# III. Fiscal 2002 Research Assistance Program

(Information about grant recipients appears as provided by the recipients at the time of the presentation ceremony. Some details may have changed since that time.)

## 1. Natural Sciences Research Assistance
*58 grants*

### Key subjects: Substances and materials, life sciences, information sciences and automatic control systems, the environment, and energy

### Area 1 (Chemistry and Biology)
*40 grants*

**Research Areas**

* *Design and precision fabrication of new substances and materials*
* *Creation and functional evaluation of hybrid inorganic/organic materials*
* *Surface/interface control at the nano level*
* *Creation of environmentally friendly chemical processes*
* *Research integrating chemistry and biosciences*
* *Bioproduction based on research into substances*
* *Investigation and application of biological processes at the molecular level*
* *Basic research into environmental biology*

**Specific reseach assistance A: 2 grants**

**1. Design of Environmentally Benign Chiral Phase-Transfer Catalysts and Development of Practical Asymmetric Processes of Useful Amino Acids and Peptides**

Keiji Maruoka
Professor, Department of Chemistry, Graduate School of Science, Kyoto University
¥10,000,000; 2002-2004

Phase transfer reactions, in which organocatalysts move between water and organic layers, have been easily developed to industrial processes, and serve as environmentally benign, pollution-free reaction systems. In order to overcome several intrinsic disadvantages in previously designed catalysts, we would like to design new, chiral phase transfer catalysts from commercially available chiral sources and applied such organocatalysts to practical synthesis of various types of natural and unnatural amino acids, direct synthesis of physiologically active amino acids such as L-dopa and L-azatyrosine, and new synthesis of α, α-dialkylamino acids to prepare physiologically active, unnatural peptides as potential new drugs.

**2. Approach for Cell-Free Immunology**

Takuya Ueda
Professor, Department of Integrated Biosciences, Graduate School of Frontier Sciences, The University of Tokyo
¥9,500,000; 2002-2003

Antibody is widely utilized as diagnostic product and has been paid attention as a potential therapeutic product in the medical field, because of its high specificity toward a target molecule. However, present method for the production of the antibody is based on the use of immune system of living animals, which is sometimes accused in terms of animal protection. Moreover the variation of antibody produced by this method is limited within the naturally occurring possibility. In this research, we will synthesize antibody genes with random sequences and will address to design a novel selection system for particular antibody molecules specifically binding to target molecules. Through this approach we will establish a cell-free immune system.

**Specific research assistance B: 17 grants**

**3. Environmentally Benign Lewis Acid Catalysts Derived from Main Group Elements as an Active Center**

Masahiro Terada
Associate Professor, Department of Chemistry, Graduate School of Science, Tohoku University
¥5,000,000; 2002-2004

Lewis acid complexes have been utilized to an efficient catalyst for some carbon-carbon bond forming reactions as well as other transformations. In spite of such efficiency of the Lewis acid catalysis, there exists disadvantage to be overcome in terms of the construction of environmentally benign processes avoiding waste materials. To develop a highly efficient catalysis we focus on the main group element, which has been paid little attention to the active center of Lewis acid catalysts so far. The key to success of this research project is rational design of the catalyst molecule. The main group element as an active center of the catalyst can be introduced to the solid phase through

covalent bonding. The solid supported catalyst can be readily removed from reaction media and construct recyclable process without any loss of active center, because active center is connected via covalent bonding. This immobilization protocol can be expected to make this catalytic system environmentally benign.

### 4. Development of High Energy Density Oxide as an Anode in Lithium Ion Batteries

Masataka Wakihara
Professor, Graduate School of Science and Engineering, Tokyo Institute of Technology
¥5,000,000; 2002-2004

In recent years, lithium ion secondary batteries have much attention because of their wide applications as the power source for portable telephones, laptop computers, and electric vehicles. Generally, commercially available lithium ion batteries consist of two Li-intercalation materials as both cathode and anode materials. Commonly, lithiated transition metal oxide is used as the cathode and graphite is used as the anode. However, the graphite anode suffers from low specific capacity. Oxide anode is attractive because of their chemical stability and high reversible capacity. In this research, we will develop a novel oxide having a monoclinic brannerite type structure. We will determine the electrochemical reaction mechanisms, crystal structural changes during charge-discharge process. Based on the information, we will design novel oxide materials with high energy density as an anode.

### 5. Explore of Photo-Controllable Conductive Oxides

Yutaka Moritomo
Associate Professor, Department of Applied Physics, Nagoya University
¥5,000,000; 2002-2003

Purpose of this study is to explore oxides materials whose magnetic and electronic properties can be controlled by irradiation of light. For example, the physical properties of perovskite-type doped manganites can be controlled by chemical substitution from ferromagnetic metal and insulator. If the material state can be controlled by irradiation light, we can make metallic wire and/or insulative wire by micro-fabrication technique. Especially, insulative thin wall in the ferromagnetic metal behave as a tunneling junction. Then, we can expect a large magnetoresistance effect, which can be utilized as a magnetic sensor or magnetic head.

### 6. Preparation of Novel Ionic Conductors of Coordination Polymers

Susumu Kitagawa
Professor, Department of Synthetic Chemistry and Biological Chemistry, Kyoto University
¥5,000,000; 2002-2004

Toward new materials with high ionic conductivity, novel coordination polymers with channel structures are designed and prepared. A characteristic feature for this materials is a channel constructed from coordination frameworks, where lithium ions run smoothly while counter anions are fixed. This materials would open up a new dimension for studies on conductors.

