Title of project	Three-Level Structure of Civil Society and Governance: A Comprehensive Comparative Study of Japan, Korea, the United States, Germany, and China
Head Investigator Name	Yutaka Tsujinaka, University of Tsukuba, Graduate School of Humanities and Social Sciences, Professor
Abstract of Research Project Number of Researchers : 7 Term of Project: 2005–2009	To successfully formulate and implement policies to create a better society, cooperation of various social actors is essential. Since severe financial situation and changing socio-economic environment have prevented the government and political parties from exercising effective leadership, the issue of governance, in terms of interactions between political and social actors, has attracted much attention. To understand such interactions, we examine the structure of Japanese civil society by running a nation-wide survey, and by comparing Japan with the United States, Korea, Germany, and China. We also explore the structural pattern of civil society organizations at three levels: traditional autonomous bodies (neighborhood organizations), existing social organizations (business and labor organizations and cooperatives), and emerging bodies (NGOs and non-profit organizations). This research reconstructs the Western concept of civil society. It also offers policy implications regarding local governance with respect to ongoing decentralization, as well as for the possibilities of strengthening civil societies in other countries through ODAs.

Title of project	An Empirical Study of Life Styles, Norms and Values through the AsiaBarometer
Head Investigator Name	Takashi Inoguchi, Chuo University, Faculty of Law, Professor
Abstract of Research Project Number of Researchers : 9 Term of Project: 2005–2008	The project aims at investigating the daily lives of ordinary peoples in Asia through social surveys in East, Southeast, South and Central Asia. The data sets acquired through nationwide random sampling and with the same size of 800 will be made accessible to all users as much as possible. All these data will be analyzed with local social scientists participating at each stage of the project. The primary theoretical angles from which all the data are examined are (1) how much developmental momentum is Asia manifesting? (2) how vigorous is Asia's democratizing impulse? (3) How strong is Asia's regionalizing imperative? The project tries to answer these questions.

Title of project	Spin-isospin responses in nuclei in time-like region by means of exothermic charge-exchange reactions
Head Investigator Name	Hideyuki Sakai, The University of Tokyo, Graduate School of Science, Professor
Abstract of Research Project Number of Researchers : 5 Term of Project: 2005–2009	Spin-isospin response of nucleus is a unique excitation mode since it is related with mesons in nuclei and consequently it provides valuable information on nuclear forces. So far the research has been performed by using endothermic reactions by a stable beam such as (p,n) or (n,p) which is inevitably accompanied by a finite momentum transfer to nucleus. Such reactions hamper the study of spin-isospin responses in highly excited regions. We will try to overcome this difficulty by using exothermic reactions by an unstable beam such as (12N,12C) or (12B,12C). With this new experimental means, we pursue the study of spin-isospin responses in the highly excited region, namely in the time-like region. We are aiming to identify new spin excitation modes by constructing a high energy resolution spectrometer SHARAQ dedicated to the exothermic reactions by unstable beams.

Title of project	Study of Quantum Critical Phenomena at Micro Kelvin Temperatures
Head Investigator Name	Haruhiko Suzuki, Kanazawa University, Graduate School of Natural Science and Technology, Professor
Abstract of Research Project Number of Researchers : 3 Term of Project: 2005-2009	A phase transition which occurs at 0 K with changing the value of magnetic field or pressure shows very interesting phenomena due to the quantum fluctuation. This is so called as quantum phase transition. It is unsolved big problem in solid state physics to clarify the phase transition and the state at the critical region of the quantum phase transition which can be affected strongly by the quantum fluctuation. We cannot reach at absolute 0 K, but we will study the phase transition at the lowest temperatures available, that is hundreds of μ K temperatures. This is two orders of magnitude lower than those temperatures in which other researchers are studying 'quantum phase transition'. Then we expect to get more clear data about the quantum phase transition.

