches on inorganic non-metallic materials. At present, in the field of inorganic non-metallic materials, functional materials with high efficiency, reliability and sensitivity, smartness and functional integration are being developed, and also high on the agenda are structure ceramics with multi-functionality, high toughness, specific strength, wear-resistance, corrosion-resistance, high-temperature endurance, low cost and high reliability. Meanwhile, conventional materials are also being remolded and upgraded. Furthermore, inorganic non-metallic materials are playing ever increasingly significant roles in information technologies, life science, energy and environmental science, and interdisciplinary research with other related areas. A review of all the related proposals submitted in the past three years indicates that, in addition to an annual increase in the number of proposals, researches have been broader in range and more interdisciplinary in

nature.

In 2009, there were 1,088 applications for General Program projects, an increase of 13.57 % compared with those submitted in 2008, and 171 projects were supported, reaching a funding rate of 15.7 %. Among the applications, researches on functional materials accounted for 63.53 % of the total. These applications unfolded many innovative ideas and induced the hot-spots of research on various areas including nano-materials, piezoelectric and ferroelectric materials, carbon and super-hard materials, photoelectric information functional materials, composite materials, photoelectric conversion and photo-catalysis materials and so on, among which applications from photoelectric information functional materials (about 21.08 % of the total) ranked above all the others in recent years. There were also many applications from new energy materials, display materials, bio-medical materials and inorganic non-metallic based composite materials. Although the number of proposals on functional composite materials is increased, the novelty of the proposals needs to be improved and further refinement about the scientific problems in inorganic non-metallic materials is needed.

The Division will support basic research with creative ideas, research on inorganic non-metallic materials and substantial interdisciplinary research with other related areas. It encourages synthetic science and related fundamental application research on novel inorganic non-metallic materials in accordance with domestic resources; research on low-dimensional and nano-materials including new fabrication techniques, property characterization, novel effects and applications related basic physical and chemical problems; research on the surface, interface and compatibility of inorganic materials; basic research on “structural-functional” integration materials; research on material synthetic science and techniques about high-performance, low-cost and high reliability materials; research on the composition, structure, performance and characterization features of smart materials, new energy materials, bio-medical materials and eco-environmental materials; basic theoretical research on design (at macro-, meso- and micro-scales, respectively) and corresponding fabrication science of inorganic non-metallic materials; and basic applied research on the improvement and remolding of conventional inorganic non-metallic materials based on new theories, with new techniques and through new processing science.

### **Organic Polymer Materials**

In the field of organic polymer materials, the Division received 841 proposals in 2009 for General Program, 123 more than that in the previous year and an increase of 17.1%. Among them, the number of proposals for opto-electronic functional materials, functional inorganic/organic composites, polymer-based nano-composites, biomedical materials and eco-environmental polymer materials reached 83, 87, 50, 108 and 68, respectively, representing 9.9%, 10.4%, 5.9%, 12.9% and 8.1% of the total.

At present, the main tasks and developing directions for organic polymer materials science are as follows:

- (1) For general polymer materials, the focus is on the implementation of high performance and functional properties, the relationship between machine forming and congregation state textures, and the variation of materials textures and materials properties in their utilization;
- (2) Functional polymer materials and organic solid functional materials;
- (3) For polymer-based composites, the stress is on high performance, interface, new synthesis technology, computer aided technologies and low cost technology;
- (4) Special polymer materials and engineering plastics;
- (5) Polymer materials related to environment, energy resource and resource utilization.

Basic and applied basic researches in the following fields are encouraged: general polymer materials with high performance or functional properties, functional polymer materials and organic solid functional materials, preparation science and technical processes for polymer materials (e.g. new technique and new technology for material preparation and processing, new theories of reinforcement and toughening, fatigue and fracture, friction and lubrication, structures and performance of multi-component materials in congregation state, composite materials-based matrix resin and its interface properties, and computer aided design and forming), adhesives, coatings and assistants of new organic polymers, biomedical polymer materials, organic nano-materials, intelligent materials and bionic polymer materials, eco-environmental polymer materials including natural polymer materials, environmental friendly polymer materials and renewable polymer materials.

The Division highly encourages fountainhead innovation, and promotes interdisciplinary cooperation.

### **Division I of Engineering Sciences**

The Division mainly supports fundamental researches in mining and metallurgy sciences, including such main fields as resource exploitation, safety science and engineering, mineral processing and separating, metallurgical and material physical-chemistry, ferrous and nonferrous metallurgy, material preparation and fabrication, eco-environment of mining and metallurgy, resource recycling, etc.

The research trends at present are as follows: Basic research scope in the above-mentioned fields has been increasingly extended and deepened. Many researches transfer from macro, middle scope to microscope, and each inosculates and intercrosses with another, from raw minerals to the recycling of resources, from metal to composite materials, even functional materials. Interdisciplinary differentiation and amalgamation

have been strengthened. With the interdisciplinary amalgamation and differentiation with life science, informatics, mechanical science, chemistry, materials science, managerial science, etc., new research fields such as resource recycling science, non-pollution process engineering, green catalyzing engineering, bio-metallurgy, environmental bio-chemical engineering, bio-chemical mining, computing metallurgy and physical-chemical metallurgy, metallurgical informatics and electro-magnetic metallurgy have appeared. Relationship between science and technology is getting increasingly closer. Equipment for mining and metallurgy, monitoring and controlling of system, metallurgical reaction engineering science and systems engineering, and metallurgical ecological technology, etc., are integrated with each other, and many new technologies, new methods and new branches of science have emerged. Researches have been carried out much more quantitatively and accurately, e.g. precisely analyzing the composition of molten salts and slag, and precise control of rolling process. Many important research areas are expected to be studied deeply and systematically.

In 2009, 959 proposals for General Program projects were received, 22.8% more than that in the previous year. 142 were supported and the funding intensity was 360,500 yuan on average. The projects with the funding intensity of more than 400,000 yuan are nearly 15% of the total. 60% of the submitted proposals dealt with the following research fields: materials preparation and fabrication, resource exploitation, safety science and engineering, mineral engineering, resource extraction and matter separations, powder engineering and powder metallurgy. The fields with relatively less proposals were subterranean heat resource and exploitation, ocean and space metallurgy, other ways of resource utilization, underground and space engineering, metallurgical chemical engineering and equipment and metallurgical reaction engineering. Proposals on metallurgical and material physical-chemistry and mechanic metallurgy were limited. There were a few proposals dealing with special metallurgical methods and other new techniques, e.g., microwave, plasma, electromagnetism, laser and ultrasonic. With the adjustment of the application codes, proposals in the fields of resources recycling decreased by half and proposals on special material preparation related with mechanical metallurgy such as fiber, foam, etc., were few. Now the hotspots are resource exploitation, material preparation and fabrication, safety science, etc.

The Division emphasizes process and engineering and will continuously promote interdisciplinary studies and the exploration of novel methods, encourage original ideas and creations, and strengthen applied basic research, especially those that would enhance our competitiveness in mining and metallurgy industry. The Division will favor fundamental researches with theoretical importance, potential application and prior prospect, which might be the new fields for knowledge production, and young scientists who have creative capabilities, good performance and good cooperation with others are encouraged. Researchers are suggested to work systematically and consistently in a

specific research field to form their own features. On the basis of research contents, more funding will be granted to projects of high cost and hard working environment (about 500-550 thousand yuan per project), such as mining, pyrometallurgy, electrochemical-metallurgy and plastic forming of metals.

## **Division II of Engineering Sciences**

The Division supports fundamental research and fundamental applied research in the areas of mechanical science and manufacturing science.

Mechanical science is a fundamental technology science aiming at functional comprehension, quantitative description and performance control of various mechanical products. Its main task is to study the characteristics of mechanical systems and to develop knowledge and information required by mechanical systems into new design theories and methods.

Mechanical science includes the mechanisms and principles of machinery composition, dynamics of mechanical systems, strength theory of mechanical structures, mechanical tribology and surface technology, mechanical bionics, mechanical design theory and methodology, mechanical transmission and robotics mechanics, and so on.

Manufacturing science is mainly to study various manufacturing theories, methods, technologies, processes, equipment and systems related to manufacturing products which meet the design requirement and improve customers' value. It includes components forming, machining, manufacturing systems and automation, mechanical metrology and measurement instruments, MEMS/NEMS, and so on.

At present, the main development trends for mechanical science and manufacturing science are as follows:

- (1) Fundamental research aiming at national strategic requirement and the frontiers of disciplinary development, as well as the potential industrial application;
- (2) Investigation on the integration of design and manufacturing for environment-friendly and resources economization;
- (3) Research on the innovative design, manufacturing principles and measurement theories for the super, high-precision, high-tech and special (large/heavy) equipment and instruments, including the processing mechanisms, theories and technologies on the prototypes;
- (4) Research on the manufacturing methods and design of extreme conditions, such as the size from meso, micro to nano scale, and the parameters from conventional to unnormal or extreme conditions;
- (5) Multi-interdisciplinary research among mechanics, electronics, hydraulics, magnetism and information, and the multi-physics coupling analysis and design methods.



Proposals for General Program submitted to the Division in 2009 reached 2,018, and 304 were funded with a total funding of 109.38 million yuan. The average funding rate is 359,800 yuan per project, and the success rate is 15.06%. In the 12 secondary disciplines of mechanical science, the research fields in which over 250 proposals for General Program were received in 2009 are mechanical dynamics (451), components forming (410), mechanical design (365), components machining (323) and manufacturing system and automation (260) respectively, meanwhile those with the number below 150 are mechanical bionics (96) and strength theory of mechanical structure (136). As to the growth rate of proposals, mechanical bionics increased by nearly 60% compared with that in 2008, strength theory of mechanical structure 49.45%, and mechanical transmission 43.48%, which indicates that there are still a lot of researchers adhering to research in these traditional and important areas.

The Division will continue to support creative fundamental research, encourage and fund substantial interdisciplinary research, especially fundamental mechanical research involving in electronics, information, biology and materials and fundamental researches which may achieve innovative results and further promote related work.

### **Division III of Engineering Sciences**

The Division supports fundamental research and part of applied research in the field 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, renewable energy utilization and other fundamental and innovative researches related to engineering thermo-physics and energy utilization.