### 7. Design of the New Hybrid Organic/Inorganic Nano-Clusters and Branched Polymers, and Their Application to Advanced Functional Materials

Akira Sekiguchi
Professor, Department of Chemistry, University of Tsukuba
¥5,000,000; 2002-2004

Polysilanes, linear polymers with silicon backbone, and inorganic silicon clusters are highly promising compounds, which have received much attention due to their unique optical and electronic properties. The principal objective of this study is to create the new hybrid organic/inorganic nano-clusters and branched polymers composed of silicon and germanium atoms. During the course of this investigation the structure, specific physical and chemical properties of such new organic/inorganic materials will be investigated, as well as their application for the creation of the new advanced functional materials. This study will be devoted to the development of material science.

### 8. Syntheses of Nano-magnets

Hiroki Oshio
Professor, Department of Chemistry, University of Tsukuba
¥5,000,000; 2002-2003

Multi-nuclear complexes with high-spin ground states have a parallel spin alignment of constituent metal ions in the ground state. Such molecules show superparamagnetic behaviours including magnetic hysteresis and quantum tunneling of magnetization, and behave as a single-domain bulk magnet. These molecules are, therefore, called as a nano-magnet (single molecule magnet), and are expected to be used as memory devises. This research project focuses on the two points: First, preparation of high-temperature nano-magnets, and secondly to establish methods of assembling nanomagnets for application to memory devises.

### 9. Electron Transfer Dynamics at Solid-Liquid Interface

Masatoshi Osawa
Professor, Catalysis Research Center, Hokkaido University
¥5,000,000; 2002-2004

Electrochemistry can be used in modern technologies such as fuel cells, biosensors, nanofabrication of materials (nano-scale etching and deposition), and self-assembly of molecular monolayers. It constitutes also the basis of biochemistry. Despite extensive studies, however, reaction processes occurring on the electrode surface have not yet been understood so well due to the lack of suitable methodology. This project aims to investigate electrochemical reaction processes in detail by focusing electron transfer between electrode and solution. Fast time-resolved surface-enhanced infrared spectroscopy developed in our laboratory allows real-time monitoring of reactions at a molecular scale with time-resolutions down to nanoseconds. This

study will be able to support the newly developing technologies mentioned above.

### 10. Development of a New Technology to Prepare Metal Oxide Films with Nanometer Thickness

Takato Nakamura
Professor, Faculty of Engineering, Shizuoka University
¥5,000,000; 2002-2003

Much attention has been paid for metal oxide films with nanometer thickness. Amongst them, $ZrO_2$ film is one of the candidates as a high-k insulator applicable to semiconductor devices. It is essential for this purpose that the films are defect-free. Therefore, the preparation technique being developed should be capable of controlling the sophisticated stepwise growth of $ZrO_2$ monolayer. The techniques being studied so far are useful under reduced pressure, which leads to the formation of oxygen defects in the oxide films. On the contrary, there have been few investigations reported on the $ZrO_2$ film deposited under atmospheric pressure. In this project, therefore, we develop a new technique to prepare the $ZrO_2$ films under atmospheric pressure by atomic layer deposition (ALD). It would be proved that the atmospheric pressure ALD with metal halides as a starting material is not only a simple and inexpensive method, but also applicable for the preparation of a variety of high quality metal oxides films.

### 11. Development of Epoxidation of Alkenes with Molecular Oxygen

Noritaka Mizuno
Professor, Department of Applied Chemistry, School of Engineering, The University of Tokyo
¥5,100,000; 2002-2003

Catalytic epoxidation of alkenes have attracted much attention both in industrial processes and organic syntheses because epoxide is one of the most useful synthetic intermediates. Epoxidation of alkenes can be carried out using various techniques with various oxidants. However, stoichiometric (non-catalytic) epoxidation is still widely used, and large amounts of byproducts, particularly salts, were formed. The utilization of molecular oxygen for catalytic epoxidation without reducing reagents or radical initiators is a rewarding goal because molecular oxygen has the highest content of active oxygen and forms no byproducts from itself among various oxidants. Here, metal-substituted polyoxometalates will be used as a catalyst precursor for the development of green epoxidation of alkenes with molecular oxygen.

### 12. Bioinorganic Chemical Studies of Copper-containing Reductases in Anaerobic Respiration System

Shin-ichiro Suzuki
Professor, Osaka University
¥5,000,000; 2002-2004

This work is focused on the elucidation of structure-function relationship of copper-containing reductases, nitrite reductase and nitrous oxide reductase isolated from anaerobic respiratory denitrifying bacteria by various spectroscopies, recombinant DNA method, and X-ray crystal structure analysis. The results obtained by this research will give basic clues as to 1) an understanding of anaerobic respiration system which is still not completely understood and 2) the protection against global population (greenhouse warming and the destruction of ozone) of increasing nitrous oxide probably responsible for denitrifying bacteria and mold, for feeding humankind now demands much nitrogen-based fertilizer.

### 13. Analysis of Novel Functions of Ubiquinone and Its Microbial Production

Makoto Kawamukai
Professor, Department of Life Science and Biotechnology, Faculty of Life and Environmental Science, Shimane University
¥5,000,000; 2002-2004

Ubiquinone (Coenzyme Q) has been known to be an important component of the electron transfer system. In addition, it was recently shown that ubiquinone works as a lipid antioxidant, involves in life span of nematode and disulfide formation of protein. We have found ubiquinone involves in generation of hydrogen sulfide. In this study we aimed to study novel roles of ubiquinone and develop the microbial production of ubiquinone. The gene analysis of ubiquinone biosynthesis will also help to understand the involvement of ubiquione in human genetic disease.

