Title of project	Maritime Cross-cultural Exchange in East Asia and the Formation of Japanese Traditional Culture： Interdisciplinary Approach Focusing on Ningbo
Head Investigator Name	Tsuyoshi Kojima, The University of Tokyo, Graduate School of Humanities and Sociology, Associate Professor
Abstract of Research Project **Term of Project: 2005–2009**	This project aims at historical reexamination on the formation of Japanese traditional culture, through analyzing the maritime cross-cultural exchange in East Asia with various academic disciplines. The project will solve the problems of how Chinese culture spread over Japan, of how it had influence there, and of how it was transformed there, focusing on the city of Ningbo, which was one of the most important emporia in Zhejiang province. For the purpose, the project members has come from many disciplines like history, philosophy, literature, fine arts, performing arts, Buddhism study, archeology, anthropology, architecture, medical study, shipbuilding engineering, and mathematics. This interdisciplinary approach of the project will accomplish its mission: What is "Japanese culture" from the view of the maritime area.

Title of project	Formation of Communities of Semitic Tribes：Integrated Research in the Bishri Mountains on the Middle Euphrates
Head Investigator Name	Katsuhiko Ohnuma, Kokushikan University, Institute for Cultural Studies of Ancient Iraq, Professor
Abstract of Research Project **Term of Project: 2005–2009**	The aim of this research area is to clarify how Semitic tribal communities were formed in the Bishri Mountains on the Middle Euphrates, North-East Syria, said to have been a major homeland of the builders of the ancient civilizations of West Asia, such as the Assyrians and Babylonians. To attain this aim, a series of integrated research is to be conducted in the region, through harmonized cooperation of natural and cultural sciences such as environmental geology, physical anthropology, archaeology and philology. This series research is expected to clarify processes of formation of tribal communities in settled societies in the prehistoric period and details of the characteristic features of West Asian cities that have been always linked with nomadic tribal communities surrounding them, thereby providing us with important academic information on "Semitic tribal communities", to which not much attention has been paid so far.

Title of project	Electron transport through a linked molecule in nano-scale
Head Investigator Name	Maki Kawai, The University of Tokyo, Graduate School of Frontier Sciences, Professor
Abstract of Research Project **Term of Project: 2005–2009**	The realization of molecule-based electronic device is a great leap in the electronic device technology. It is crucial to unlock the key problems of how current flows through a single molecule attached to metal electrodes and what combination of molecule and electrode is optimal to achieve specific functions such as switching, amplification and rectification by utilizing a variety of molecular properties. We will investigate how chemical composition, structure, contact chemistry, conformational transformability, and local electronic structure affect the electronic conductivity and the functions of molecular junction, and establish underlying basic physics and chemistry.

Title of project	Multi-quark Systems with Strangeness
Head Investigator Name	Tomofumi Nagae, High Energy Accelerator Research Organization, J-PARC Project Office, Professor
Abstract of Research Project **Term of Project: 2005–2009**	A nucleus at the center of an atom is composed of two types of quarks, up(u) and down(d) with an almost constant density. It is also a many-body system comprised of protons and neutrons. In this research project, we implant the third quark, strange(s) quark, into a nucleus by using the accelerator beams from J-PARC, SPring-8 etc., and produce new types of multi-quark systems. Introduction of a new quark flavor is expected to extend the multi-quark systems in various ways, which are impossible with up- and down- quarks only. We aim to establish a new field of physics on multi-quark systems with strangeness.

Title of project	Development of New Quantum Simulators and Quantum Design
Head Investigator Name	Hisazumi Akai, Graduate School of Science, Osaka University, Department of Physics, Professor
Abstract of Research Project **Term of Project: 2005–2008**	Computational materials design is an efficient method of developing new materials of high functionality in virtual laboratories formed inside computers. In this method, predictions of possible materials realizing desirable properties and/or functionalities are made on the basis of quantum simulations. The purpose of the present investigation is to develop next generation methods of quantum simulation and design, to publicize them and to use these methods to perform quantum design. This revolution will enable us to design materials in which the electrons are strongly correlated. So far such systems have been very difficult to treat. It will also enable us to simulate high functionality devices of submicron size; a size that has never been reached before in quantum mechanical simulations.