Proposals in recent years demonstrate that research in the fields of engineering thermo-physics and energy utilization is very active. The research contents have gone deeper, research objectives more extensive and research achievements for wider applications. In 2009, the Division received 834 proposals for General Program, 101 more than that in the previous year, with a remarkable increase in the areas of combustion related pollutant generation and pollution control, heat and mass transfer in micro- and nano-scale structures, radiation and phase-change heat transfer, and renewable energy utilization. Totally, 130 were supported with a funding rate of 15.59%.

The main development trends of the discipline are as follows. ( i ) Research on the basic issues has gone 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 has crossed traditional disciplinary borders and formed interdisciplinary projects with related disciplines (e.g. with 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 renewable energy transformation and utilization.

The Division requests that applicants provide detailed information on their research achievements obtained in all previous NSFC projects and the list of papers published on international and domestic journals in recent years. All the information provided must be impersonal and true, or it will directly affect the evaluation and approval of the applications.

It is noted that applications in the fields of energy saving and storage, renewable energy and alternative energy should be in connection with basic thermo-physical principles.

### **Division IV of Engineering Sciences**

The Division's funding scope mainly covers architecture, environmental engineering and civil engineering. The development trends of architecture are research on the development of region, city and building, the innovation of construction techniques from the viewpoint of human-environment relationship, and research on basic theory, methods of planning and design, and construction technology innovation, based on sustainable development strategy. The emphasis of environmental engineering research is on 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 problems 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 architecture, focus should be given to new scientific problems 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 emphasizes key scientific issues related to new theories and technical bases of new high-efficiency and low-consumption technologies, which includes water purification, wastewater treatment and utilization, municipal water supply and drainage system, urban refuse disposal and utilization, air pollution cleaning and control and renovation of the polluted water environment. Other research subjects related to environmental science should be submitted to other relevant divisions. In civil engineering, more attention should be paid to innovative research on the analysis, design and reliability of complex structures. Key scientific problems on the following topics are encouraged: intelligent structural systems and performance design theories in civil engineering, disaster effect, failure mechanism and performance control of civil infrastructure and structures, new structure systems and constructing technology, modern structure experiment, on-spot measurement and digital simulation technology, and health diagnosis and renovation of structures. Research on structural disaster-resistance on the level of overall structural system should be strengthened, and efforts be made to improve the innovativeness and practicality in the study of seismic-resistant, fire-resistant and wind-resistant engineering structures. 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. In traffic engineering, the emphasis is on the research of planning theory and key construction technology in traffic infrastructure.

## **Division V of Engineering Sciences**

The Division is mainly responsible for funding projects in the disciplines of hydro-science and water research, hydraulic engineering and ocean engineering, and electrical science and engineering.

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

It supports researches in three areas: hydro-science and hydraulic engineering, geotechnical engineering and structure engineering, and coastal engineering and ocean engineering, which include hydrology and water resource engineering, water/soil science and irrigation engineering, water environmental engineering and water eco-system research, dynamics of river and coast and sediment research, soil/rock mechanics and geotechnical engineering, hydraulics and hydro-informatics, hydraulic structural engineering, coastal and offshore engineering, naval architectures and ocean engineering. Among them, coastal engineering and ocean engineering are the main funding fields according to NSFC application codes revised in 2008, water environmental engineering mainly regards unblocked water or soil system, and geotechnical engineering emphasizes researches on common characteristics in this field.

Cross-disciplinary and integrative innovation is greatly encouraged since water has close and broad linkage with population and society, resources and environment, energy and economy, such as hydro-informatics. The impacts of climate change and human activities on water cycle, extremely events of flood and drought and the related countermeasure or disaster mitigation are the main themes of hydrology and water resource engineering. Physical, chemical and ecological processes along with water cycle and impacts of engineering projects are most popular issues of water environmental engineering and water eco-system research. Fundamental theory of sediment transportation is highly emphasized in the research on the dynamics of river and coast. Researches on constitutive relationship, engineering behavior, damage process and related countermeasure are the main tasks of geotechnical engineering. More attention will be paid to performance design and environment friendly design in hydraulic structure engineering. Research on ground transient flowing and machinery transient flowing are encouraged in hydraulics.

Coastal engineering (including estuary and offshore) emphasizes foundational research on the integrated technology of coastal development and the protection and mitigation technology of coastal disaster due to Typhoon and serious storm. Recent hotspots in this field include the effect of marine hazard to coastal structures, landslide debris flow and hazard prevention due to coastal storms, coastal hydrodynamics and sediment transportation, estuary and harbor and waterway engineering, engineering relates coastal resource and energy, coastal environment and ecology, and so on. More attention in the field of naval architecture and ocean engineering is paid to new vessel type research, deep water technology and equipment of ocean development. Mathematic simulation, digital experimental pool and *in site* measuring become important methods recently. Hotspots in this field include extreme ocean events and its loading to ocean facilities, nonlinear dynamics of vessel and ocean structures, digital design method, intelligence of marine engine system, underwater acoustics, deep water survey and development.

According to proposals received during the last three years, proposed themes of the discipline of “hydro-science and water research, hydraulic engineering and ocean engineering” are extended gradually and tend to be more interdisciplinary. The number of proposals increases year by year in this discipline. In the year 2009, 824 proposals were received for General Program, with an increase of 23% compared with that in the previous year. Among them, 251 proposals are on ocean engineering, which is an increase of 128%, 248 proposals on soil/rock mechanics and geotechnical engineering, and 180 proposals on water environmental engineering and eco-water system research. Proposals on hydraulics and hydro-informatics, hydraulic machinery and coastal engineering kept a low increase compared with that in 2008. Finally, 118 projects were granted for General Program with an average funding of 360 thousand yuan and a success rate of 14.3%.

## **Electrical Engineering**

Electrical engineering includes two parts: electric (magnetic) energy science and the interaction between electromagnetic field and matters. The first one deals with electrical energy conversion (mutual conversion between electric power and other kinds of energy) and its control, electric machine and its control, power system and its automation, power electronics, superconducting technology, pulse power technology, and so on. The second one mainly includes high voltage and electrical insulation technology, engineering dielectrics, discharge and plasma technology, bio-electromagnetic technology, environmental electro-technology, and electromagnetic compatibility. Furthermore, the two parts share some common basic research contents, such as electric network theory, electromagnetic field theory, electromagnetic measurement technology and so on.

In 2009, 657 proposals were submitted for General Program in the field of electrical engineering, and 95 projects were funded after peer review and panel evaluation. Among the funded proposals, those in electromagnetic field and circuit theory accounted for 8.2% of the total, electric machine and its systems 15.7%, power systems 29%, electric engineering materials, apparatus, high voltage and insulation technologies 16.9%, power electronics 18.6%, pulsed power and discharged plasma technologies 9.3% and others 2.3%.

With the requirement of national energy security and sustainable development, the original research innovation is encouraged. Priorities will be given to the following proposals: those on research principles, methodology and approaches in the field of electrical engineering and those attaching importance to the experimental verification and the scientific aspect and quantification of experimental research.

Electric energy science focuses on new theories, technologies and apparatus of high efficiency, flexibility, safety and reliability and of environmental friendly for electrical energy conversion, transmission and utilization. These mainly include high efficient conversion and utilization of electric energy, power generation of new energy and renewable energy, safety and reliability of power systems and apparatus, power electronic converters and integration, electric vehicle and its control, and superconducting electrical technologies.

As to the domain of electromagnetic field and the interaction between electromagnetism and matter, focus is on new phenomena, exploration of new principles, establishment of new models and discovery of new applications. These include electrical insulation under complicated and special conditions, microstructure and performance of nanocomposite dielectrics, time and space compressive transmission of electromagnetic energy, measurement of electromagnetic characteristics, coupling between electromagnetic pulsed energy and its applied objects, discharge theory and high active plasma generation,

interaction between electromagnetic field and bio-matter, processing and utilization of biologic electromagnetic signals, and complicated transient electromagnetic fields.

## **Department of Information Sciences**

The Department of Information Sciences funds researches in 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: nano electronics and bioelectronics, radio wave transmission and new types of antenna, information acquisition and advanced information processing, future communication theory and system, space information processing and application, key issues in theoretical computer science, computer software, computer system configuration and storage system, key technologies in computer application, computer network and distributed computer system, network and information security, bionic sensing and advanced sensors, modeling, analysis and control of complex systems, basic theory and application of intelligent science, advanced robot technology and application, basic research on semiconductor integrated chip system, quantum information technology, key scientific issues in optical information display and processing, advanced laser technology, biomedical optics, next generation network and applications, recognition science and intelligent 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.

Scientific and technical issues in information science are increasingly interdisciplinary in nature. Therefore, the Department pays great attention to proposals of interdisciplinary researches between information science and mathematics, physics, materials, life science, chemistry and so on. The Department encourages applicants to submit cross-disciplinary research proposals and proposals for cooperation among scientists with different background and knowledge. It encourages scientists to combine theory with practice and explore basic theory and key technical problems that have important application potentials for the national economy and national security. The Department will continue to give preferential funding to proposals that have a good background of international cooperation in order to encourage scientists to conduct substantive international cooperative research with scientists abroad in frontier areas of information science.

In 2009, the Department received 11,436 applications of various types. Among them, 6,323 were for General Program projects, which represented an increase of 20.14% from 2008. In 2009, it funded 1,085 General Program projects, with a total funding of 339.77 million yuan. The average funding is 313.1 thousand yuan per project (307.8 thousand yuan per project in 2008), which is slightly higher than that of 2008. The average funding

rate is 17.16%, which is 1 percentage lower than that of 2008. The Department expects that the average funding per project will be higher in 2010.

In project evaluation in 2009, panel experts made strict checks on the qualification of the applicants. Meanwhile, the PIs of those projects rated “exceptionally excellent” in project completion evaluation, were given special credits towards their new applications. It is worth noting that some summary reports of the completed projects did not give proper acknowledgement or no acknowledgement at all to NSFC’s funding. It is hoped that PIs and the home institutions pay due attention to this issue.