### 14. Molecular Analysis of Pollen Sterility in Higher Plants and Its Application to Hybrid Crop Breeding

Tetsuo Mikami
Professor, Graduate School of Agriculture, Hokkaido University
¥5,000,000; 2002-2003

Pollen sterility is a commonly observed phenotype in higher plants. For hybrid seed production, this phenotype provides an alternative to hand or mechanical emasculation, which is usually costly or impractical. Pollen sterility is a mainstay for the hybrid sugarbeet industry because large-scale emasculation is not feasible, owing to sugarbeet's small flower size and the close proximity of stamens and carpels. Unfortunately, very little is known about the mechanism of pollen sterility. The primary goal of this research is to elucidate the structure and expression of genes which are responsible for pollen sterility in sugarbeet. Our study would help to develop the new techniques in molecular breeding of hybrid sugarbeet varieties.

### 15. Functional and Structural Studies on the Raft Domain of the Mammalian Neuronal Cell Membrane

Shohei Maekawa
Professor, Graduate School of Science and Technology, Kobe-University
¥5,000,000; 2002-2003

The nutrition, transport, and excretion of cholesterol are definitely controlled in our body. The imbalance of the cholesterol metabolism will cause not only arteriosclerosis but also Alzheimer's disease. Cholesterol works mainly as a component of the cell membrane. This study focuses on the elucidation of the role of cholesterol in the neuronal cell membrane. The understanding of the construction and regulatory mechanism of the neuronal cell membrane will contribute to the molecular understanding of the neuronal depression through aging and neuronal cell death.

### 16. Biodiversity and Coevolving Genomes

Naoyuki Takahata
Vice President, Professor, Department of Biosystems Science, Graduate University for Advanced Studies
¥5,000,000; 2002-2003

It is more likely that the human has evolved by loss of genes than that it has evolved by gain of new genes. In this project, to examine this view deduced from a few instances, we systematically search for genes that were lost specifically in the human lineage during the past 5 or 6 million years. We will then determine the cause and timing of loss of genes, and investigate the relationship among the genomes of the human and other related organisms. Specifically, we demonstrate the inter-dependence or the principle of coexistence that holds true at the genomic level. We also argue the significance of biodiversity from a viewpoint of genetics.

### 17. Physiological Role of Placenta in Iron Reutilization System

Reiko Akagi
Associate Professor, Department of Nutritional Science, Faculty of Health and Welfare Science, Okayama Prefectural University
¥5,000,000; 2002-2003

Although iron is an essential nutrition, excess amount of free iron is known to cause oxidative stress via reactive oxygen species production. The reasonable amount of iron intake should be based on the physiological movement of iron. The aim of this study is to clarify the reutilizing system of iron, which supplies 99% of iron demand within organisms. We will start investigating placenta, which supply a huge amount of iron from maternal blood flow to fetus. We have already found that placental trophoblast expresses extremely high level of heme oxygenase, which is a key enzyme to break down heme to iron. Since 90% of iron in organisms is incorporated in heme, biological iron is thought to make a round trip mediated by heme oxygenase. Based on the result from placenta, we intend to propose an appropriate way of iron supply throughout life stage.

### 18. Identification of a Centromere-like Sequence on Bacterial Chromosomes Using a Gemonic Manipulation

Hironori Niki
Associate Professor, The Radioisotope Center, National Institute of Genetics
¥5,000,000; 2002-2003

Now, bacterial infection is very serious problem for human health. Genomic analyzes using complete sequences of bacterial genome make a breakthrough to conquest infection diseases. However, cis-acting elements on the bacterial chromosome are not elucidated by the only sequences. Especially a cis-acting site for chromosome partitioning like a centromere in eukaryotes has not revealed until now. We challenge to identify the cis-acting site on the Esherichia coli chromosome by using our developed method to manipulate bacterial chromosomes. According to this, one circular chromosome will be split into two chromosomes. A series of such chromosomal mutants is very useful for identification on cis-acting elements on the chromosome. Indeed we have already found candidate chromosomal region as centromere in bacteria. Furthermore, we will identify the specific region and some binding factors to the site. To elucidate molecular mechanism on chromosome partitioning will be help for design of a drug which targets chromosome partitioning.

### 19. Development of a Novel Synthetic Method of Pheromones Using Recombinant Prenyltransferases

Masahiko Nagaki
Associate professor, Faculty of Science and Technology, Hirosaki University
¥4,500,000; 2002-2004

The purpose of this study is to develop a synthetic method using recombinant prenyltransferases of a novel pheromone-like material for a noxious insect to disturb their biological communication. If the insect communication is disturbed by the synthetic sex pheromone, the progeny of the noxious insect will be gradually exterminated. Reductions of the amount of the commonly used toxic insecticides as well as the manpower are expected when it is used jointly with the pheromone material, which is effective specifically with a trace amount and is harmless toward human body and crops. Some spin-off benefits for prevention of the toxic agricultural chemicals can be expected. Therefore, the enzymatic syntheses of such pheromone-like material are worthwhile and will contribute for the development of a clean agriculture in the twenty-first Century.

## Encouragement research assistance: 21 grants

### 20. Enantioselective Polyene Cyclization Reaction Induced by Lewis Acid-Assisted Chiral Brønsted Acid

Kazuaki Ishihara
Associate Professor, Department of Biotechnology, Graduate School of Engineering, Nagoya University
¥2,000,000; 2002-2003

A variety of terpenoids are enzymatically synthesized by cyclization of polyprenoids such as squalene in biological systems. The purpose of the project is to develop a highly enantio- and diastereoselective cyclization of polyprenoids induced by a Lewis acid-assisted chiral Brønsted acid (chiral LBA). The rational design of "chiral Brønsted acid catalysts" based on the concept of LBA may lead to practical artificial cyclases for the asymmetric synthesis of a wide range of optically active polycyclic terpenoids.