Title of project	Physics of new quantum phases in superclean materials
Head Investigator Name	Hiroshi Fukuyama, Department of Physics, Graduate School of Science, The University of Tokyo, Associate Professor
Abstract of Research Project **Term of Project: 2005–2009**	In recent years, new quantum phases and phenomena became known to exist in superclean materials with practically no impurities at very low temperatures close to absolute zero. They include i) the quantum spin liquid state, a new magnetic state, in monolayer helium-three, ii) the superfluid turbulence in liquid helium-four which could be a prototype for understanding the classical fluid turbulence, and iii) the possible coexistence of charge superfluidity and spin superfluidity in the spin-triplet superconducting state of Ruthenium oxides. The aim of this research area is to establish new physical concepts behind these phenomena and, by this, to contribute for developing physics and material science in the 21st century.

Title of project	High Magnetic Field Spin Science in 100 Tesla
Head Investigator Name	Hiroyuki, Nojiri, Tohoku University, Institute for Materials Research, Professor
Abstract of Research Project **Term of Project: 2005–2009**	The project aims at the investigation of the basic principles for spin control of materials and of the novel phases induced by extremely strong magnetic fields. For those purposes, we will develop powerful microscopic methods in non-destructive magnetic fields of 100 Tesla range, such as X-ray scattering, magnetic resonance and time resolved spectroscopy. High field properties of materials such as itinerant magnet, semiconductor, superconductor, complex material and protein will be investigated by those advanced techniques with high precision. The project will lead to the establishment of interdisciplinary high field spin science and the expansion of its frontier.

Title of project	Advanced Molecular Transformations of Carbon Resources
Head Investigator Name	Keiji Maruoka, Kyoto University, Graduate School of Science, Professor
Abstract of Research Project **Term of Project: 2005–2008**	The development of excellent synthetic organic reactions to prepare important materials is urgent to Japan, where natural resources are scarce, as a scientific and technological country in order to keep the international superiority in the field of pharmaceutical and chemical industries. In this priority area, we utilize the readily accessible carbon resources efficiently, and pursuit "preparation of important materials for the safety and security of the mankind" by developing (i) new synthetic reactions based on the truly efficient molecular transformations and (ii) the design of high-performance catalysts in consideration of the following keywords, "synthetic power", "environmental harmony", "atom economy", and "sequential transformations". It is to urgently establish the scientific support system which supplies the results of our basic research to "process synthetic organic chemistry" of our industrial world.

Title of project	The development of tools and methods for analyzing single cell based on the accurate quantitative and digital analysis of bio-molecules：Lifesurveyor
Head Investigator Name	Hideki Kambara, Tokyo University of Agriculture and Technology, Graduate School of Engineering, Professor
Abstract of Research Project **Term of Project: 2005–2008**	Human beings have successfully developed various tools to modify our environments, while we are facing big problems like unusual climate changes, food, and the energy as well as medical problems. It is expected that various bio-technologies will give the solution in a way without affecting our environment because we have got a useful database through the human genome project. However, it is necessary for solving the problems to develop new tools and methods which enable us to understand and utilize life systems based on the database. We focus our attention on the development of tools and methods for analyzing single cell, which is the basic unit of life. The very quantitative analysis of all the molecules in single cell together with the detail analysis of cell to cell communications is the research targets, which will greatly contribute to understanding a real life to solve the problems.

Title of project	Science of Ionic Liquids
Head Investigator Name	Keiko Nishikawa, Chiba University, Graduate School of Science and Technology, Professor
Abstract of Research Project **Term of Project: 2005–2009**	The aim of this research area is to investigate unique properties of ionic liquids, to develop novel chemistry by using them as media, and to create many functional liquids by designing the composite ions. We develop our project from the following three standpoints: 1) What are ionic liquids?, 2) what occur in ionic liquids?, and 3) what can we make by use of ionic liquids?. Results of the researches can contribute to present novel concepts of the materials, to develop "Green Chemistry", and to design and create many functional liquids. Finally, We will establish the roles and status of the ionic liquids.

Title of project	Control of Super-Hierarchical Structures and Innovative Functions of Next-Generation Conjugated Polymers
Head Investigator Name	Kazuo Akagi, University of Tsukuba, Graduate School of Pure and Applied Sciences, Professor
Abstract of Research Project **Term of Project: 2005–2008**	The aim of this research area is to explore profound potentialities of conjugated polymers, and to extract innovative electronic, magnetic and optical functions that should give rise to the next-generation materials. The project focuses on (i) synthesis of novel and fruitful conjugated polymers by means of sophisticated designs for molecules and chemical reactions, and (ii) super-hierarchical control covering primary to higher order structures, and morphological control of self-organized assemblies and complexes, and (iii) precise evaluation of physical properties and investigation of intrinsic functions by virtue of well defined multi-layered structures. Through rigorous achievement of the project, we intend to foster and cultivate the scientific field of conjugated polymers.