Title of project	Development of the 4 Spaces Access Neutron Spectrometer (4SEASONS) and Elucidation of the Mechanism of Oxide High-Tc Superconductivity
Head Investigator Name	Masatoshi Arai, Japan Atomic Energy Research Institute, Center for Neutron Science, R&D Group for Neutron Instrument, Group Leader, Principal Scientist
Abstract of Research Project Number of Researchers : 9 Term of Project: 2005-2009	Discovery of the high-Tc superconductivity (HTSC) in copper-oxides is a significant incident for science as well as technology. Even after 20 years of vigorous research activities, its mechanism has not been completely clarified, though importance of magnetism as well as lattice dynamics has been suggested. Neutron scattering is one of the most powerful tools to study the mechanism of HTSC, because it can directly detect lattice and magnetic properties of materials. In Japan, a world-class pulsed neutron source will be brought into operation in 2007 in Japan Proton Accelerator Research Complex (J-PARC). In the present project, we develop a novel neutron scattering instrument with 100 times higher performance than existing world-class instruments. With this instrument, we solve the challenging problem of HTCS ahead of any other research groups in the world.

Title of project	Highly Controlled New Materials of Heavy Group-14 Elements. Creation and Development of Their Unique Functions
Head Investigator Name	Mitsuo Kira, Tohoku University, Graduate School of Science, Professor
Abstract of Research Project Number of Researchers : 3 Term of Project: 2005-2008	Organic chemistry―chemistry of carbon-based materials has long history and finds various applications towards synthetic medicines, synthetic polymers, functional organic materials, and so on. On the other hands, the chemistry of heavier group-14 elements like silicon and germanium is relatively young and rapidly developing as a field of the basic science. The aim of this study is to make rapid progress of the basic chemistry of silicon and heavier group-14 elements by creating new types of materials and discovering their unique properties and reactions. Our achievements will lead to the development of new excellent catalysts and new functional materials based on the advanced chemsitry of the heavy group-14 elements in the near future.

Title of project	Molecular Design and Quantum Hysteresis of Polyoxometalates-based Molecular Magnets
Head Investigator Name	Toshihiro Yamase, Tokyo Institute of Technology, Chemical Resources Laboratory, Professor
Abstract of Research Project Number of Researchers : 5 Term of Project: 2005–2007	Spin-frustrated polyoxometalate, $K_{11}H[(VO)_3(SbW_9O_{33})_2]\cdot 27H_2O$, containing approximately equilateral $(VO)_3^{6+}$-triangle sandwiched by two diamagnetic $[SbW_9O_{33}]^{9-}$ ligands is found to show magnetization jumps with distinct hysteresis for the S=1/2 $\leftrightarrow$ S=3/2 level-crossing under fast sweeping pulsed magnetic fields at $T \leq 0.5$ K. This unusual phenomenon is attributed to the theoretical prediction of half step magnetization, which is expected for an antiferromagnetic spin triangle with antisymmetrical Dzyaloshinky-Moriya interaction. The spin-frustrated $(VO)_3^{6+}$-triangle for **1** is a good model of the magnetization between pure quantum states S=1/2 and 3/2 and provides a new class of single-molecule magnets. The present research focuses on the molecular design of the extensive series (such as prism, spin hexagon, and spin ball) of magnetic polyoxometalates, which provide a framework for probing magnetic ordering in a spin lattice of the largest series of isoelectronic and isostructural spin systems. Such molecular magnetism of frustrated or ferromagnetic lattice spin systems not only provides a new avenue for detailed exploration of the basic issues of geometric frustration and the origins in the spin anisotropy, but also offers the prospect of being modeled unencumbered by some of the complications of bulk magnetic materials.