### 21. Application of an Asymmetric Synthesis Technique to the Preparation of Optically Active Metallocene Polymers

Masamichi Ogasawara
Assistant Professor, Department of Chemistry, Graduate School of Science, Kyoto University
¥2,000,000; 2002-2003

The objectives of this research project are synthesis of novel optically active polymers and their application to asymmetric reactions, molecular recognition, and chiral sensing. The target chiral polymers contain metallocene substructures in their main chains, in which metallocene-based planar chirality as well as carbon central chirality can be introduced. The main strategy to these goals is synthesis of enantiomerically enriched chiral monomers taking advantage of the asymmetric synthesis technology. Practical chiral polymers prepared with optically active monomers are very rare except for polymerization of naturally occurring monomers or their derivatives due to expensiveness of optically active compounds. Since the asymmetric synthesis of small molecules is already a "mature" technique, very high ee's (possibly enantiomerical pureness) in the designed chiral monomers is a realistic target. The polymers from the chiral monomers will be enantiomerically pure, thus novel application in asymmetric synthesis and high-performance in chiral sensing/chiral recognition will be expected with the polymers.

### 22. Low Temperature Electrochemical Synthesis and Characterization of Crystals of Oxide Superconductors

Hiroaki Samata
Associate Professor, Electro-Mechanical Engineering, Faculty of Mercantile Marine Science, Kobe University of Mercantile Marine
¥2,000,000; 2002-2003

For wide practical application of superconductors, it is decisively important to discover new superconductors with high transition temperature. Moreover, the discovery of new materials will open up a new physics. In some cases, the search for new materials is limited by the synthesis method, and a new route must be developed to discover new materials. This study has been planed to develop a new technique for synthesis of oxide single crystals and to search new oxide superconductors. Among the synthesis methods, electrochemical method is an effective method for low temperature crystal growth. This method, however, has hardly been used for the synthesis of oxides. In this study, the electrochemical method is applied to the synthesis of oxides and the characterization of the crystals is performed from various viewpoints.

### 23. Construction of Chiral Environment Due to Spontaneous Resolution of Optical Activity

Isao Azumaya
Lecturer, School of Pharmaceutical Sciences, Kitasato University
¥2,000,000; 2002-2003

Various kinds of chiral ligands have been developed for asymmetric reactions. All such ligands have fixed chiral center, axis or plane. In this study, a spontaneous resolution of optical activity in crystallization of a compound which has no fixed chiral center will be applied to obtain a chiral source. An asymmetric induction will be tried in various reactions in the presence of the chiral crystal. Furthermore, the compound will be tried to use as a chiral auxiliary in a reaction at low temperature at which a racemization of the compound is slow enough. A procedure for a rapid determination whether a compound crystallizes as chiral crystals or not will be also developed.

### 24. Prostate Cancer Specific Cell-Mediated Immunotherapy Utilizing Dendritic Cells Pulsed with Prostate-Specific Antigen

Yutaka Horiguchi
Department of Urology, School of Medicine, Keio University
¥2,000,000; 2002-2003

Prostate cancer is a significant and growing health problem in the Japanese population, and hormone-refractory disease is known to be highly resistant to the conventional radiotherapy and/or chemotherapy. Therefore, it is important to develop an alternative strategy to treat these hormone-refractory prostate cancer patients. Prostate-specific membrane antigen (PSMA), which is a transmembrane glycoprotein predominantly expressed in prostate cancer, is an attractive target for tumor-specific immunotherapy. Because HLA-A24 is the most common MHC class I allele among Japanese population and is also frequently present in Asian and Caucasian, it is of great interest to identify HLA-A24-restricted epitope peptides from PSMA for further application of the dendritic cells (DC)-based immunotherapy targeting of prostate cancer. To identify HLA-A24-restricted epitope peptides, several PSMA-encoded HLA-A24 binding peptides will be designed and screened for their capabilities to elicit specific antitumor cytotoxic T-

lymphocytes response. These epitopes would be utilized to further evaluate the clinical utility of DC-based immunotherapeutic strategies for treatment of hormone-refractory prostate cancers.

### 25. Anisotropy of Surface/Interface Free Energy of Ceramics

Takayuki Narushima
Associate Professor, Department of Metallurgy, Graduate School of Engineering, Tohoku University
¥2,000,000; 2002-2003

The new experimental method to evaluate anisotropy of surface/interface free energy of ceramics has been proposed. Using the new method, the anisotropy of surface free energy of silicon carbide crystal and of interface free energy between liquid steel and sapphire are clarified experimentally at high temperatures. Surface/interface free energy of ceramics is closely related to many industrial processes such as ceramic syntheses, metal refining or single crystal growth. However, experimental evaluation of the anisotropy has been considered to be difficult at high temperatures. The evaluation method newly developed in the present work can be applied to a variety of material systems because the new method is hardly limited by the experimental conditions of the system (temperatures, atmospheres, materials and so on).

### 26. Fabrication of New Nano-Materials at the Oxide-Metal Interfaces

Yuji Matsumoto
Research Associate, Materials and Structures Laboratory, Tokyo Institute of Technology
¥2,000,000; 2002-2003

For the future nano-science and technology, oxide ceramics material is expected to play a key role as well as Si-based semiconductors. The powerful combination of a pulsed laser deposition technique and scanning tunneling microscopy enables us to fabricate new functional nano-materials and structures such as quantum dots and heterogeneous catalysts at the interface between metals and oxides. This project is aimed to establish the atomic level fabrication of metal-oxide interface structures and to find out new functional nano-materials and structures for the contribution to the development of new quantum device and environment catalyst.