### Funding for General Program Projects in the Last Two Years

Unit: 10,000 yuan

Divisions		2008			2009		
		Projects	Funding	Funding rate <sup>++</sup> (%)	Projects	Funding	Funding rate <sup>++</sup> (%)
Division I	Electronics and technology	91	2,910	21.26	108	3,376	19.01
	Information and communication system	63	1,926	16.15	102	3,118	18.89
	Information acquisition and processing	111	3,303	20.22	89	2,759	16.30
Division II	Theoretical computer science, computer software and hardware	90	2,768	17.37	99	3,015	16.58
	Computer applications	103	3,109	18.07	121	3,657	16.67
	Network and information security	70	2,122	16.06	96	2,932	16.47
Division III	Control theory and control engineering	93	2,870	19.06	116	3,569	18.44
	Systems science and system engineering	29	831	15.18	33	1,001	14.67
	Artificial intelligence and intelligent systems	85	2,581	17.24	84	2,579	16.50
Division IV	Semiconductor science and information devices	78+11*	2,801	18.39	78+16*	3,129	16.88
	Information optics and photoelectric devices	61+9*	2,218	18.09	60+12*	2,435	17.10
	Laser technology and technical optics	55+8*	2,014	19.15	60+11*	2,407	16.82
Total		929+28*	29,453	18.18	1,046+39*	33,977	17.16
Average funding per project		30.78 (31.70**)			31.31 (32.11**)		

Notes: \* Projects of the Small Fund for Exploratory Studies.

\*\* Average funding without projects of the Small Fund for Exploratory Studies.

++ Success rate includes projects of the Small Fund for Exploratory Studies.

## **Interdisciplinary Research between Information Science and Mathematics**

In 2010, the Department of Information Sciences and the Department of Mathematical and Physical Sciences will continue to fund interdisciplinary researches that require combined efforts from information science and mathematics. The approval rate and funding will be not lower than that for General Program projects. The areas to be included are mathematical methods in modern computer science, mathematical methods in information security, information system and advanced control theory. Interdisciplinary researches in the following areas (but not limited to) are encouraged:

### **1. Theory and algorithm of integer representation of real numbers**

To design the theory and algorithms of integer representation of real numbers, to realize by computer and to give complexity analysis of the algorithm.

### **2. Theory and methods of formalized representation of software systems**

To describe and represent, by using the formalization theory and methods, practical software systems applicable not only to real time application software systems, but also to interactive, discrete event software systems.

### **3. Theory and methods of designing security software systems**

To verify both theoretically and practically the advantages of the theory, algorithm and system structures of typical software system (system software or application software) analysis, design and development for improving the safety performance of software systems.

### **4. Theoretical studies on new software system structure**

To study, by addressing the contemporary needs of software application, the structure, theory and methods of the system structure of novel software and to give appropriate scientific characteristics in combination with practical software system.

### **5. Theoretical studies on the validation of software systems**

To establish the theory and methods on the validation of software system development so as to ensure the validity of the developed software.

### **6. Theory and methods of formalized representation of practical engineering projects**

Please make proper selection of the application codes when writing proposals.



## **Division I of Information Sciences**

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

Research in electronic science and technology relates to circuit and system, magnetic field and wave, and electronics and applications. Funding mainly includes the design, test and verification of circuits and system, diagnosis, reliability, micro/nano circuit design theory, methods and technology, power, radio electronic technology and system, circuit and network theory, low power consumption communication electronics, electro magnetic computational theory and methods in electromagnetic fields and waves, characteristics of electromagnetic field and waves in new types of media, mechanism of interaction between electromagnetic field and wave and objects, electromagnetic compatibility and electromagnetic environment, electronic wave transmission and antenna, micro wave optics, tera hertz electronic technology, vacuum, surface, membrane, superconducting, quantum, plasma, molecular and nano electronics in physical electronics, electromagnetic effect in bioelectronics, biochips, medical information diction methods and technology; information processing and analysis in bio informatics, detection and identification of bio cells and molecules, 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, bop sensors, properties of new types of sensitive materials and devices, and so on.

Information and communication system relates to theoretical and technical researches in the transmission, exchange and application of information. The main funding scope includes informatics, signal coding, channel coding, network service theory and technology, information system modeling and simulation, communication network and communication system security, diagnosis and evaluation, cognitive wireless in information theory and information system; wireless, spatial, multi media, optical, quantum, computational, transducer network communication theory and technology, new network access technology, mobile wireless internet technology, and next generation mobile communication theory and network, future information network theory and transmission mechanism, network communication theory and system, etc.

Information acquisition and processing relates to the theory, methods and applied technology of information acquisition and processing. The main scope of funding includes the processing of multi dimensional signals, self adaptive signals, radar, remote sensing and acoustic signals in signal theory and signal processing; information acquisition mechanism and technology, weak signal detecting and processing, detection and imaging system in information detection and processing, image interpretation and

processing, integrated processing of multi sensor signals, multimedia information processing and presentation, bio information processing at molecular, cellular and system levels, space and network information processing, etc.

In 2009, the Division received 1,554 proposals for General Program, and funded 299 projects. The rate of funding is 18.08% and the average funding per project is 309,500 yuan. Some projects funded are related to interdisciplinary research such as information and mathematics, and information and health related subjects.

In 2010, the Division will continue to support researches in the areas of detection and imaging technologies, detection data decoding, bio-information processing and space information processing, electromagnetic environmental effect, network information processing, green communication electronics and research in basic theory and key technologies that are significant to the national security, innovative and cross-disciplinary research without common view from reviewers, continue to offer small amount of funds for exploratory studies, support exploratory studies having good prospects, continue to pay attention to performance and results in project evaluation, and give preferential funding to projects which have scored outstanding achievements in previous research. Applicants are encouraged to combine theory and practice, to focus on innovation and to study and solve basic problems in important application areas, so as to improve our research capabilities in this discipline.

## **Division II of Information Sciences**

The Division mainly funds researches in basic theories, basic methods and key technologies 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 science. The Division supports researches in the theory of computer science, architecture, computer network, parallel and distributive processing, storage principle and system, system software, software engineering and methods, information security, natural language interpretation, data engineering and knowledge engineering, multimedia information processing, virtual reality, man-machine environment, mobile computation, embedded computation, artificial intelligence, pattern recognition and machine learning, bio information processing, etc. The objectives of computer science and technology are to obtain high efficiency and performance, large storage, high reliability, networking, and universal and intelligent applicability. Applicants are recommended to conceive their research around these main features.

In 2009, the Division received 1,770 proposals for General Program, and funded 316

projects (including 2 related to health science). The success rate is 16.55% and the average funding is 303.2 thousand yuan per project.

It is worth noting that proposals in 2009 still have the problem of lacking creative ideas, and not related to basic research for major national needs. The Division suggests that applicants aim at the national needs or international frontiers, and select basic, key and in-depth scientific issues to carry out sustained research.

The Division emphasizes here that it encourages proposals focusing on key scientific problems and technologies in computer science, and original, fundamental and far-sighted research. The Division especially encourages and supports scientists to address those basic issues that are well known internationally for their difficulty and significance. In 2010, the Division will continue to support interdisciplinary research in life science, mathematics, physics, chemistry, geo-science, mechanical engineering and management, and the exploration of new ideas, new theories and novel approaches and technology so as to promote the mutual development of computer and other sciences.

### **Division III of Information Sciences**

The Division mainly funds basic research and far-sighted research for the national economy and disciplinary development in control theory and engineering, systems science and system engineering, artificial intelligence intelligent systems, etc.

Research funded in control theory and engineering includes control theory and applications, trouble shooting and system service, system emulation and evaluation, navigation, guidance and telemetry, sensor technology and sensor network, multi-information fusion, etc.

Research funded in systems science and system engineering includes system description, modeling and analysis, system dynamics and application, emergence and laws of the evolution of complex systems, engineering system design and optimization, engineering system scheduling and decision making, etc.

Research funded in artificial intelligence intelligent systems covers pattern recognition and application, artificial intelligence and knowledge engineering, robotics and robot technology, cognitive science and intelligent information processing, etc.

In 2009, the Division received 1,273 proposals for General Program projects and funded 233. The success rate is 18.3% and the average funding per project is 306,900 yuan. Some are interdisciplinary projects related to mathematics and health sciences.

Statistics of recent years show that the following areas are becoming hotspots in application and research: intelligent and self-adaptive control of complex systems, unified safety control of energy saving, pollution reducing and low consumption production process, coordinated control of multi autonomous system, data based system analysis and control, diagnosis and system maintenance based on data; complex network analysis and network system control, advanced navigation and guidance theory and techniques, new types of transducers and transducer system, optimal dispatching and emergency management of complex engineering systems, analysis and optimal design of complex supply chain system, new theory and methods of pattern recognition, object identification and tracking in complex background and interference, new theory of computer vision and realization of high performance system, natural language understanding and syntax computation, new methods of data understanding and machine learning, web information detection, searching, processing and application, advanced robot system and key technology; and computer modeling and application of cognitive process. In addition, the Division gives due support to farsighted and interdisciplinary researches such as modeling and control of micro-nano and micro scale systems, modeling and control of hypersonic aircraft, navigation and guidance and control in deep space and deep ocean exploration, bio genetic network analysis and regulation, quantum system regulation, finite dimensional approximation of infinite dimensional system and controls, agricultural information technologies, etc.

In 2010, the Division will continue to encourage and support interdisciplinary research with mathematics, mechanics, mechanical engineering, semiconductors, optics, energy, environmental science, management, biology, neural science and psychology, etc.

### **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 in 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 in optics and photo-electronics includes optical information acquisition and processing, photon and photoelectric devices, transmission and exchange photonics, inferred physics and technology (including tetra-hertz), 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 2009, the Division received 1,400 proposals, which was 16.77% more than that in 2008, and funded 237 projects, with a funding rate of 16.9% and an average funding of 382.94 thousand yuan per project.

In recent years, along with the development of information science, the above areas are now having more and more interactions with physics, chemistry, materials science and life science, and many new research directions are emerging. Among the major branch areas, more applications come from the following areas: semiconductor crystals and membrane materials, IC design and test, semiconductor photoelectric devices, optical information processing, photon and photoelectric devices, transmission and exchange photonics, laser, etc. There is still room for improvement for applications in such areas as semiconductor electronic devices, semiconductor physics, IC manufacturing and packaging, inferred physics and technology, nonlinear optics and quantum optics, applied optics, optics and photoelectric materials, biomedical photonics, etc. Research in the following areas needs to be encouraged: semiconductor micro nano mechanical electrical devices and systems, new types of information devices, spectrum technology, space optics, atmospheric and marine optics, and optical problems in interdisciplinary areas.

The Division will continue to give priorities to solar cell materials and devices, tera hertz devices, nano device and technology, optical information processing and display technology, advanced photonic technology, wide gap semiconductor materials and devices, semiconductor integrated circuit system (SoC), etc.

