特定領域研究　新規研究領域要点一覧（English）

Title of project	Compilation of a balanced corpus of written Japanese: Infrastructure for the coming Japanese linguistics
Head Investigator Name	Kikuo Maekawa, The National Institute for Japanese Language, Department of Language Research, Group leader.
Abstract of Research Project **Term of Project: 2006-2010**	The aim of the project consists in the construction of a large-scale balanced corpus of the present-day written Japanese and its application to basic and applied areas. The research members are divided into two groups: the compilation group and the evaluation group. The former group constructs a balanced corpus of about 50,000,000 words consisting of samples taken randomly from two statistical populations. The latter group evaluates the corpus under construction from various points of view encompassing Japanese linguistics, teaching of Japanese as a second language, language planning, dictionary compilation, and natural language processing. The compilation group will make the most use of the feed-backs given by the evaluation group. The corpus compiled in this project will be a complete balanced corpus of the present-day written Japanese when it is coupled with the corpora that will be developed by the NIJL during the same term. The entire corpus will provide a firm basis for the corpus linguistic study of the Japanese language in the 21st century.

Title of project	Multi-level Environmental Governance for Sustainable Development
Head Investigator Name	Kazuhiro Ueta, Kyoto University, Hall of Global Environmental Research, Professor
Abstract of Research Project **Term of Project: 2006-2011**	The objective of the scientific research in this priority area is to present ideas about the format of multi-level environmental governance required to achieve sustainable development. The theories of sustainable development and environmental governance have been undertaken not only by economic science, but also by fields such as political science, public administration, social science, environmentology, and urbanology. However, in order to contribute to the resolution of problems, it is vital to achieve dramatic expansion of the results achieved in these various fields, from a comprehensive viewpoint, and to integrate these results. Specifically, we analyze the dynamic state of economics, the heterogeneous manifestations of the effects economics have on the environment at various levels — global, regional, national, and local — and the interrelationship between these levels. We also clarify the overall structure of environmental governance undertaken in response to this environmental impact. Furthermore, in addition to theoretically presenting a concept of multi-level environmental governance, as it should be realized, we also establish a strategy for making a transition to this type of environmental governance.

Title of project	Creation of non-equilibrium soft matter physics: Structure and dynamics of mesoscopic systems
Head Investigator Name	Takao Ohta, , Kyoto University, Graduate School of Science, Professor
Abstract of Research Project **Term of Project: 2006-2010**	Soft matter includes flexible materials such as polymers, liquid crystals, amphiphilic molecules, colloids, emulsions or biological materials. Soft matter is widely used in our daily life in food, cosmetic or electrical products. We elucidate structure formation and non-equilibrium states of soft matter which are subjected to external forces such as flow, electric, magnetic, stress or optical fields. Basic research on the structure and dynamics of soft matter through the combination of experimental and theoretical methods as well as computer simulation techniques will provide us with a new way to regulate the mesoscopic structures which appear between microscopic and macroscopic length scales.

特定領域研究　新規研究領域要点一覧（English）

Title of project	Linkages in biogeochemical cycles between surface ocean and lower atmosphere
Head Investigator Name	Mitsuo Uematsu, The University of Tokyo, Ocean Research Institute, Professor
Abstract of Research Project **Term of Project: 2006-2010**	Climate and environmental change will have significant impacts on and feedbacks to biogeochemical cycling in the ocean, on atmospheric chemistry, and on chemical exchange between the ocean and atmosphere. These couplings include atmospheric deposition of nutrients that control marine biological activity and ocean carbon uptake, and emissions of trace gases and particles from the ocean and their relations of importance in atmospheric chemistry and climate. Our goal is to achieve quantitative understanding of the key biogeochemical interactions and feedbacks between the ocean and atmosphere. We approach to resolve this linkage by field observation studies mainly using research vessels over the North Pacific Ocean. Numerical modeling studies are required for their systematic evaluation and quantitative assessment.

Title of project	New Developments of Flavor Physics
Head Investigator Name	Taku Yamanaka, Osaka University, Graduate School of Science, Professor
Abstract of Research Project **Term of Project: 2006-2011**	The matter is composed of elementary particles, quarks and leptons. Each type of particles has its own "flavor", and the flavors are mixed together in weak interaction. However, the underlying structure of the flavors is still unknown. Also, physics beyond the standard model, such as supersymmetry, can influence the quark and neutrino mixings. We will make precision measurements on s, b, and t quark transitions, and aim to discover transitions from ν_μ to ν_e or ν_τ. We will also study the new experimental results from theoretical viewpoints. These studies pursue a unified understanding of the structure of the flavors, and the physics beyond the standard model.