### 27. Microscopic Ion-Exchange of Glass by Atomic Force Microscope

Tetsuji Yano
Research Associate, Department of Chemistry and Materials Science, Graduate School of Science and Engineering, Tokyo Institute of Technology
¥1,900,000; 2002-2003

Electric field-assisted ion-exchange on glass will be carried out using a microprobe of atomic force microscope (AFM) as an electrode. The objective of this study is to clarify the availability of ion exchange on the modification of glass in nanometer-size region. It would become one of the fundamental technologies for the fabrication of micro-optics like integrated optical circuit, where a lot of elemental optical devices are assembled on a substrate like glass. It would be also applicable in other fields of material science and technology. If it is extended to manipulate functional ions and/or molecules on the solid surface, it would also be utilized as a new technique to induce various functions in solids.

### 28. The Structural Deformation of the Organic Ultra-Thin Films on the Surface of the Piezoelectric Crystals and Their Application to the Surface-Properties Modulation

Kenji Hisada
Research Associate, Department of Applied Chemistry and Biotechnology, Faculty of Engineering, Fukui University
¥2,000,000; 2002-2003

The piezoelectric crystals deform by the application of the electric field. We are planning to utilize this deformation in order to induce the structural modification of the ultra-thin films that are covered on the piezoelectric materials. Our target is to modulate the surface properties by the modification of the film state, such as molecular tilt angles in the film. As a typical surface property, we monitor the friction force as a function of the molecular tilt angle. This modulation procedure makes it possible to alter the sate of aggregate without any additives in the film. This means that it is applicable to a variety of organic films without considering the miscibility of the additional reagents. The modulation of the surface properties will propose the new molecular devices, e.g. motor-less fluid transport and the friction tunable surface.

### 29. Investigation on Initial Process of Nano-Size Colloids Prepared by Laser Ablation in Solution

Takeshi Tsuji
Research Associate, Department of Synthetic Organic
Research Associate, Institute of Advanced Material Study, Kyushu University
¥1,900,000; 2002-2003

High power laser irradiation onto substance results in evaporation of materials. This process is known as laser ablation, and is significantly important as a promising technique in nano-science. Laser ablation onto a metal plate immersed in water produces nano-size metal colloids via an aggregation of evaporated metal. I would like to investigate initial process of the colloid generation, namely from evaporation to aggregation of metal, by using a spectroscopic technique. Results of this work will be useful to clarify ablation mechanism as well as to control particle size of colloids.

### 30. Functional Design for Luminescent Devices of Hybrid Nanocrystal Phosphors

Tetsuhiko Isobe
Associate Professor, Department of Applied Chemistry, Faculty of Science and Technology, Keio University
¥2,000,000; 2002-2003

We try to investigate a process to produce hybrid nanocrystal phosphors with optimum luminescent properties by designing "nanosizing" and "surface modification." Appropriate surface modification could realize "quantum confinement effect", which promotes effective energy transfer from a pair of electron-hole to a luminescent ion. Based on this effect, we expect that remarkably high efficiency of phosphors can cause a reduction of $CO_2$ gas in the world and hence a prevention of global raising temperature.

### 31. Direct and Selective Synthesis of Dimethyl Carbonate from Methanol and Carbon Dioxide Using Acid-base Bifunctional Oxides

Keiichi Tomishige
Lecturer, Institute of Materials Science, University of Tsukuba
¥2,000,000; 2002-2003

Dimethyl carbonate is an environmentally benign substitute of poisonous phosgene and dimethyl sulfate, and it is a candidate of oxygen-containing clean fuel additive. The purpose of this research is the development of novel catalytic process for the dimethyl carbonate synthesis using $CO_2$ as a raw material, which is different from the conventional production method. The key is the acid-base bifunctional solid oxide catalyst. The catalyst has the neighboring acid and base in a nano scale and also gives the merit in the separation of the catalyst from the product. My research will realize novel green process where $CO_2$ can substitute phosgene.

### 32. Transition Metal-Catalyzed Reaction of C1-Compounds such as Methane in Ionic Liquids

Yuki Taniguchi
Research Associate, Department of Chemistry and Biochemistry, Graduate School of Engineering, Kyushu University
¥2,000,000; 2002-2003

The growing importance of the environmentally benign processes has led to the development of new synthetic methods. This project is focused on the use of ionic liquids in the fields of C1-chemistry of carbon dioxide and hydrocarbons. We would like to develop some new catalytic reactions in C1-components by using ionic liquid, an environmentally benign solvent, such as N-alkyl pyridinium and imidazolinium salts. In this study, C1 components (CO, $CO_2$, $CH_4$, etc) would convert to useful compounds by transition metal catalyzed reaction. Recycling and reusing of greenhouse gases such as $CO_2$ would be useful method to reduce the $CO_2$ exhaustion. Furthermore, the use of non-halogenated and non-volatile solvents as ionic liquids would be effective for air pollution. In this project, new chemical process in ionic liquid will be constructed by chemical conversion and reuse of greenhouse gases.