Based on the trend of applications in recent years, the following areas will become the hotspots in the following years: radio frequency and digital analog mixed integrated circuit design, micro-nano optical and electro-mechanical device and technology, on-chip network chip design, low dimensional quantum structure materials and devices, wide gap semiconductor materials and devices, self-spin electronics and self-spin photo electronic materials and devices, high speed optical communication technology and devices, high density information storage, display materials and devices, inferred detection and tera hertz technology, spectrum technology, space optics, atmospheric and marine optics, optical problems in interdisciplinary areas, and information devices, optics and photonics technology in health and life sciences. We hope that researchers make brave explorations and propose more, better and creative proposals and suggestions on Key Program project topics.

## **Department of Management Sciences**

Management is an interdisciplinary science which aims at revealing and applying the basic laws of various management activities in order to optimize the utilization of limited resources with the help of modern science and technology. There are three divisions in the Department of Management Sciences, namely management science and engineering, business administration, and macro-management and policy. Research proposals should be submitted to one of these divisions according to the relevant contents.

Scientists from diverse academic backgrounds are encouraged to take an active part in management science research and advance the development of management science, a comprehensive intercrossing scientific discipline. However, applications centering on social science and humanities, together with applications on topics funded by other scientific departments of NSFC, will not be accepted by the Department of Management Sciences. Applicants are advised to propose their research topics from the perspective of management science research.

Based on NSFC's strategy of "supporting basic research, adhering to free exploration and playing a guiding role", the Department of Management Sciences formulates its guideline in the Eleventh Five-Year Plan period as "guiding the frontier of research, featuring Chinese management activities and promoting independent innovation", and sets three strategic targets, i.e. to primarily lay a foundation for the gradual buildup of Chinese school of management science, to effectively improve the connection between Chinese management studies and activities, and to complete the overall design and partial construction of the infrastructure for management science research in China. Meanwhile, the Department has always attached great importance to both the adoption of international standard research methodologies and the focus on new issues stemming from the management practice in China. In turn, better theoretical insights from the investigation into these issues are expected to shed light on the resolution of practical management issues in China.

Chinese management science is now facing a critical transformation from following research abroad to indigenous innovation. In the coming years, the Department will focus on promoting the original creativity of Chinese management study through selecting, supporting and managing innovative research projects. Proposals emphasizing on the combination of theory and practice and intercrossing of multiple disciplines will be supported with priority.

The Department encourages researchers to explore the objective laws underlining management activities through scientific methodology, and adopt internationalized

standard in their research. Although the practitioners and researchers might propose their hypotheses by intuitive inspiration based on long-term management practice and research accumulation, management research concerning pure social science will not be considered by the Department because another organization (the National Social Science Foundation) supports all social science researches in China.

The Department supports both experimental research projects which depend on experiment, observation, measurement, etc., for data collection, and theoretical research projects that aim at offering solutions to management issues based on the analysis and interpretation of management phenomena through modeling, computation, induction and deduction.

Compared with other scientific disciplines, management research is featured by its complicated characteristics in data collection, which mainly conducts long-term large-scale on-spot observation of a long range of investigation subjects such as communities, organizations and markets, collects large-scale sample data and cases, conducts simulation and experiments through physical equipment or computer systems, constructs and maintains (or directly purchases large-scale commercial) large-scale database or case database, and accumulates data through various other means. The Department pays due attention to not only repetitive research results that are obtained by the whole process of hypothesis proposition, data collection and experiment, but also research conclusions shedding light on the objective judgment of laws governing management activities based on data analysis and assessment of the real situation. For those experimental research projects featuring long-term large-scale data collection and processing, filed investigation and high performance computing and experiments, applicants are advised to propose a higher budget than the average funding intensity in accordance with their specific cases.

Specific application requirement in 2009:

### **1. No repetition of funding**

To optimize the allocation of the National Science Fund and to ensure that PIs invest adequate time and energy in conducting their on-going national projects, the Department of Management Sciences will decline proposals by the following applicants in 2010:

- (1) PIs of on-going projects supported by the National Social Science Fund (All projects supported by the National Social Science Fund are regarded as on-going projects if they are not marked as completed projects on the portal website of the National Planning Office of Philosophy and Social Science.);
- (2) Applicants submitting proposals to both the Department of Management Sciences of NSFC and the National Planning Office of Philosophy and Social Science in 2010.

## **2. Accuracy and integrity of information**

Applicants are held responsible for the accuracy, integrity and truthfulness of the contents of their applications, and their home institutions are obliged to give serious check on the relevant information. Among other related regulations, the following requirement should be abided by during application writing process:

(1) Detailed information about working experience, educational backgrounds, research projects undertaken and related assessments, and publications of PI and main participants should be provided in the CV column. With respect to publications, the title of the journal, names of all authors, article title, year of publication, volume number and page numbers are required to be listed;

(2) Applicants submitting proposals through other institutions because their own home institutions have not registered at NSFC should provide detailed information about their own home institutions and the positions they hold at their home institutions;

(3) Applicants are required to give an account on their preliminary research (including relevant publications) pertaining to the proposals submitted;

(4) One proposal is not allowed to be submitted to more than one science funding agency. For those applicants who propose new research topics based on their projects formerly supported by NSFC, they are supposed to clarify the relation and differences between the newly submitted proposals and the projects formerly supported by NSFC. For applicants undertaking projects funded by other agencies such as MOST, NSSF or local science funding organizations, they are required to state the similarities and differences between their on-going projects and the newly submitted proposals to NSFC.

## **3. Special requirement for PIs of newly started NSFC projects**

To ensure that PIs of NSFC General Program projects, Young Scientists Fund projects and Fund for Less Developed Regions projects that started in 2008 and 2009 to invest adequate time and energy in conducting their on-going projects, new proposals by these PIs will be assessed through especially strict procedures.

## **4. Consideration of performance evaluation of projects completed**

The Department of Management Sciences periodically organizes experts to conduct performance evaluation of all General Program projects, Young Scientists Fund projects and Fund for Less Developed Regions projects one year after their completion and the evaluation results will be published on NSFC's website. Researchers with good performance evaluation results will be given priority for funding when they apply for new projects. However, researchers with bad performance evaluation results will undergo stricter reviewing procedures when they apply for new projects.

For more information, applicants are strongly recommended to refer to other NSFC regulations.



In the past three years, the average funding intensity per General Program project in the Department of Management Sciences has kept a steady annual increase of 10-20%, from 200.2 thousand yuan in 2007 to 234.3 thousand yuan in 2008 and 250.6 thousand yuan in 2009. The average funding intensity will steadily increase in 2010, and the number of General Program projects granted will stay basically the same as that in the previous years, with a slight increase. For concrete information about the funding of General Program projects, please refer to the following table.

### Funding for General Program Projects in the Last Two Years

Unit: 10,000 yuan

Divisions		2008			2009		
		Projects	Funding	Funding rate <sup>++</sup> (%)	Projects	Funding	Funding rate <sup>++</sup> (%)
Division I	Management science and engineering	127+1*	3,028.4+10*	16.45	146	3,659	15.32
Division II	Business administration	123	2,932.5	12.84	146	3,659	13.18
Division III	Macro-management and policy	135+2*	3,103.5+16*	12.21	148	3,710	11.64
Total		385+3*	9,064.4+26*	13.58	440	11,028	13.21
Average funding per project		23.43 (23.54**)			25.06		

Notes: \* Projects of the Small Fund for Exploratory Studies.

\*\* Average funding without projects of the Small Fund for Exploratory Studies.

++ Success rate includes projects of the Small Fund for Exploratory Studies.

## Division I of Management Sciences

### Management Science and Engineering

The Division of Management Science and Engineering mainly supports research projects associated with fundamental theories, methods and techniques in the field of management science, which include the history of management science, general management theory, operations management, decision-making and game theory, organization theory, management psychology and behavior, management system engineering, industrial engineering, information technology management, technology and theory of internet management, forecast, prediction and evaluation methods, quantitative economic analysis, financial engineering, complexity science, knowledge management, etc.

The Division will strengthen its support to researches on basic theories and frontier areas, especially those from Chinese management experience, culture and philosophy.

In 2009, a total of 739 proposals were accepted by the Division (an increase of 22.18% compared with that in the previous year), of which 146 were funded. The success rate is

15.32%. Of all the applications, 18.58% are in the area of operation research and management, mainly focusing on logistic and supply chain, product management and traffic and finance operation, 13.69% fall in the area of information system and management, with a focus on IT adoption, network information system, data mining, business intelligence modeling, 7.94% are in the area of finance engineering with the focus on risk management, product design and pricing, behavioral finance, etc. Among the rest of applications, 7.34% focused on management theory and methods, 7.34% on industrial engineering and management, and 7.27% on management system engineering.

The past few years have witnessed rapid development of management science and engineering and the great enhancement of research capacities of a group of young scholars under the age of 45. However, the number of original and innovative applications was still quite small and very few applications focused on issues of the management practices in China were proposed. Therefore, young researchers are encouraged to undertake explorations on frontier issues and conduct research in management theories, techniques and methodologies in consideration of the specific requirement and the status quo of management practices in China.

## **Division II of Management Sciences**

### **Business Administration**

The Division of Business Administration mainly supports basic research and some applied basic research in management theories and new management techniques and methodologies targeted at micro-level organizations and nonprofit organizations.

In 2009, 1,108 applications were received (15.7% more than that in 2008) and 1,027 of them were accepted. After peer review, 146 projects were finally funded, with a success rate of 13.18%. A large proportion of applications that were accepted and approved mainly centered on such fields as strategy management, enterprise finance, market management, accounting theories and methods, logistics and supply chain management, human resources management and organizational behavior. A lot more applications focusing on innovation and entrepreneurship management, R&D and technological innovation management were funded. Compared with the previous year, more applications were received and approved owing to the novel research methodologies and techniques adopted in such fields as service management, e-business, project management, production management, quality management, non-profit organization management, and so on. In general, a balanced funding of all fields of business management science was achieved.

The Division will continue its support to innovative basic research and applied basic research on frontier issues of business sciences, with the emphasis on research in

theoretical innovation and new knowledge creation, on research that combines empirical analysis, case analysis and on-site observation for scientific accumulation and discovery, on research that focuses on the management practices in China and shows potential social application, and on research featuring substantial international cooperation. In recent years, basic research on business administration has achieved significant progress in the areas of corporation theory, accounting, technology innovation, operation management, logistic and supply chain management, e-business and intelligent business, etc., while the study in some other areas is not satisfying, such as service operation management, quality management, innovative management, technology management, project management, non-profitable organization management, etc. In 2010, the Division will stick to its funding principles of “calling for scientific spirit, encouraging the exploration of unknown areas and supporting basic research with original creativity”.