Title of project	Science and Technology of Concentrated Polymer Brushes
Head Investigator Name	Takeshi Fukuda, Kyoto University, Institute for Chemical Research, Professor
Abstract of Research Project Number of Researchers : 5 Term of Project: 2005–2008	Polymer chains densely end-grafted on a solid surface are stretched away from the surface to avoid mutual steric interference, forming a “polymer brush”. The structure and properties of a polymer brush should strongly depend on graft density, but a concentrated brush, in which graft chains occupy more than about 10% of the substrate surface, had remained an unknown and inexperienced tissue until recently, when we succeeded in synthesizing concentrated brushes comprising low-polydispersity graft chains by the use of living radical polymerization. The variety of unique and new properties observed for them have promoted us to undertake this comprehensive and systematic study on the synthesis, structure and properties, and functions and applications of concentrated polymer brushes, aiming at the development of new fields of science and technology.

Title of project	Efficient Pattern Discovery from Massive Semi-Structured Data for Knowledge Infrastructure Formation on the Web
Head Investigator Name	Hiroki Arimura, Hokkaido University, Graduate School of Information Science and Technology, Professor
Abstract of Research Project Number of Researchers : 4 Term of Project: 2005–2007	By rapid progress of network and storage technologies for the last decade, a huge amount of weakly structured electronic data of various types, called semi-structured data, is accumulated over networks. In particular, the World Wide Web (WWW, or Web) is the largest knowledge archive spread over the Internet that the human being ever had. We study efficient semi-structured data mining technologies that supports human discovery of useful knowledge from massive collections of semi-structured data on networks. In particular, we develop high-speed semi-structured data mining engines as a core of large-scale knowledge Infrastructure formation technology from the Internet and establish their architecture and base technologies.

Title of project	Atomistic Clarification, Control and Prediction of Irradiation-Induced Embrittlement and Degradation Nuclear Reactor Steels by Advanced Technology of Nano-Materials Science
Head Investigator Name	Masayuki Hasegawa,Tohoku University, Institute for Materials Research, Professor
Abstract of Research Project Number of Researchers : 5 Term of Project: 2005-2009	In Japan, more than 30% electricity is provided by nuclear reactors. Ensuring safe operation of these reactors is a current vital issue since the reactors of the first generation are approaching their initially designed operating lifetimes. The present project focuses on one of the major concerns about the safety of reactor steels - such as embrittlement of the pressure vessel steels. Their microscopic mechanisms in atomic scale are clarified by using a newly developed positron annihilation technique supplemented by the 3D atom probe and electronic-structure calculations. The resulting mechanisms, correlated with the macroscopic mechanical properties, are employed to control and to predict the embrittlement and degradation.

Title of project	Development of an ultra-high resolution semi-conductor PET(:next generation PET) with resolution smaller than 1mm
Head Investigator Name	Keizo Ishii, Tohoku University, Graduate School of Engineering, Professor
Abstract of Research Project Number of Researchers : 10 Term of Project: 2005-2009	PET（Positron Emission Tomograph）is a state-of-the-art medical device using the property of elementary particle (particle-antiparticle annihilation). By measuring 2 gamma rays produced by positron-electron annihilation outside the body after injecting a drug labeled with a positron emitter radioisotope, the distribution of the drug consumed can be imaged. In this project, on the basis of capabilities to define the detection position of gamma rays within accuracy smaller than 1mm by using a semi-conductor detector, we develop a PET with ultra-high spatial resolution smaller than 1mm. This improves the current resolution of PET(3mm~4mm) by one order of magnitude. Our PET enables to find a cancer with size smaller than 1mm and contributes to the extermination of cancer. In addition, it promotes the development of new drugs and gene therapy at molecular level.