### 33. A Highly Efficient In Vitro Protein Synthesis System Using a Protein Repair Polymer

Naoki Tanaka
Research Associate, Department of Polymer Science & Engineering, Faculty of Textile Science, Kyoto Institute of Technology
¥2,000,000; 2002-2003

One of the major aims of current life science is the elucidation of the function of the gene. Whereas huge sequences of human genome have been solved, the functions of most of them are still remain unknown, and the methods for the rapid and efficient transcription and translation are necessary. The in vitro protein synthesis is one of the effective methods for this purpose because its can translate the DNA sequences rapidly. However, this method has weak point of the low yield due to the lack of the chaperone systems, which assist the folding of newly synthesized proteins. To construct a highly efficient in vitro protein synthesis system, protein repair polymers, water-soluble copolymers with the chaperone-like activity, are applied in this project. The result will widely spread the investigation on the protein structure and function and the drug development.

### 34. Transcriptional Regulation of Phosphate Translocators in Chloroplasts from the Facultative CAM Plant, Mesembryanthemum Crystallinum

Shin Kore-eda
Research associate, Department of Biochemistry and Molecular Biology, Saitama University
¥2,000,000; 2002-2003

Taking oncoming possibilities of population explosion and climate changes by global warming into consideration, improvement of drought tolerance of crops is one of most important subjects to supply enough food to the world in the near future. Crassulacean acid metabolism (CAM) is a mode of photosynthesis acquired by many plants in arid regions to perform carbon assimilation under the drought condition. Although it is well known that phosphate translocators have important roles in transporting metabolites between chloroplast and cytosol in general photosynthetic mode, C3 photosynthesis, their roles in CAM still remain unclear. The purpose of this study is to clarify which kind of phosphate translocators are involved in CAM and how they share their roles in a chloroplast transporting system. Because most of crop plants cannot perform CAM, such basic researches to elucidate a mechanism of CAM contribute toward efforts to improve tolerance of crops to drought stress.

### 35. A Study of the Mechanism of Rotary Motor of Flagella Using Single Molecule Imaging and Nano-Manipulation Technique

Akihiko Ishijima
Associate professor, Department of Applied Physics Graduate School of Engineering, Nagoya University
¥2,000,000; 2002-2003

The purpose of this study is to observe directly the rela-

tionship between influx, flow of ion, and efflux, rotational motion, of bacteria flagella motor using single molecule imaging and nano-manpulation techniques. The size of this rotary motor is only several nanometers, that is too small compared with the artificial machine. If the mechanism of this rotary motor will be clear, it will lead up to understand of the mechanism of life, and will accelerate the evolution of nano-machine technology.

### 36. Functional Analysis of Membrane Cytoskeletal Proteins in Convergence and Coordination between Cell Adhesion and Growth-Factor Signaling

Noriyuki Kioka
Research Associate, Division of Applied Life Sciences, Graduate School of Agriculture, Kyoto University
¥2,000,000; 2002-2003

Cell-extracellular matrix adhesion regulates a number of biological phenomena, including embryonic development and cell proliferation, in a cooperative manner with growth factor stimulation. Membrane cytoskeletal proteins are believed to play pivotal roles in linking the cell adhesion and growth factor signaling. In this study, we use gene targeting methods to analyze the functions of membrane cytoskeletal proteins and determine the mechanism of "CONVERGENCE" and "COOPERATION" between cell adhesion and growth factor stimulation. We can contribute to the regenerative medicine and to develop the procedure regulating the cell differentiation by controlling the convergence of cell adhesion and growth factor stimulation.

### 37. Studies on the Molecular Mechanism of the Regulation for Insulin Secretion by Glutamatergic Signal Transmission Among Islet Cells

Hiroshi Yamada
Research Associate, Department of Neuroscience, Graduate School of Medicine and Dentistry, Okayama University
¥2,000,000; 2002-2003

The Langerhans's islet, a pancreatic endocrine miniature organ, is composed of four major types of endocrine cells such as insulin-secreting β cells, glucagon-secreting α cells, polypeptide-secreting cells and somatostatin-secreting γ cells. Recently we demonstrated that low glucose treatment stimulates the release of glutamate as well as glucagon from α cells. AMPA-type glutamate receptors have been identified in the β cells. Stimulation of β cells with AMPA causes the increase of intracellular calcium concentration, resulting in promotion of insulin secretion. These results suggest that the glutamatergic signal transmission among islet cells is involved in the regulation of blood glucose level. In this study, we focus on glutamatergic signaling via AMPA receptors in β cells. Findings from this study would contribute development of new research for diabetes.

### 38. Molecular Mechanism of Regulation of Myristoylation Dependent Novel Protein - Protein Interaction Found in Brain Specific Proteins

Nobuhiro Hayashi
Assistant Professor, Division of Biomedical Polymer Science, Institute for Comprehensive Medical Science, Fujita Health University
¥2,000,000; 2002-2003

N-myristoylation, a posttranslational modification of proteins, has so far been regarded as necessary for anchoring of proteins to membranes. Recently, we have revealed that N-myristoylation of several brain proteins unambiguously regulates certain protein-protein interactions which may affect signaling pathways in the brain. Comparison of the amino acid sequences of myristoylated proteins including other myristoylated proteins suggests that the regulation is involved in signaling pathways not only in the brain but also in other cases including HIV gene product (HIV Nef), oncogene product (pp60v-src), etc. The purpose of this study is, through investigations of the regulation mechanism of this myristoylation dependent novel protein-protein interaction, to reveal molecular mechanisms of brain functions, development of AIDS, development of cancers, etc., and to apply the results to the treatments of myristoylated proteins related diseases such as AIDS, cancers, etc.