To achieve a balanced disciplinary development and sharpen the edge of management science research, the Division puts its priority on frontier research in enterprise theories, enterprise strategy, financial management, innovation and entrepreneurship management, human resources management, marketing management, e-business, operational management, etc. Meanwhile, the Division will increase its funding to research in such fields as small and medium-sized business management, service management, logistics and supply chain management, quality management, risk management of large-scale projects, safety management, management of non-profit organizations.

## **Division III of Management Sciences**

### **Macro-management and Policy**

The Division of Macro-management and Policy mainly supports basic research in such fields as macro-economy management and policy, financial management and policy, tax management and policy, industry management and policy, agriculture and forestry economics management, public administration and policy, science and technology management and policy, health management and policy, education management and policy, public security and crisis management, labor, employment and social welfare, resources and environment management and policy, regional development management, information resources management, etc. Meanwhile, the Division attaches great importance to the promotion of science development and academic innovation on the one hand and the nurturing of talents and research teams on the other. While developing related theories and methodologies, researchers are encouraged to provide consultation, support and suggestions to the government in its national macro decision-making.

In 2009, the Division received 1,272 proposals, an increase of 13.37% over that in 2008. After scientific evaluation, 148 applications were finally approved with a total funding of 37.1 million yuan, a success rate of 11.64% and an average funding intensity of 227.7

thousand yuan per project.

Many more applications were received and approved in such areas as agriculture and forestry economy management, resources and environment management, health management and policy, financial management, etc. in 2009. Much higher success rate was achieved for applications in the fields of agriculture and forestry economy management, health management and policy, and so on. On the whole, the applications received lived up to the requirement of “adoption of international standard research methods and focalization on management practices in China”. Much more attention was paid to the application of scientific theories and methodologies to the investigation of significant issues stemming from the management practices in China.

In 2010, priority-funding areas in the Division include research in basic theories and methods in public administration, public security management, education management, resources and environment management, etc. Original research based on long-term academic accumulation is especially encouraged and theoretical research achievements are encouraged to take active part in international communication by means of publication in international academic journals. Applicants are recommended to seek scientific topics from the practical issues in China’s management practices and pay due attention to the adoption of scientific and standard research methodologies.

## **Department of Health Sciences**

The Department of Health Sciences, consisting of 8 scientific divisions, mainly supports basic and applied basic researches on the morphological, structural, functional, developmental, genetic and immune abnormalities in cells, tissues, organs and systems of human beings or animal models, and on the occurrence, progression, regression, diagnosis, treatment and prevention of diseases. Research on normal structure, function and development of organisms is therefore not appropriate for this department. Applicants are expected to refer to the instructions in the Department of Life Sciences section in this guide.

Review activities of the applications in the Department of Health Sciences are organized by 31 primary application codes and their related secondary application codes, which are further assigned to 8 scientific divisions. The scientific areas covered by 31 primary application codes include areas related to respiratory system, circulatory system, digestive system, reproductive system/perinatology/neonatology, urinary system, motion system, endocrine system/metabolism and nutrition support, hematology, nervous system and mental disorders, medical immunology, skin and appendages, ophthalmology, otorhinolaryngology/head-and neck science, oral and craniomaxillo-facial science, acute

and severe medicine/trauma/burn/plastic surgery, oncology, rehabilitation medicine, medical imaging and biomedical engineering, medical pathogenic microorganism and infection, laboratory medicine, special medicine, radiation medicine, forensic medicine, endemic diseases/occupational diseases, gerontology, preventative medicine, traditional Chinese medicine, TCM materia medica/TCM pharmacology, integration of TCM and western medicine, materia medica and pharmacology. These application codes present the following major characteristics: ( i ) The primary application codes which are arranged in the order of organs or systems, are scientific problems based on an effort to combine the relevant basic research with clinical research, and to review applications focusing on common scientific problems from different disciplines 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, including research on the congenital, genetic, immune-mediated, inflammatory and infectious diseases relevant to the given organ or system, as well as on their transplantation.

To facilitate basic and applied basic medical research in China, the Department will support both curiosity-driven and national needs-driven research, with its emphasis on the innovative studies focusing on the scientific issues related to the prevention, control and treatment of diseases. Research in the following areas is strongly encouraged: ( i ) Innovative research aimed at solving the scientific issues emerging from medical practices by new thinking or new methodologies; ( ii ) Translational medical research combining basic medicine with clinical medicine; ( iii ) Integrative medical research aimed at understanding the underlying mechanism of diseases by utilizing multidisciplinary techniques or methods at various levels from molecular, cellular, tissue to the whole-organism level; ( iv ) In-depth systematic research built upon existing bases that will possibly lead to innovative academic ideas; ( v ) Interdisciplinary crosscutting research with other research fields; ( vi ) International communicative and collaborative research; research that will possibly result in high-impact papers or patents. The Department will highlight basic and applied basic researches closely related to the national welfare and people's livelihood, to public health emergency and to common diseases that severely affect people's health, and will nurture both the weak research areas to insure the balanced development of various areas and the weak research institutions with relative weak research workforces by addressing their proposals and the training of young scientists.

The major problems existing in the previous proposal applications include: ( i ) Follow-up or descriptive research plan in research content section; ( ii ) Lack of originality, especially unique or original studies targeting at the scientific issues emerging from clinical practices in research content section; ( iii ) Lack of analysis of published

relevant work in the background and significance section; (iv) Superficial research plan without defined scientific issues or hypothesis in research content section; (v) Failure to work on research built upon existing bases with their own features, to elaborate the significance of the selected hot-spot topic research in the research content section; (vi) Failure to justify the employment of high techniques in the research design section; (vii) Failure to elaborate the research significance in background and significance section; (viii) Questionable reasoning in research design section; (ix) Lack of relevant preliminary work proving the feasibility of the research and competencies of the applicants in the biographical sketch and existing work bases section; (x) Incomplete or friction information contained in the application; (xi) Failure to conform to the requirement specified in the *Guide for Applications* in the application format, etc. Therefore, the Department reminds applicants that a scientific, serious and creative attitude should be taken in preparing complete and accurate applications, and when special medical research objects such as human subjects are concerned, the related ethical and informed content requirement must be met.

The fact that post-award management concerns directly with the efficiency of the national fund and public investment makes it necessary for the Department to strictly enforce post-award management, to stress performance evaluation, and to give priority support to continuous research and systematic research, especially research by applicants with good performance records in their previous awards.

Since the effective application codes of the Department are completely new, applicants are expected to be fully aware of the changes in order to accurately select the proper secondary application codes for their applications. The significant changes that should be taken special notes are as follows: (i) Scientific areas related to newborn diseases are covered in “H04 Reproductive system/perinatology/neonatology”, while other scientific areas related to pediatrics are covered in the corresponding application codes of the given organ or system; (ii) Scientific areas related to tumors are mainly covered in the primary code “H16 Oncology”, and the specific areas in its secondary application codes (with the exception of leukemia, which is covered in “H08 Hematology”); (iii) Scientific areas related to sexually transmitted diseases are covered in “H19 Medical pathogenic microorganism and infection” and the specific areas in its secondary application codes; (iv) Scientific areas covered in “H25 Geriatrics” include mainly research on common scientific issues involving multiple organs or systems in aging and aging related diseases, and those related to a single organ or system are covered in the corresponding application codes of the given organ or system; (v) Scientific areas covered in “H22 Radiation medicine” include mainly those related to radioactive pathology, protection and treatment, with the exception of radioactive treatment of tumor, which is covered in the application code “H1610 Physical treatment of tumor”.

In view of the fact that the new application codes have not yet been subject to practical tests, a special secondary application code is designed for each primary application code with secondary application codes to cover the scientific issues not elsewhere included in case of the possible ignorance of significant specific scientific areas, and this will be further modified or improved in the practical management.

## **Division I of Health Sciences**

The Division provides financial support for basic research and applied basic research on morphological, functional, genetic and developmental abnormalities of respiratory, circulatory, digestive and hematologic systems. It funds studies on etiology, pathogenesis, diagnosis and treatment of non-infectious and non-tumorous diseases of these systems, and also on gerontology. Thus, research proposals on tumorous or infectious diseases are excluded from the Division's funding scope. Proposals on tumors of respiratory, digestive and hematolymphatic systems (except leukemia) should be submitted to Division V of Health Sciences and proposals on infectious diseases to Division IV of Health Sciences.

### **Respiratory System**

The Division mainly funds studies on morphological, functional and developmental abnormalities and diseases of lung, airway, pulmonary circulation, mediastinum, pleurae, thoracic cage and diaphragm. It also funds studies on pulmonary transplantation and new diagnostic techniques. Asthma, chronic obstructive pulmonary disease (COPD), pulmonary hypertension, pulmonary fibrosis, lung injury, and lung transplantation and protection are hot topics in this field drawing increasing attention. In the past several years, studies on sleep apnea have been growing. The Division will keep supporting innovative and high-level studies on the areas mentioned above.

### **Circulatory System**

The main funding scopes are studies on morphological, functional and developmental abnormalities in circulatory system, diverse cardiac and vascular diseases, microcirculation and shock. Proposals received in the past several years are mostly on atherosclerosis and coronary heart diseases. The next is on arrhythmia, hypertension, cardiac injury, repair and remodeling. Applicants are encouraged to carry out original and translational studies by benefiting from the advantages of this field. Collaborative research between clinicians, developmental biologists and genetic biologists on cardiac development abnormalities for elucidating mechanisms of congenital heart diseases and the development of therapeutic strategy will be encouraged. Recently, studies on the role of stem cells in cardiovascular injury repair have been an active topic and lead to advances on differentiation, homing and function of stem cells. In this field, both international collaboration and original and independent work will be needed.

### **Digestive System**

The funding scope covers studies on morphological, functional, developmental abnormalities and diverse non-infectious and non-tumorous diseases of digestive system. Due to the change of disease spectrum and the high morbidity of hepatitis, studies on various hepatic diseases, such as fatty liver, hepatic fibrosis, hepatic cirrhosis, hepatic injury, repair, regeneration and transplantation, have become important topics in this field. The number of proposals and grants on inflammatory bowel disease and immune of gastrointestinal (GI) tract has greatly increased in recent years. Studies on Irritable Bowel Syndrome (IBS) and dynamics of GI tract have also been growing. Digestive diseases related to drugs, toxicants or alcohol also receive more attention. Research on these important problems mentioned above, studies on pathophysiology of pre-clinical phase of these diseases and the mechanisms of functional disorders will be encouraged.