Title of project	Basic Processes In Hydrogen Atom-Surface Reactions: Spin Effect, Reaction Dynamics, and Origin of Interstellar Hydrogen Molecules
Head Investigator Name	Akira Namiki, Kyushu Institute of Technology, Faculty of Engineering, Professor
Abstract of Research Project Number of Researchers : 6 Term of Project: 2005-2009	The reaction of atomic hydrogen with surfaces is of a great relevance to vast fields from the material to space science. To know their mechanisms is indispensable for human beings to achieve further development of since and technology. How do hydrogen atoms stick to surfaces? How do they abstract hydrogen adatoms to formhydrogen molecules? In order to answer these questions we will do experiments employing a well defined atomic hydrogen beam and well characterized surfaces. Hydrogen reactions on cold ice surfaces are also studied in experiments to verify that the hydrogen molecule in the space are produced on small dust particles covered with cold water ices.

Title of project	Establishment of Verified Numerical Computation
Head Investigator Name	Shin'ichi Oishi, Waseda University, Faculty of Science and Engineering, Professor
Abstract of Research Project Number of Researchers : 5 Term of Project:2005-2009	When John von Neumann innovated computers, one of his major motivations was to analyze rigorously nonlinear partial differential equations governing fluid. Contrary to this, until present, usually errors of numerical computations do not estimated rigorously. The aim of this research is to establish theory and practice of verified numerical computations, i.e., for linear algebraic equations, we will develop fast and accurate algorithms for calculating rigorous error bounds of numerical solutions. Especially, we will treat sparse and extremely high dimensional problems. Based on this, we will establish a method of computer assisted proof for boundary value problems of nonlinear partial differential equations.

Title of project	Postnatal developmental changes in synaptic molecules underlying maturation of excitatory synaptic transmission and synaptic regulation
Head Investigator Name	Tomoyuki Takahashi, The University of Tokyo, Graduate School of Medicine, Professor
Abstract of Research Project Number of Researchers : 5 Term of Project: 2005-2007	Our principal aim is to clarify molecular mechanisms underlying synaptic transmission and synaptic regulation. Our strategy is to clarify causal relationships between molecules and functions at developing synapses. At the calyx of Held in brainstem slices of rodents at various postnatal ages, we make simultaneous whole-cell recordings from presynaptic terminals and postsynaptic target cells, and infuse, for example, a specific inhibitor or an activator of a functional molecule into a presynaptic terminal. By analyzing changes in synaptic responses, presynaptic ion channel currents and vesicle exo- and endocytosis, a role of a molecule in the nerve terminal can be identified. Using this method in combination with immunocytochemical techniques for presynaptic proteins and gene-knockout mice, we will solve fundamental questions regarding transmitter release and its regulation.

Title of project	Mechanisms that lead to the difference in equational and reductional chromosome segregation
Head Investigator Name	Yoshinori Watanabe, The University of Tokyo, Institute of Molecular and Cellular Biosciences, Professor
Abstract of Research Project Number of Researchers : 1 Term of Project: 2005-2009	Throughout long history of life, organisms have persisted with dependence on equational division, which equally divides replicated copies of genome (or chromosomes). Eukaryotic organisms could diversify and achieve splendid evolution thanks to the acquisition of a sexual reproduction system, which involves the mixture of the genomes of two different organisms. In establishing the sexual reproduction system, the bottle neck must have been the acquisition of the ability to precisely reduce the chromosome number by half, a process that is much more complex and exquisite than that of mixing genomes. In this study, we will uncover the molecular mechanisms that comprise the difference between equational and reductional chromosome segregation.

Title of project	AID-dependent genetic alteration mechanism to generate antigen-specific antibodies
Head Investigator Name	Tasuku Honjo, Kyoto University, Graduate School of Medicine, Immunolgy and Genomic Medicine, Professor
Abstract of Research Project Number of Researchers : 4 Term of Project: 2005-2009	Vertebrates defend themselves from innumerabale pathogens (antigens) by producing diverse antibodies that efficiently bind and destroy antigens. To do so, vertebrates like humans have to introduce alterations in the genes for antibody because they have only 20,000 to 30,000 genes. The antibody gene is altered by two distinct manners; somatic hypermutation (SHM) that replaces base-pairs in DNA encoding the antigen binding domain of antibodies and class switch recombination (CSR) that replaces the exons encoding the domain for antigen elimination. In 1999, we discovered AID essential for SHM and CSR and showed that AID cleaves DNA for these DNA alterations. In this project, we will focus on the following aspects; a) how AID can mediate two apparently distinct DNA alteration machanisms, i.e. mutations and recombination, and b) how AID cleaves DNA. This research will unveil the machanism for generation of antigen specific antibodies, which has been one of the greatest mysteries in biology since last century.