Title of project	Innovation for New-Generation Optical Communications — Based on Photonic Device Breakthrough —
Head Investigator Name	Kohroh Kobayashi, Tokyo Institute of Technology, Precision and Intelligence Laboratory, Professor
Abstract of Research Project **Term of Project: 2005–2008**	The aim of this research area is to establish the scientific basis for new-generation optical communications through the breakthrough of innovative photonic devices, which enable ultrahigh capacity, flexible and secure photonic networks in future. This technology involves the innovation on functionalities including the control of various parameters of lightwave such as velocity, phase and quantum states of light. Also, the research team will challenge novel device structures for high speed photonic switching, wide wavelength tuning and so on. In addition, all-optical signal processing for flexible photonic networks will be developed. This new technology and science allow future progress of new-generation optical communication systems with ultrahigh speed transmission and all-optical packet routing functions. The results of this research should contribute to human welfare in future global information societies.

Title of project	Japanese Technological Innovations – Compiling Experience and Forming a Knowledge Base
Head Investigator Name	Keiichi Shimizu, National Science Museum, Chief of the Division of History and Science and Technology, Department of Science and Engineering
Abstract of Research Project **Term of Project: 2005–2009**	During the 20th century, Japan achieved countless technological innovations that have made it the advanced country that it is today. The "experiences in technological innovation" accumulated during the past 100 years represents a massive storehouse of knowledge that can be put to use in further technological development and innovations in Japan during the 21st century. At the same time, however, these "experiences in technological innovation" are rapidly being lost, as a result of numerous factors including the dramatic changes in the industrial structure, the breakdown of the lifelong employment system, and the aging of the engineers that contributed to post-war technological innovations. It is essential that we compile this experience while we are still able, and form a knowledge base that can be put to use in the future.

Title of project	Cyber Infrastructure for the Information-explosion Era
Head Investigator Name	Masaru Kitsuregawa, University of Tokyo, Institute of Industrial Science, Professor
Abstract of Research Project **Term of Project: 2005–2010**	Information created by people has increased rapidly since the year 2000, and now we are in a time which we could call the "information-explosion era." This Grant-in-aid for Priority-area Research aims to establish the following fundamental technologies in this information-explosion era: novel technologies for efficient and trustable information retrieval from explosively growing and heterogeneous information resources; stable, secure, and scalable information systems for managing rapid information growth; and information utilization by harmonized human-system interaction. This priority area also aims to design a social system that cooperates with these technologies. Moreover, it maintains the synergy of cutting-edge technologies in informatics.

Title of project	Emergence of Adaptive Motor Function through Interaction between Body, Brain & Environment –Understanding of *Mobiligence* by Constructive Approach-
Head Investigator Name	Hajime Asama, The University of Tokyo, RACE (Research into Artifacts, Center for Engineering), Professor
Abstract of Research Project **Term of Project: 2005–2009**	Animals can behave adaptively in diverse environment. Such intelligent adaptive motor function is considered to emerge from the interaction among body, brain and environment, which is produced by active motion of the cognitive subject. Thus, we call such adaptive motor function *mobiligence*. In this project, the mechanism of *mobiligence* is elucidated by closely co-operative studies between biology and engineering, which are carried out by a constructive and systematic approach: physiological analysis in the animal, modeling, construction and experiments on artificial systems by utilizing robotic technologies, creation of hypothesis, and its verification. In this project, mechanisms of adaptive motor function on various aspects are studied as well as the common principle through them.

Title of project	System Cell Engineering by Multi-scale Manipulation
Head Investigator Name	Toshio Fukuda, Nagoya University, Department of Micro-Nano Systems Engineering
Abstract of Research Project **Term of Project: 2005–2009**	In this research area, we study on system cell engineering aiming at understanding of communication and control principle of bare function and integration function of the cell. We focus on manipulation technology for works from nano to macro scale (multi-scale manipulation), and we promote interdisciplinary research works between engineering, biological and medical fields. By controlling local environment around the cell, we actively lead to chemical and physical interaction inside and outside the cell, and measure changes. Then, we elucidate the mechanism of the cell system, and realize an artificial cell model based on gene expression control, and regenerate tissue by function control. Based on the engineering innovative technology, we will obtain new scientific knowledge in life science and develop medical engineering, subsequently to contribute to society.

Title of project	Regulatory mechanisms of plant movement by LOV photoreceptors.
Head Investigator Name	Ken-ichiro Shimazaki, Kyushu University, Graduate School of Science, Professor
Abstract of Research Project **Term of Project:2005–2009**	Plants do not move when environmental conditions become worse. The principle environmental factor is light and plants cannot survive without light. Plants respond appropriately utilizing blue region of light by moving the organelles, cells and tissues. Those are chloroplast movement, stomatal opening, and phototropic bending. All these responses enhance photosynthesis and plant production and are mediated by LOV photoreceptors, including phototropins. The responses by LOV photoreceptors are important for plant proliferation on earth and agricultural production. In this project, we aim to elucidate the function of LOV photoreceptors in plants, which induce diverse movement responses of plants.