Title of project	Probing the Dark Energy through an Extremely Wide & Deep Survey with Subaru Telescope
Head Investigator Name	Hiroshi Karoji, National Astronomical Observatory of Japan, Optical and Infrared Astronomy Division, Professor
Abstract of Research Project **Term of Project: 2006-2011**	One of the most important discoveries of the last decade in Astronomy is the acceleration of the expansion rate of the Universe, and the hypothetical existence of the "Dark Energy" to take account of this phenomenon. The main goal of this newly established research area is, firstly, to develop and manufacture an extremely wide field camera to be mounted on Subaru Telescope's prime focus and conduct a very deep survey of 1000 square degrees level. Secondly, it is intended to analyze thus obtained 100-200 million galaxies to extract pseudo-three dimensional mass distribution (including that of Dark Matter), and to investigate the existence and time variation of Dark Energy by comparing the mass "map" with theoretical models and simulations.

特定領域研究　新規研究領域要点一覧（English）

Title of project	Chemistry of *Concerto* Catalysis
Head Investigator Name	Takao Ikariya, Tokyo Institute of Technology, Graduate School of Science and Engineering, Professor
Abstract of Research Project **Term of Project: 2006–2009**	Many thousands of materials and products as well as fuels required by our modern societies would not be possible without existence of catalysts. Catalysts are also crucial for reduction of water and air pollution and for reduction of waste of natural resources and energy. However, recent advances in green and sustainable science and technology strongly demand more powerful and sophisticated catalysts with a tunable multifunction. This research area focuses on exploring conceptually new *concerto* catalysis by an appreciable improvement in the performance of transition metal-based molecular catalysts in terms of reactivity and selectivity, by a significant accumulation of knowledge of multimetallic catalysts with a multifunction, by a molecular-or nano-level architectural designing of the heterogeneous catalysts, and by efficient integration of biocatalysts and chemocatalysts. We believe that the emergence of powerful *concerto* catalysis provides a great leap to reach more efficient, sustainable and green production processes.

Title of project	Molecular Theory for Real Systems
Head Investigator Name	Shigeyoshi Sakaki, Kyoto Univeristy, Graduate School of Engineering, Professor
Abstract of Research Project **Term of Project: 2006–2009**	In our project of "Molecular theory for real systems", we wish to clarify bonding nature, electronic structure, reaction process, and physicochemical properties of molecules and molecular systems not only by electronic structure theory of isolated molecule but also by consideration of solvation, entropy, coupling with nuclear wavefunction etc. To achieve these purposes, we need to develop high quality electronic structure theory for large system, efficient method for dynamics of large system, high quality molecular dynamic calculation theory, quantum dynamics and so on. We apply these methods to complexed electronic systems, nano-scale molecular systems, biological systems, and reaction dynamics in solution.

Title of project	Synergistic Effects for Creation of Functional Molecules
Head Investigator Name	Norio Miyaura, Hokkaido University, Graduate School of Engineering, Professor
Abstract of Research Project **Term of Project: 2006–2009**	The progress of modern science and technology is largely dependent on the creation of functional molecules precisely controlled at the atomic level. This is because specific interactions and cooperative effects between the elements provide novel functions that are unobtainable through the individual elements. In this project, we pursue the fundamentals and applications of this "synergistic effect of elements". Particular interest will be mainly focused on heavy-element compounds, which are stereoelectronically dynamic and rich in functionality. The newly exploited reactions and compounds are expected to provide the basis for further advance in socially important research areas including environmental chemistry, materials chemistry, and nanoscience.

特定領域研究　新規研究領域要点一覧（English）

Title of project	Deepening and Expansion of Statistical Mechanical Informatics
Head Investigator Name	Yoshiyuki Kabashima, Tokyo Institute of Technology, Interdisciplinary Graduate School of Science and Engineering, Professor
Abstract of Research Project **Term of Project: 2006-2009**	Everything that exists in the natural world is made up of several types of elementary particles. However, we cannot discover everything about nature by identifying the properties of these particles. This is because observations of nature reveal that the collection of many particles can give rise to wholly unpredictable phenomena, regardless of what we know about the particles' properties. In the physical sciences, the importance of focusing on "a large number" of things is reflected in the expression, "More is different." By introducing this perspective into information science, we promote research under the common concept of "More is different in informatics as well." Preliminary studies have produced significant results regarding the basic theories of information and communications. In this project, we expect to deepen our achievements in these fields, while expanding into the fields of quantum information science and bioinformatics.