### **Hematological System**

More and more Chinese scientists in this field have strong research background and have achieved original findings on hematological system diseases, especially leukemia. The Division advocates that applicants apply new techniques and new methods, such as genomics, proteomics and animal model, to carry out a highly competitive bed to bench and bench-to-bed research. The hot topics in this field include studies on characterizing hemopoietic stem cell, stem cells transplantation, the relationships between stem cell and microenvironment, and between stem cell and pathophysiologic states. Due to the fact that the number of applications on anemia, hemorrhagic and coagulation abnormalities and thrombus are relatively low, young investigators in this field should be expected.

### **Gerontology**

The main funding scopes are studies on Geriatric multi-system and multi-organ dysfunction, and their related diseases and pathophysiology of aging. The important research direction in this field includes studies on finding targets and markers for pre-diagnosis, diagnose and treatment by using system biology. However, applications on single diseases should be submitted to other related application codes.

### **Division II of Health Sciences**

The Division mainly supports researches on urinary system, reproductive system/perinatology/neonatology, endocrine system/metabolism and nutrition support, ophthalmology, otorhinolaryngology head and neck science, oral and craniomaxillo-facial science. It also supports studies on the structure, function, abnormal development and genetics of human tissues and organs of the above systems, and basic and applied basic researches on the etiology, pathogenesis, diagnosis, treatment of all the diseases in the above areas or systems except for cancer and infectious disease. All applications on cancer research should be submitted to Division V of Health Sciences.



**Urinary System**

The Division mainly supports studies on the structure, function and abnormal development of kidney, renal duct, bladder and urethral canal and all the disease related proposals except tumor research. The proposed research in the Division includes different kinds of diseases of kidney, abnormal function of kidney, renal failure, renal transplantation, diseases of prostate and bladder, urodynamics, urinary stone and damage and repair of urinary system. Most of the research proposals cover the above research fields in recent years, mainly focusing on the studies of chronic kidney diseases, renal failure, immunology of renal transplantation, diseases of prostate and urodynamics, which have a good research background on the pathogenesis of chronic kidney diseases. The Division will continue to support consistent and innovative researches and translational researches in the above fields.

**Reproductive System/Perinatology/Neonatology**

The Division mainly supports studies on the structure, function and abnormal development of reproductive system and all the diseases except tumor. The Division receives proposals on the abnormal development, trauma and repair, inflammation and infection, genetics diseases of reproductive system, abnormal endocrine and related diseases, female pelvic floor dysfunction, endometriosis, sexual dysfunction, male infertility, female infertility and assisted reproduction, contraception, birth control, pregnancy and delivery related diseases, fetal development and prenatal diagnosis and neonatal related diseases. The above research fields are greatly associated with the control of human population, improvement of population quality, associated with the health of female, fetal, newborn and reproductive system, and involved in the research areas of obstetrics-gynecology, andriatria, pediatrics and pathology. Research proposals in the past few years mainly focused on the research on abnormal development of embryo and fetal, pregnancy induced hypertension syndrome, intrauterine infection, endometriosis, polycystic ovarian syndrome, neonatal related diseases, infertility and pelvic floor dysfunction. There are few proposals on the safety of assisted reproduction, prenatal diagnosis, contraception, inflammation and infection of reproductive system and sexual dysfunction, and the Division will give preferential support to the above aspects.

**Endocrine System/Metabolism and Nutrition Support**

The Division mainly supports studies on the structure, function and abnormal development of endocrine system, including pineal gland, hypothalamus, pituitary, thyroid, parathyroid, adrenal gland and islet. It receives proposals on disease related research of endocrine system and endocrine abnormal of other non-traditional endocrine organs, supports various dysfunctions of metabolism, malnutrition and nutrition support, metabolic syndrome, abnormal glucose, lipid, amino acid, nucleic acid metabolism, water and electrolyte metabolism disorders, abnormal calcium and phosphorous metabolism, and osteoporosis. Research on diabetes mellitus, metabolic syndrome and its

complication are hot areas, while there are few studies on new peptide hormones, the mechanism of action and the interaction of different hormones.

### **Sense Organ System of Ophthalmology, Otorhinolaryngology Head and Neck Science, Oral and Craniomaxillo-facial Science**

The Division mainly supports basic and applied basic researches on pathogenesis, development role, diagnosis, innovative treatment measures and functional reconstruction of the system, the functional and structural diseases of eye, ear, nose, throat, oral and neck involved in the research of vision, audition, olfactory sensation and taste of human sense organ system. There is a tendency of using advanced methods of molecular biology, genomics, proteomics, stem cell, combining with the development interdisciplinary areas such as immunology, microbiology, biomedical materials, materia medica, biomechanics, and tissue engineering to solve the key problems of clinical diagnosis and treatment. As there is much overlapping in proposals on tissue organ growth and development and regeneration, bone research, temporomandibular joint research, implant research under the previous application code of oral medicine, oral surgery, prosthodontics and orthodontics, the Division has made more modifications of application codes of oral and craniomaxillo-facial science this year. The new application codes represent the scientific question based application. Application should be submitted according to the secondary code and research on implant research should be in the code of “other research related to repair and correction of tooth defects, tooth loss and dental facial deformity”.

### **Division III of Health Sciences**

The Division mainly supports basic and applied basic researches in the fields of neurological and psychiatric diseases, medical imaging and biomedical engineering sciences. Projects concerning tumors in the central nervous system should be submitted to Division V of Health Sciences instead of this division.

#### **Neurological and Psychiatric Diseases**

The Division mainly supports basic and applied basic researches regarding the structure, function, heredity and developmental anomalies of the nervous system, as well as studies concerning the etiology, pathogenesis, diagnosis and treatment of non-tumorigenic neurological diseases. The Division supports not only researches on common disorders in the nervous system such as cerebrovascular diseases, epilepsy, neurodegenerative diseases, and traumas and repair in brain and spinal cord, but also studies on rare nervous system diseases. Considering hereditary neurological diseases, it preferentially supports those to collect information about disease-families in China, in attempt to uncover the disease-causing genes and to investigate the functions of disease-causing genes combined with neurobiological methods. Thus, these studies could provide clues for treating

genetic diseases and help us better understand the functions of normal brain.

The modern disease spectrum is characterized by the rapid rise in the prevalence of psychological and psychiatric diseases and the increasing degree of public concern. The efforts are mainly aimed to initiate studies regarding early recognition, reliable diagnoses and treatments targeting at the etiologies and pathogenesis of these disorders based on unraveling biological mechanisms and etiologies. In order to reduce the prevalence of psychological and psychiatric disorders in China, researches are encouraged to illustrate the mutual interaction between environment and genetics and their impact on the development of these diseases, unravel the potential etiologies, discover the practical biomarkers monitoring the development, progression and prognosis of the conditions, establish early diagnostic methods, and develop pharmaceutical and non-pharmaceutical methods for early intervention and treatment.

In the past years, the grants in the field of neurological and psychiatric diseases are obviously homogeneous, predominantly in epilepsy and neurodegenerative diseases, but less in the diseases of peripheral nervous system and neuroimmunology. Although there are many applications on cerebro-vascular diseases, few of them have unique new concepts and researches on cerebral hemorrhage are scarcely funded. The Division hopes to balance its support among applications from neurology, neurosurgery, psychiatric medicine and related clinical medicines such as pediatric medicine and anesthesiology. Clinicians and researchers in basic neurosciences are encouraged to apply together to perform scientifically significant investigation.

### **Medical Imaging and Biomedical Engineering**

In the field of medical imaging and biomedical engineering, the main feature is the disciplinary intercrossing among physics, mathematics, chemistry, information sciences, biology and medicine. Basic and applied basic researches which take medical imaging and information as the content and medical engineering as the means of research are mainly funded, including structural magnetic resonance imaging and disease diagnosis, fMRI and detection of abnormality of brain and spinal functions, magnetic resonance imaging technique and contrast agents, X-ray and CT, electron and ion beam, medical ultrasound and acoustic contrast agents, nuclear medicine, medical photonics, spectrum and optical imaging, molecular imaging and probes, EEG, MEG and brain-computer interface, data processing and analysis of medical images, detection, recognition, processing and analysis of human medical signals, modeling and simulation of biomedical systems, biomedical sensors, medical information system and telemedicine and other related scientific issues. In the field of medical imaging, the important funding direction is to solve basic scientific problems by the application of CT, MRI, fMRI, ultrasound, nuclear medicine, optical imaging methods, combined with data processing and analysis of medical images. Meanwhile, the explorative interdisciplinary studies in

the scientific forefront of this field including the areas of molecular imaging and probes, EEG, MEG, brain-computer interface etc are also encouraged.

In the field of biomedical engineering, medical engineering projects associated with disease diagnosis and treatment as well as applied basic researches related to regenerative medicine, are mainly funded, including the planning or navigation of treatment and robot-assisted therapy, interventional medicine and engineering, rehabilitation engineering and intelligent control, nanomedicine, drug delivery materials and gene transfer systems, medical biomaterials and implantation science, cell transplantation and tissue regeneration, tissue engineering and regenerative medicine, artificial organ and bionic medicine of specific receptors, electromagnetic and physical therapy and medical devices and instruments for the detection, analysis, imaging and treatment. Among them, interventional medicine and engineering, implantation science, cell transplantation and regenerative medicine, etc., are important funding directions. Meanwhile, applications on bacteria or animal models constructed by specific gene modification, cloning and other bio-engineering techniques, as well as rehabilitation medicine, radio-oncology, transplantation organs and their storage methods, pharmacology and drug delivery quomodo, vaccines, immunology and bioinformatics will not be accepted and should be submitted to the corresponding departments or divisions.

The rapid development of modern basic science and applied technology accelerates the progress of medical imaging and biomedical engineering. The Division will continue to focus on the interdisciplinary studies of medical imaging and biomedical engineering not only with mathematics, physics and chemistry, but also with information sciences, materials science and engineering. At the same time, preferential support will be given to young investigators in interdisciplinary scientific frontier exploration mentioned above. It will continue to support those innovative exploration research projects, to encourage the cooperation of scientists with different academic backgrounds and their interdisciplinary research.