### 39. Molecular Mechanism of Multi-Stress Tolerance in Terrestrial Cyanobacteria

Toshio Sakamoto
Assistant Professor, Division of Life Sciences, Graduate School of Natural Science and Technology, Kanazawa University
¥2,000,000; 2002-2003

### 40. Research on the Environmental and Ecological Roles of the Virus Infecting to the Marine Fungoid Protists, Labyrinthulomycetes

Daiske Honda, Ph.D.
Lecturer, Department of Biology, Faculty of Science and Engineering, Konan University
¥1,900,000; 2002-2003

It becomes clear that the infection of the environment virus acts on regulating the disintegration of the red tide plankton. We succeeded in the isolation of a virus to be infected with the fungoid protist, labyrinthulomycetes, which decomposes land source organic substance from the river and so on. It aims at explaining an influence on regulating the disintegration of the labyrinthulomycetes with infecting of this virus by this research. As for the decomposing capacity of the labyrinthulomycetes, the possibility to be equal to the bacteria was suggested. So it is very important to understand this virus for appreciation of the early stage of the food chain. The information which is indispensable to the whole aspect elucidation of the ecosystem of the coastal environment repair will be provided.

## Area 2 (Physics and Information)
*13 grants*

**Research Areas**

* *Design at the atomic level of revolutionary new materials and their applications*
* *Discovery of new properties and new nano-structures through atom manipulation (micro-assembly nanotechnologies )*
* *Basic technologies for micro-machines*
* *Quantum computing and quantum information technology*

### Specific research assistance A:
*1 grant*

#### 41. Storage and Retrieval of Quantum Information of Light with Atomic Gas Bose-Einstein Condensate Trapped in a High Q Optical Micro Cavity

Mikio Kozuma
Associate Professor, Department of Physics, Tokyo Institute of Technology
¥9,950,000; 2002-2004

Light is the fastest and most robust carriers of information. As is known from the researches on optical quantum teleportation, light can transmit not only classical but also quantum information. There is no doubt that telecommunication technology in the next generation utilizes light with quantum information. However, light is very difficult to localize and store. The purpose of this research is to trap, store and release the quantum information of light by using atomic spin coherence. The success of this research makes it possible to switch the optical quantum information and thus produce new telecommunication market.

### Specific research assistance B:
*6 grants*

#### 42. Study of Single Photon Generation with Pyramidal Three-Dimensional Optical Microcavity Buried with Single Quantum Dot

Ikuo Suemune,
Professor, Research Institute for Electronic Science, Hokkaido University
¥5,000,000; 2002-2004

The purpose of this project is to bury single quantum dot in a pyramidal optical microcavity to realize single photon emitter. Selective growth method will be used for this purpose. From the viewpoint of safety of internet communications, quantum cryptography based on single photons is one of the favorable candidate because of the quantum nature of photons. Single quantum dot will be used as a generator of single photon one by one, and the transition probability will be enhanced by the coupling with the three dimensional optical microcavity with very small mode volume. The emission wavelength will be also temperature stabilized, which is important for multiple wavelength division multiplexing in optical fiber communications.

#### 43. Study of Voltage Control of Tunnel Magnetoresistance Effect Using Coulomb Blockade

Koki Takanashi
Professor, Magnetic Materials Laboratory, Institute for Materials Research, Tohoku University
¥5,200,000; 2002-2003

Spin dependent tunneling means that the tunnel probability of electrons through an insulating barrier between two ferromagnetic electrodes depends on the relative directions of the two magnetization vectors. The magnetoresistance caused by spin dependent tunneling is called tunnel magnetoresistance (TMR). TMR devices are expected to be useful for nonvolatile memory cells in magnetic random access memories (MRAMs). The objective of this study is to realize the voltage control of TMR at room temperature using the Coulomb blockade effect, i.e., the suppression of electron tunneling taking place when the current flows through an assembly of small magnetic dots. This will make it possible to make the MRAM consisting only of metals and insulators without any semiconductors, and contribute to the development of MRAM with a tera-bit class ultrahigh density.

#### 44. Development of New Magneto-Optical Materials for Rapid Communication by Nano-Domain Engineering

Tetsuya Hasegawa
Associate Professor, Frontier Collaborative Research Center, Tokyo Institute of Technology
¥5,000,000; 2002-2003

In order to construct high-speed communication networks, it is truly needed to develop new magnetic materials with high transmittance and large magneto-optical (MO) effects. Recently, we have discovered a new room-temperature ferromagnet, cobalt doped titanium oxide (CoTiO), with the aid of combinatorial techniques. The compound is transparent against visible/IR light, as far as the cobalt content is less than 10%. In this research program, we would like to establish huge MO effects, comparable with those of garnet, in CoTiO by means of nano-domain engineering. Such a function enables fast communication using visible light. Moreover, because the material indicates both double reflection and large Faraday rotation at once, it is possible to downsize MO-related devices, such as an optical isolator, considerably. Therefore, the results of the present research would make a significant contribution to society, through large progress in IT technologies.

### 45. Nano-Glass with Giant Magneto-Optical Properties

Akihiro Murayama
Associate Professor, IMRAM (Institute of Multidisciplinary Research for Advanced Materials), Tohoku Universityy
¥5,000,000; 2002-2004

The aim of this research is to fabricate "nano-glass materials with giant magneto-optical properties" which are nano-scale quantum structures of magnetic semiconductors in glass materials. Magnetic ions responding sensitively to the magnetic field are added to semiconductors showing strong absorption for the visible light and photoluminescence. The nano-scale quantum structures of such magnetic semiconductors can be fabricated in glass materials. Optical properties, such as, photoluminescence and polarization properties, of the nano-structure of magnetic semiconductor in the glass are strongly dependent on the magnetic field, since the photo-excited electronic states are largely affected by the magnetic interactions due to the magnetic ions and the quantum confinement effects. It means that the optical properties of these nano-glass materials can be reversibly controlled by the magnetic field. Therefore, new types of active devices for the optical communications can be developed using these nano-glass materials, since the glass material is suitable and used for the optical devices.