Title of project	Microwave-Excited, High-Temperature Thermally Non-Equilibrium Reaction Fields
Head Investigator Name	Motoyasu Sato, National Institute for Fusion Science, Coordination Research Center, Professor
Abstract of Research Project **Term of Project: 2006-2010**	Microwaves are not mere substitutes for conventional heating, but they reside in the new domain of materials science, namely, a microscopic and strongly thermal non-equilibrium system. Based on the research results to date, a concept of "Microwave-excited, high-temperature thermally non-equilibrium reaction field" is created. Experiments will be conducted to clarify the energy transfer from electromagnetic waves to materials, and the relaxation process of transferred energy in the materials. It will guide theoretical explanation and development of simulation method. The aim of this project is to develop academic achievements into new materials processing method in various industries. The target industries are, iron manufacturing in the heavy industry area where benefits of energy savings is the greatest and, in the high-tech area, functional materials industries such as nano-science and metal glass for which an innovative manufacturing method is constantly being sought.

Title of project	Single-Flux-Quantum Integrated Circuits based on Localized Electromagnetic Waves
Head Investigator Name	Nobuyuki Yoshikawa, Yokohama National University, Graduate School of Engineering, Professor
Abstract of Research Project **Term of Project: 2006-2009**	Single-flux-quantum (SFQ) circuits, which utilize picosecond small voltage pulses as logical bit information, have properties superior to semiconductor circuits because of their extremely small power consumption with high operating speed. Besides, because superconducting transmission lines propagate a localized electromagnetic wave ballistically without changing its waveform, they can be used as a flexible and high-throughput interconnection in the SFQ circuits. The aim of this research area is to establish future sub-terahertz integrated-circuit technologies, which enable clock frequency beyond 100 GHz, through the systematic study on their physical principles, device technologies, design technologies and their digital applications. These researches will create new integrated electronics with excellent ability unachievable in the present semiconductor electronics.

特定領域研究　新規研究領域要点一覧（English）

Title of project	Giant Straining Process for Advanced Materials Containing Ultra-High Density Lattice Defects
Head Investigator Name	Zenji Horita, Kyushu University, Faculty of Engineering, Professor
Abstract of Research Project **Term of Project: 2006-2008**	Lattice defects in metallic materials are important in determining the mechanical properties and they are normally produced by straining When the imposed strain is extremely large, microstructure refinement occurs to the range of submicrometer to nanometer. Furthermore, both strength and ductility are enhanced simultaneously. In this research project, we impose large strain in metallic materials using a process of severe plastic deformation and investigate the role of high density lattice defects for the microstructure refinement and simultaneous achievement of strength and ductility. This project also aims to establish a new concept of material strengthening based on high-density lattice defects.

Title of project	Technology Evolution for Silicon Nano-Electronics
Head Investigator Name	Shigeaki Zaima, Nagoya University, Graduate School of Engineering, Professor
Abstract of Research Project **Term of Project: 2006-2009**	Silicon ultra-large scale integrated circuits (ULSIs) are now being faced to various physical limits on the scaling. The aim of this research area is to establish the basic science and technology in realizing nano-scale complementary metal-oxide-semiconductor devices (Nano-CMOS) with high performance, new functionality and large-scale integration. This project focuses on (1) the development of new physics, new materials and new functionality for Nano-CMOS, (2) the development of process technologies to construct nano-scale structures and to control various fluctuations, (3) the understanding and control of physical and technological factors in device fluctuations, and (4) the integration and implementation of new functions in Nano-CMOS, and will contribute to the innovation of future silicon nano-electronics with high performance, low power consumption and high flexibility.

Title of project	Optoelectronics Frontier by Nitride Semiconductor -Ultimate Utilization of Nitride Semiconductor Material Potential-
Head Investigator Name	Yasushi Nanishi, Ritsumeikan University, Department of Photonics, Professor
Abstract of Research Project **Term of Project: 2006-2010**	Through the recent developments of the blue light emitting diode and the violet laser diode, nitride semiconductors have contributed a great deal to the development of our society. In terms of high intrinsic potential of the materials, however, nitride semiconductors presently produce only a part of the wavelength region from ultraviolet to infrared. The aim of this research area is to extract the full potential of nitride semiconductors and explore the new frontier of optoelectronics fields by developing novel crystal growth technique and deep understanding of defect physics and luminescence dynamics. The result of the project will provide foundations for advanced science and technology in the 21st century.