Title of project	Nutrient uptake and transport in plants・Identification of molecules responsible for transport and their regulation mechanisms
Head Investigator Name	Naoko Nishizawa, The University of Tokyo, Graduate School of Agricultural and Life Sciences, Professor
Abstract of Research Project **Term of Project: 2005–2009**	The aim of this research area is to identify molecules responsible for nutrient uptake and transport and to understand their regulation mechanisms. Resources of model plant systems such as Arabidopsis and rice will be fully utilized in this project. With the use of techniques and knowledge on various fields including molecular genetics, electrophysiology, biochemistry and cell biology, this project will reveals sophisticated molecular mechanisms of plants to take up nutrients in soils which are usually present at very low concentrations. The results of the present projects will provide foundations for the improvement of plant productivity and the protection of global environment.

Title of project	New research initiatives in the study of G-protein signaling systems integrating cell communication network
Head Investigator Name	Toshiaki Katada, The University of Tokyo, Graduate School of Pharmaceutical Sciences, Professor
Abstract of Research Project **Term of Project: 2005–2009**	G proteins, which cycle between the two different conformations of GTP- and GDP-bound states, are involved in many intracellular signaling pathways. There are various families of G proteins that play important roles as a "molecular switch" in the signal transduction systems. The aim of this research area is to clarify the molecular mechanisms underlying how G-protein machinery operates specifically or diversely in the signal transduction systems, and to understand the G-protein signaling systems integrating cell communication network. The progress of the researches can thus contribute greatly to the understanding of mechanisms of diseases resulting from the impairment of cell signaling, which is crucial for the development of new drugs.

Title of project	The network regulating the chromosome cycle
Head Investigator Name	Hisao Masai, Tokyo Metropolitan Organization for Medical Research, The Tokyo Metropolitan Institute of Medical Science, Project Leader
Abstract of Research Project **Term of Project: 2005– 2009**	The chromosome, the carrier of genome DNA, undergoes a series of dynamic changes during the cell cycle. This "chromosome cycle" involves the interplay of DNA replication, segregation, recombination and genomic rearrangement, permitting faithful duplication of the genome and its stable inheritance. The goal of this project is to understand the molecular mechanisms underlying each of these processes and to elucidate how they are coordinated with each other to achieve the integrated and highly regulated progression of the chromosome cycle. The outcome of this project will not only reveal novel insights into chromosome cycle regulation but will also shed light on the mechanisms of how the dysfunction of the chromosome cycle leads to various diseases such as cancer, or to developmental abnormality and, potentially, to aging.

Title of project	Transportsome on biomembrane systems: its molecular assembly and physiological function.
Head Investigator Name	Yoshikatsu Kanai, Kyorin University School of Medicine, Department of Pharmacology and Toxicology, Professor
Abstract of Research Project **Term of Project: 2005– 2009**	The aim of this research area is, by promoting membrane transport researches, to elucidate biological bases of homeostasis and adaptation in violently fluctuating environment. Toward this goal, it is not sufficient to focus on the individual transport molecules such as ion-channels and transporters, but it is essential to study the molecular complexes formed by the assembly of transport molecules and their regulatory molecules. In this research area, we regard such molecular complexes named "Transportsome" as a functional unit of membrane transport and study its molecular assembly and behavior, interaction with biomembranes and roles in biological functions and diseases. By introducing such new theories in membrane transport researches, it would be possible to extend the frontiers of physiology and basic biology and then to contribute to clinical medicine and drug development.

Title of project	Dynamics of extracellular environments that control cell fate–determination and behavior
Head Investigator Name	Takashi Nagasawa, Kyoto University, Institute for Frontier Medical Sciences, Professor
Abstract of Research Project **Term of Project: 2005– 2009**	In every multicellular organism, life and disease are dependent on organized communication between cells and "extracellular environments" since all cells behave in the extracellular space of organs. Extracellular environments contain key players responsible for the communication, including signaling molecules such as cytokines, matrix components, and various modifying enzymes. These molecular cues are spatiotemporally regulated and act on cells in a coordinated manner. Thus this program research project aims at integrating findings made by individual studies of these molecules, which tend to be conducted within a specialized research area, and unraveling the detail of essential contribution of extracellular environments to the cell fate determination and behavior using various approaches.