### **Division IV of Health Sciences**

The funding scope covers pathogenic organisms and infection, laboratory medicine, skin and appendages, orthopedics and sports medicine, emergency and intensive care/trauma/burns/cold injury/plastic surgery/special medicine/rehabilitation. Applications on the neoplasm in dermatology and orthopedics are covered by Division V of Health Sciences and therefore will not be accepted by this division.

### **Medical Pathogenic Microorganism and Infection**

The Division mainly supports scientific research in pathogenic organisms, principally studies on the characteristics of medical microbes, regularity of heredity and variation,

collection and conservation of pathogenic organism resource, infection and pathogenic mechanism, the immune response of hosts upon infection, detection and study of the ecological behavior of vectors for tracing the sources and the routes of transmission of infectious diseases, acquired drug resistance of pathogenic microorganism and clinical diagnosis and therapeutics of hospital infection, sexually transmitted disease and infectious diseases.

Key scientific problems in the field of pathogenic organisms and infectious diseases are the heredity, variation of pathogenic microorganisms, the structure, function and pathogenicity of pathogenic organisms, and the interaction between pathogens and the hosts, which are also the hot issues worldwide. The Division encourages basic researches carried out innovatively in the above areas, and research in the group abundance, collection and preservation of clinical pathogenic organisms and also related biomedical research. Continuous preferential support will be given to basic research on the rare concerned topics in the field of pathogenic organism.

Analysis of proposals in recent years reveals the rapid improvement of scientific studies in this field in China. Considering fundamental research, more and more scientists bend themselves to the primitively innovative issues, and actively promote their research to meet the international standard. In basic applied areas, more and more candidates focus on the actual status of our country and confront serious problems of health and safety to select topics or fields that are in urgent needs but weak in actual research. However, the following main problems still exist, showing that scientists from medical sciences lack sufficient cooperation with biologists, leading to the difficulty in pursuing in-depth studies in certain key research fields. For example, in the field of pathogenic microbe, due to the lack of efficient cooperation, deep and systematic researches in biological characters and the rule of heredity and variation of pathogen are not adequate, which has caused difficulties in specific identification of pathogenic organisms, vaccine development and drug screenings. Meanwhile, the pathogen species in research is not wide enough, which will bring the risk of coping with the newly exploded contagious diseases unprepared. Aiming at the above problems, the Division will give preferential support to relevant applications.

In laboratory medicine, the funding scope mainly covers research on scientific problems of different contents by diverse methods at different levels. Clinicians are encouraged to cooperate closely with biologists, chemists and physicists to explore new technologies, methods and theories in laboratory medicine in clinical practice.

### **Skin and Appendages**

The funding scope mainly covers the structure, function and dysplasia of the skin and its appendages, basic research and applied basic research on hereditary diseases, immune

diseases and infectious diseases.

### **Orthopedics and Sports Medicine**

Proposals to be accepted here cover all scientific problems in orthopedics and sports medicine except tumor, including structural, functional and developmental disorders, genetic diseases, immunologically mediated diseases, infection and inflammation, injury and repair, grafting and reconstruction, fatigue and recuperation, degenerative disorders, sports injury and deformity and correction. Applications to develop biomaterials in the reconstruction of bone, joint and soft tissue are also encouraged.

### **Emergency and Intensive Care/Trauma/burns/cold Injury/plastic Surgery/Special Medicine/Rehabilitation**

Attention will be focused on the pathophysiological process, influence factors and diagnosis and treatment about emergency and intensive care/trauma /burns/cold injury. Wound healing and scare, reconstruction/regenesis/ transplantation and reforger, craniomaxillofacial deformity and correction are the main concerns in plastic surgery. Special medicine refers to specific pathophysiological process and related diseases in aeronautic, astronautic, nautical, submarine, plateau, polar and other extreme conditions. Rehabilitation medicine mainly supports scientific research on the mechanism of rehabilitation of dyskinesia caused by neuro-musculoskeletal disorders.

Diseases in extreme environment, emergency and intensive care, trauma, burns, etc., are disorders with high disability rate and mortality, therefore, threaten the safety and quality of life. The Division pays high attention to researches on new techniques that could reduce the disability rate and mortality. Since more than one system or organ are usually involved in the diseases, causing systemic inflammation and immune reaction, the Division encourages in-depth and interdisciplinary research.

### **Division V of Health Sciences**

The Division mainly funds research on oncology, including tumor etiology, tumor development, tumor genetics, tumor immunology, tumor prevention, recurrence and metastasis of tumor, tumor stem cell, tumor diagnosis, tumor chemotherapy, physical treatment of tumor, biological treatment of tumor, integrated treatment of tumor, tumor rehabilitation (including social and psychological rehabilitation), new techniques of tumor research, and tumors of all systems and organs which cover tumors in respiratory system, blood and lymph system (excluding leukemia), digestive system, nervous system (including special receptor tumor), urinary system, reproductive system, breast, endocrine system, bone and soft tissue, head, neck and maxillofacial, skin, surface and other parts of the human body.

Proposals related to common scientific problems of tumor biology should choose application codes on tumor etiology, tumorigenesis, tumor genetics, tumor immunology, tumor recurrence and metastasis, tumor stem cell and new techniques of tumor research. Proposals related to clinical basic research on tumor, including tumor prevention, diagnosis, treatment and rehabilitation (including social and psychological rehabilitation), should choose application codes on corresponding system or organ (or) tumors.

Tumor research involves various organ systems. Oncology is one of the most active areas in medical science research, also one of the important areas of “translation medicine, evidence-based medicine and integrative medicine” which have achieved prominent successes. The establishment of a division specialized on oncology is to emphasize, on the one hand, the commonness of tumors, which focuses on the studies of scientific problems and principles about tumors’ occurrence, development, prognosis and so on, and on the other hand, to attach great importance to the distinctiveness of tumors of different systems and organs. The scientific objectives should be set up by the observation and analysis of phenomena and problems in the process of clinical practice from the perspective of tumor prevention, diagnosis and treatment. The results and conclusions of scientific research would further guide clinical practice and raise the level of tumor diagnosis and treatment.

In recent years, research on tumor biology mainly focuses on the exploration of cellular and molecular mechanisms of tumor etiology and occurrence principle. Owing to the rapid development, overlap and pervasion among disciplines such as cell biology, developmental biology, genetics and immunology, the fields of research on tumor cell origin, tumor epigenetics, tumor immunologic tolerance and escape, micro-environment and tumor growth, etc. are becoming the focus of oncological research. While applicants use cell pattern to study tumor biology, attention should be paid to the development and utilization of pattern animals to carry out tumor-related research as well as the methods of genomics and bioinformatics to carry out tumor-related interdisciplinary research. The Division will pay more attention to the research on tumors affecting Chinese people’s health, and to carry out research in terms of environmental and genetic factors and their interaction.

In the clinical basic research of tumor, tumor prevention and diagnosis are one of the important research directions. Main research contents cover the relationship of tumor with various factors ranging from nourishment, radiation, chemical substance to hormone and virus, the finding of molecular markers of tumor early diagnosis, types, lapse and prognosis, and the development of more effective diagnosis methods. In recent years, proposals on tumor treatment study predominantly focus on the research of biological treatment strategies which include the selection and regulation of target gene in gene therapy, selection and optimization of genomic vector, modification of immunological

competent cell, combination of gene therapy and immunotherapy, tumor vaccines and so on. The Division encourages experimental researches of tumor treatment aiming at biological characteristics of various organ tumors, and the exploration of different tumor therapies such as physical, chemical, biological therapy as well as comprehensive treatment methods. In addition, the Division also emphasizes research on tumor individualized therapy.

Applicants should note that research proposals on tumor epidemiology should be submitted to Division VI of Health Sciences, while leukemia-related proposals should be submitted to Division I of Health Sciences.

## **Division VI of Health Sciences**

The Division is responsible for applications concerning basic scientific problems in the areas of preventive medicine, endemiology, occupational medicine, radiology, medical immunology and forensic medicine.

### **Preventive Medicine**

It mainly provides financial assistance to basic and applied basic researches concerning environmental medicine, occupational medicine, human nutrition, food hygiene, women and nursing health, children and adolescent hygiene, hygienic toxicology, hygienic analytical chemistry, epidemiology and health statistics.

### **Endemiology**

Endemiology mainly covers basic and applied basic researches concerning natural nidus diseases, biogeochemical diseases and diseases related to specific living and working modes.

### **Occupational Medicine**

It funds basic and applied basic researches concerning diseases caused by occupational harmful factors.

### **Radiology**

It covers basic and applied basic researches concerning radiological pathology, radiological therapy and radiological prevention. Applications on tumor radiological therapy are accepted by Division V of Health Sciences.

The Division pays more attention to proposals focused on the discovery of new theory, new access and new method. Projects with important scientific significance and original innovation are preferred. The Division supports applications which are based on the actual needs of population health and disease prevention, carry out population research



and use optimal modern molecular biological and immunological methods in population research. The Division stresses research combining on-site survey with laboratory studies, research concerning new disciplinary growth points, prospective research with Chinese characteristics and international leading capacity. Applications are preferred which relate to the interdisciplinary penetration and synthesis, emphasize international cooperation, address definite and proper hypothesis, carry out long-term study on certain scientific problem and have fine research accumulation.

In consideration to the problems occurred before, it is particularly emphasized that the Division does not accept proposals not covered in its funding areas, which include proposals on diseases in gynecology and pediatrics, drug toxicology, mere laboratory study in epidemiology, medical management and health economics. To encourage applicants paying more attention to and carrying out on-site studies, the Division will give preference to proposals organically combining on-site survey and laboratory studies.