特定領域研究　新規研究領域要点一覧（English）

Title of project	Proteolysis in the Regulation of Biological Processes
Head Investigator Name	Noboru Mizushima, Tokyo Metropolitan Organization of Medical Research, The Tokyo Metropolitan Institute of Medical Science, Project Leader
Abstract of Research Project **Term of Project: 2006-2010**	It has been rapidly recognized that protein degradation is involved in not only disposal of unnecessary or damaged proteins, but also controlling various biological processes. The aim of this research area is to reveal the regulation mechanism, and the physiological and pathological roles of protein degradation systems, particularly focusing on "autophagy", "ubiquitin-proteasome" and "calpain" systems. In addition to analyses of each degradation system, we will promote cross-sectional studies between degradation systems. This research project will provide new insights into both basic life science and clinical sciences, which would complement recent genome science.

Title of project	Genome Barriers in Plant Reproduction
Head Investigator Name	Nori Kurata, National Institute of Genetics, Genetic Strains Research Center, Professor
Abstract of Research Project **Term of Project: 2006-2010**	The genome is a unique blueprint of organisms for each species. The genome acquires "genome barriers" that prevent crossing between different species. Human being has been generating novel plant species by crossing a great number of different species with one another to identify a rare combination that overcomes the "genome barriers". In this research area we collectively and integratively study functions of and interactions among genes working during sexual reproduction processes such as gamete generation, pollination, fertilization and seed development, and regulating the "genome barriers". The results obtained in this study will contribute to understanding the "genome barriers" and the mechanisms of the reproduction, and will also serve as basic biological methods to generate novel hybrid plants that consist of highly different genomes.

Title of project	Matrix of Infection Phenomena
Head Investigator Name	Akio Nomoto, The University of Tokyo, Graduate School of Medicine, Professor
Abstract of Research Project **Term of Project: 2006-2010**	Biological phenomena induced by microbe infections emerge as a result of numerous biological interactions between microbe molecules and host molecules. The aim of this study is to investigate molecular mechanisms of multiplication, life cycle, and pathogenesis of microbes. For this purpose, representative infectious agents in each microbe group are chosen. Then, host responses to microbe infection will also be studied. We identify host molecules involved in infection phenomena which support or inhibit microbe infections, and clarify biological functions of these molecules in the infection. Based on these studies, we deepen our understanding of how infection phenomena come into existence as a kind of natural ecology. At the same time, we aim at construction of systems educating young researchers in this scientific field.

特定領域研究　新規研究領域要点一覧（English）

Title of project	Molecular interaction and modal shift of cellular sensors
Head Investigator Name	Makoto Tominaga, National Institutes of Natural Sciences, Okazaki Institute for Integrative Bioscience, Professor
Abstract of Research Project **Term of Project: 2006-2010**	Cells respond dynamically to changes in their environment by sensing a variety of stimuli (including chemical and physical stimuli such as temperature and mechanical stress), converting information received into signals and transmitting the signals intracellularly or to other cells. Further, the information is integrated into sensory input essential for adaptation or survival of the cells. We call the molecules that detect extracellular stimuli 'cellular sensors'; we will clarify how these cellular sensors adjust their functions (undergo a modal shift) depending on the dynamic, spatiotemporal changes in the environment and depending on the species.

Title of project	Innovative nanoscience of supermolecular motor proteins working in biomembranes
Head Investigator Name	Hiroyuki Noji, Osaka University, The Institute of Scientific and Industrial Research (ISIR), Professor
Abstract of Research Project **Term of Project: 2006-2010**	ATP synthase and flagellar motor are supermolecular motor machinery driven by protons flux across the biomembranes in which these motors are embedded. Members of this research project individually blade trails in this research field. The main aim of this project is to promote interdisciplinary research collaborations among the fields of biochemistry, single-molecule biophysics, micro/nano- mechatronics, structural biology, and molecular simulations. In the scheme of this research project, several collaborative works are programmed. For example, collaboration between single-molecule biophysics and simulation of quantum mechanics is planned in which computer simulation of quantum mechanics for catalytic reactions on the ATP synthase will be performed to elucidate the results of single-molecule experiments. Such strategic interdisciplinary collaborations will make a large progress of general understanding of how protein converts energy into work.