Title of project	Studies on molecular mechanisms that control development and function of the neural network
Head Investigator Name	Shigetada Nakanishi, Osaka Bioscience Institute, Director
Abstract of Research Project Number of Researchers : 3 Term of Project: 2005-2009	The objective of this project is to elucidate regulatory and intergrative mechanisms of the neural network. Investigations are directed toward the neural networks of the cerebellum and the basal ganglia, in which input and output of neural information are relatively quantitatively examined. Three fundamental questions are addressed;1)how the functional cerebellar network is formed in an activity-dependent manner during the postnatal period; 2)how the cerebellar network controls motor coordination and motor learning; 3) how the basal ganglia network governs motor balance and causes addiction of abused drugs. The investigations will be conducted by combining various interdisciplinary approaches including molecular biology, knockout/transgenic techniques, electrophysiology and morphology.

Title of project	Molecular mechanism and physiological role of apoptosis
Head Investigator Name	Shigekazu Nagata, Osaka University , Graduate School of Frontier Bioscience, Professor
Abstract of Research Project Number of Researchers : 2 Term of Project: 2005-2009	Many harmful and toxic cells are generated in animal, and they die *via* apoptosis. In the apoptotic process, cells shrink and condense, and their DNA is degraded. This process is mediated by a group of proteases called caspases, and a DNase (CAD) that is activated by caspases. Dying apoptotic cells expose phosphatidylserine on their surface, and are engulfed by macrophages. In this project, we will study the molecular mechanism of the apoptotic processes. We will then prepare mice deficient in the genes involved in apoptosis, and see whether their defect will cause any diseases or not.

Title of project	Chromatin Dynamics underlying Cellular Memory
Head Investigator Name	Susumu Hirose, National Institute of Genetics, Department of Developmental Genetics, Professor
Abstract of Research Project Number of Researchers : 2 Term of Project: 2005–2007	Cellular memory is defined as a phenomenon in which a particular pattern of gene expression is maintained through cell divisions and even after cell division. For example, once expression pattern of the *Hox* genes is established during embryogenesis, it is maintained for a long period through cell divisions and governs the formation of the body segments. Thus, cellular memory plays crucial roles in the development of multicellular organisms. In this study, we aimed to elucidate the mechanisms underlying cellular memory using the fly *Drosophila melanogaster*in which both molecular and genetic approaches are amenable, and verify their generality through the studies using the mouse.

Title of project	Uncovering the mystery of molecular assembly and diversity of the proteasome
Head Investigator Name	Keiji Tanaka, Tokyo Metropolitan Organization for Medical Research, The Tokyo Metropolitan Institute of Medical Science, Vice director
Abstract of Research Project Number of Researchers : 1 Term of Project: 2005– 2009	The proteasome (a eukaryotic ATP-dependent protease complex) collaborating with ubiquitin (a posttranslational modifier serving as the degradation signal) as a partner is a protein-destroying apparatus requiring metabolic energy. It is now clear that this cellular apparatus actively controls a wide variety of biologically important processes, such as cell-cycle control, metabolic regulation, immune responses, signal transduction, transcriptional control, quality control, stress response, DNA repair, etc. Over the past 25 years, we have been aiming to elucidate comprehensively the divergent roles of the proteasome in the life science field, but the details still have remained unknown. The main objects of our study are to clarify how the proteasome is assembled with high fidelity as an unusually large multi-enzymatic complex and why the proteasome displays molecular diversity.