### **Medical Immunology**

Specific scientific areas covered in this discipline include basic and applied basic researches on the morphological, structural, functional and developmental abnormalities of immune cells, tissues, organs and systems, as well as the mechanism underlying immune pathological process, immune regulation, immunization, immunodiagnostics and immunotherapy of various diseases, with emphasis on research in the following areas: ( i ) The discovery of new immune molecules and signal transduction pathways, and their relevance to diseases; ( ii ) The phylogenesis of immune systems, immune cells and their subsets involved in immune responses and their relevance to diseases; (iii) The effect of epigenetic modification on immune cell differentiation, and its relevance to diseases; (iv) The mechanism underlying immune recognition by antigen-presenting cells (including dendritic cells, macrophages, NK cells, granulocytes, et al), the triggered immune response and inflammatory processes, as well as the immune regulation of these processes; ( v ) The mechanism underlying the immune recognition-immune responses-immune effects by both innate and adaptive immune systems; (vi) The molecular and cellular mechanisms underlying immune regulation of various diseases; (vii) The mechanism underlying the generation of immune memory cells in the anti-disease immune responses and its regulation; (viii) Research involving inflammatory diseases, hypersensitivity diseases, autoimmune diseases, primary and secondary immunodeficiency diseases, transplantation immunology and organ transplantation. The Division will highlight immunological studies in the above areas either by taking the advantages of the unique genetic or disease resources or by establishing unique research systems or technical platforms (such as unique cell models or animal models, molecular targeting techniques, etc.), studies aimed at understanding the common mechanism underlying human immune-mediated diseases by creating or modifying related animal models, systematic immunological studies that are intended to understand the

immune-related features of across various disease spectrum by immunoinformatics, immunogenomics and computational immunological techniques, and collaborative studies on scientific issues emerging from clinical practices by both basic and clinic researchers. Preferential support will be given to visualized disease-related studies on immune systems and immune response processes by utilizing the recently developed real-time dynamic imaging techniques (MRI, PET, confocal laser microscopy and living cells imaging etc).

### **Forensic Medicine**

Specific scientific areas covered in this discipline include basic and applied basic researches concerning forensic medical issues emerging from legal practices involving human bodies (both corpus and living subject) and their biological materials, with emphasis on researches related to injury, disability, diseases and death. In view of the fact that forensic medical research is generally weak in China, which is indicated by both the small number of applications each year and the lack of applications in forensic medicine jurisprudence research, the Division strongly encourages applications in this discipline, especially those on the systematic research aimed at scientific problems emerging from the legal practices by making full use of the theories and techniques in biology, law science and other scientific disciplines.

### **Division VII of Health Sciences**

The Division mainly supports basic research and applied basic research in the discipline of materia medica and pharmacology. The funding scope for materia medica focuses on sub-disciplines like chemistry of synthetic drugs, chemistry of natural medicines, microbial medicines, biological pharmaceuticals, marine medicines, special pharmacy, drug design and drug informatics, pharmaceuticals, materials for drug delivery, pharmaceutical analysis, drug resources, and other scientific issues related to materia medica. The funding scope for pharmacology focuses on sub-disciplines like neuropsychopharmacology, cardio-cerebrovascular pharmacology, pharmacology of senile diseases, anti-inflammatory and immune pharmacology, anticancer pharmacology, anti-infective pharmacology, pharmacotherapy of metabolic diseases, pharmacology of digestive and respiratory systems, pharmacology of haemal, urinary and reproductive systems, drug metabolism and pharmacokinetics, clinical pharmacology, drug toxicology and other scientific issues related to pharmacology.

In the sub-discipline of pharmaceutical analysis, the development of innovative analytic approaches and techniques are encouraged to solve key scientific problems in the field of materia medica and pharmacology. In the sub-discipline of pharmaceuticals, the integration of innovativeness and feasibility, and that of scientificity and practicability need to be strengthened. Application in the sub-discipline of materials for drug delivery is

emphasized on its own features, which is different from pharmaceuticals. The funding scope of special pharmacy mainly focuses on basic drug research related to the field of aeronautics and astronautics, radiation, military and altitude sickness, etc. In the field of pharmacology, applicants are encouraged to strengthen systematic and intensive research on action mechanism. In the sub-discipline of drug toxicology, proposals need to emphasize more on the research at molecular level or metabolite level.

In view of application in recent years, a large proportion of proposals are still from pharmaceuticals, chemistry of synthetic drugs and chemistry of natural medicines in the field of materia medica, whereas new ideas and intensive research still need to be expanded and improved in these sub-disciplines. In the field of pharmacology, most proposals focus on the functional mechanism of drugs, which are basically tracking research. However, there are also some applications with their own features formed through long-term studies. Proposals on the discoveries of new targets and verifying of targets validation to establish new screening models are insufficient. Proposals usually fail to be approved due to several fundamental facts: preliminary research data being insufficient, research design being oversized or equivocal with the aim, and research ideas being too simple or obviously lacking innovation.

Funding priority will be given to applications in the field of basic research and continuous in-depth research. Since new insights in complex network regulation in life function and disease mechanism are revealed by genomics, proteomics and metabonomics, the Division will strengthen research on network regulation in both materia medica and pharmacology, so as to help establish the theoretical basis for the discovery of new targets and to develop drugs with independent intellectual property rights.

The funding scope does not cover conventional research and pharmaceutical craft research aiming at license application for new drugs. The protection of intellectual property rights in the study of materia medica and pharmacology is very important, and applicants should deal with this issue properly. Any materials containing key techniques or chemical structures to be protected should be sent to the Division directly, which should be explained or illustrated in the application.

## **Division VIII of Health Sciences**

The Division mainly supports basic research and applied basic research in Chinese medicine (CM), Chinese materia medica (CMM) and the integration of CM and western medicine (WM). The Division highlights the advantages of CM and develops the theory of CM. The main supported areas include basic theory of CM, CM clinic, acupuncture, massage, rehabilitation, integrated CM and WM, Chinese materia medica, pharmacology

of CM, ethnic medicine, and new methods and techniques of CM.

### **Chinese Medicine**

- (1) Basic theory of CM: essence of viscera, qi and blood and body fluid and mass, etiology and pathogenesis, basis of syndrome, therapeutic principle and method, prescription of CM, diagnosis of CM, and ethnic medicine;
- (2) Clinical basis of CM: internal medicine of CM, surgery of CM, orthopedics and traumatology of CM, gynecology of CM, pediatrics of CM, ophthalmology of CM, otorhinolaryngology of CM, stomatology of CM, and senile diseases of CM;
- (3) Acupuncture and massage: meridian and acupoint, acupuncture, massage, health keeping and rehabilitation of CM, and other scientific problems related to CM;
- (4) Integrated medicine: basic theory of the integrated medicine, clinical basis of the integrated medicine, and new techniques of CM research.

Recent development tendency include:

- (1) Innovation of academic thoughts is considered as the first key point, and attention is paid to the introduction of the theories and technologies in the frontier areas of life science and other modern science, and multidisciplinary communication;
- (2) Attention is paid to both macroscopic research and microscopic research, and the combination of comprehensive research and analytic research to study the integrated regulation of human body as a whole;
- (3) Multilevel and profound investigation at entirety, system, organ, cell and molecular levels is developed following the guideline of CM theory and based on clinical practice;
- (4) Significance is given to basic research on subhealth prevention and treatment with CM;
- (5) The principles of non-linear complex adaptive system on basic research of TCM are applied to promote the development of CM.

The Division will continue to encourage interdisciplinary integration, to promote the inheritance, development and innovation of CM basic theory. It is stressed that modern science and technology which can successfully explain the theory of CM and bring into play the advantages of CM should be applied and effectively integrated and the tendency of applying high technologies one-sidedly should be avoided. According to the development of modern research of CM, the Division will continue to support the following areas in 2010: doctrine of viscera, syndrome pathogenesis, basis of clinical efficacy evaluation in the prevention and treatment of major medical or refractory diseases, the correlation of prescription and disease, basis of meridian theory and acupuncture to prevent and treat diseases, theoretical and clinical basis of integrated medicine, innovation of methodology of CM, et al. The Division encourages the cross-disciplinary collaborative research with multi-disciplinary philosophy, methods, techniques and measures combined with CM theory. It should be particularly noted that

projects mainly concerned with CM prescription or acupuncture but without mentioning specific herbs or acupoints will not be supported (Applications with confidential information illustrated with explaining letter directly to the Division are excluded.). The application of study on chemistry and pharmacology of Chinese medicine monomer will not be accepted under the discipline codes of integrated medicine, instead, it should be submitted under the code of CMM.

### **Chinese Materia Medica (CMM)**

(1) Materia medica: resources of CMM, identification of CMM, substantial of TCDE (traditional Chinese drug effects), quality evaluation of CMM, processing of CMM, pharmaceutics of CMM, theory of pharmacology of CMM and pharmacy of minority nationals;

(2) Pharmacology of CMM: pharmacology of neuropsychology CMM, pharmacology of cardio-cerebrovascular CMM, pharmacology of anti-tumor CMM, pharmacology of endocrine and metabolism CMM, pharmacology of anti-inflammatory CMM, pharmacology of anti-virus and infection resistant CMM, pharmacology of digestive and respiratory CMM, pharmacology of urinary and reproductive CMM, pharmacokinetics of CMM, toxicology of CMM and other scientific fields related to Chinese pharmacy and pharmacology of CMM.

Applications of recent years show that remarkable progress has been made in the study of CMM. These projects tried to combine the features of CM syndromes and apply cellular and molecular biology, chemistry, biochemistry and other modern scientific theories, ideas and technical measures to clarify the efficacy, mechanism and *in vivo* metabolic processes of CMM and compound, using bioinformatics, computer science, physics, chemistry, mathematics and other subjects to solve scientific issues in basic researches on CMM. From applications in recent years, it can be seen that research on pharmacology of CMM, especially cardio-cerebralvascular and anti-tumor of CMM, is still hot. Most studies still focus on the functional mechanism of certain drugs, which in turn are tracking studies. Some are based on the long-term accumulative studies, whereas studies resemble the featured thoughts of CM theory or original innovation are few. Moreover, applications on the fundamentals of TCDE and pharmaceutics of TCM account for a large percentage, but their research ideas need to be expanded. Identification of CMM, toxicology of CMM and pharmacology nature theory of CMM account for the smallest percentage, in which those having a good topic selection fail to be supported because of the lack of data and materials needed or because of the diversity of research contents, unreasonable techniques or equivocal aim. Most of the applications failed are due to the obvious lack of innovation, or to the fact that key scientific problems of CMM are not targeted at.

The Division will continue to encourage interdisciplinary integration, give priority

support to basic research and continuous in-depth studies. Emphasis will be made on scientific issues and new technical methods under the guidance of CM theory in the following fields: resources and identification of CM, processing, property and preparation of CM, material foundation, pharmacokinetics and mechanism of Chinese materia medica and compound, toxicity, toxicology and relationship between toxicity and efficacy of Chinese materia medica and compound to promote the inheritance, development and innovation of CM basic theory.

According to the features of the Division, applications that only focus on some materia medica or ingredients of CMM without real theoretical thoughts or contents of CM will not be funded. For important contents not suitable to the general application process, a confidential letter should be sent directly to the Division for explanation.