### 46. Development of a Combined Precision Machining System with a Reference Traveling Wire

Naotake Mohri
Professor, Department of Precision Machinery Engineering, Graduate School of Engineering, The University of Tokyo
¥5,000,000; 2002-2003

This study is aimed at developing a desktop type machining system on which EDM, ECM and Abrasive finishing with a traveling wire can readily be performed. The wire is used as a combined machining tool and as a contact probe for measuring the machined shape. By appropriately alternating machining processes, conductor and insulator materials can be machined into complex shapes with smooth surfaces without the requirements for skilled operators. This system is intended for the manufacture of electron microscope samples. With this system, detailed 3-D observation of material distribution can be performed with ease. As complex line swept shapes can be automatically generated by the system, rapid prototyping of fine mechanical parts is rendered easy to perform. This system, once practically implemented, will constitute a significant technological advance in basic foundation of science and in machining systems for production.

### 47. Dynamics and Motion Control of Micromechanics in Electric Gas Discharge Field

Hiroyuki Kawamoto
Professor, Department of Mechanical Engineering, Waseda University
¥5,000,000; 2002-2004

In addition to the electrical gas discharge, force is generated in a pin-to-plate electrode system, when high voltage is applied between the electrodes. Although the force is extremely small, in the order of 0.1 mN, it is large enough to drive micromachines and small particles such as liquid droplets, drugs, and living cells. Dynamics in the pin-to-plate gas discharge system will be investigated to utilize the electrostatic force generated in the system for driving mechanisms of micromachines, an inkjet printer, a particle conveyer and separator, and a biological analyzing machine.

## Encouragement research assistance: *6 grants*

### 48. Analysis on Fracture of Nano Structure based on Ab Initio

Yoshitaka Umeno
Research Associate, Graduate School of Engineering, Kyoto University
¥1,850,000; 2002-2003

In this study, simulations with high accuracy based on the ab initio method are conducted in order to evaluate strength and deformation behavior of so-called nano structures with nanometer (10-9m) scale structure, such as multilayered materials and carbon nano tubes. This will enable us to obtain important knowledge about mechanical properties of them, which is impeccable for design of advanced devices taking advantage of prominent functions of the nano structures.

### 49. Construction of Room Temperature Giant Magnetoresistive Materials by Oxide Artificial Superlattices with Atomic Layer Control

Hidekazu Tanaka
Research Associate, Institute of Scientific and Industrial Research, Osaka University
¥2,000,000; 2002-2003

In order to construct highly sensitive magnetic sensor materials, we fabricate new materials by alternative stacking of different kinds of magnetic oxides (ferromagnetic, anti- ferromagnetic, and so on) by using Laser-Molecular Beam Epitaxy (Laser-MBE) technique at atomic layer level. The resulting "artificial superlattices" have unusual and unstable spin state so that even small applied magnetic field will cause drastic change on their physical properties such as electrical transport, magnetism and so on. These novel materials could be applicable for high density magnetic recording media, highly sensitive sensor and then they will give very strong impact on our highly information oriented society.

### 50. Basis Research on Spin-Electronics Using the Ferromagnetic and the Semiconducting Phases of Fe-Si System

Tsuyoshi Yoshitake
Associate Professor, Department of Electrical and Material Science, Faculty of Engineering Sciences, Kyushu University
¥2,000,000; 2002-2003

It is extremely difficult to prepare the hetero-structure of semiconducting and ferromagnetic layers. However, it is expected to reveal a novel property. Fe-Si system has variety phases such as semiconducting β-$FeSi_2$ and amorphous FeSiX, and ferromagnetic $Fe_3Si$ and Fe. In this study, we make a basis research on spin-electronic for Fe-Si system. To give concrete expression, we study about the following points: (1) Control of ferro- and antiferromagnetic coupling between ferromagnetic layers for the multilayer film consisting of ferromagnetic and semiconducting layers, (2) Conversion of non-magnetic semiconductor β-$FeSi_2$ and amorphous $FeSi_2$ to be ferromagnetic semiconductor by doping the other elements such as Mn for the purpose of the spin injection to the hetero-structure of non-magnetic/ferromagnetic semiconductors using Fe-Si system.

### 51. Applied Mathematics in Nanoscale Fluid Engineering

Satoyuki Kawano
Associate Professor, Department of Aeronautics and Space Engineering, Tohoku University
¥2,000,000; 2002-2003

Nanoscale fluid engineering has received a considerable attention in the research area of MEMS and μ-TAS. Although the gas flow can be applied to design of the systems by the use of knowledge of rarefied gas dynamics, the flow of special liquid, e.g., a protein and a blood, can never be analyzed by this dynamics. Furthermore, in the liquid flow through the ultra narrow gaps in MEMS is governed by the electrostatic force, interface tension, wettability, and the intermolecular force. Classical fluid dynamics based on Navier-Stokes equations can not be applied to these phenomena. This study will provide the useful design data of ultramicro machines and advanced DNA chips.

### 52. Investigation of Micro-Discharge Due to Friction between Dielectric Surfaces

Takashi Miura
Research Associate, Department of Physics, Faculty of Science, Gakushuin University
¥2,000,000; 2002-2003

During friction between a spherical dielectric surface and a flat one, micro-discharge luminescence in the gap is observed. In the present study, the friction experiments are performed in controlled ambient-gas condition in order to investigate the mechanism of triboelectricity by sliding between the dielectric surfaces. Electrification on the dielectric surface will be more significant in inorganic material science and technology. When an insulator, e.g., glass and ceramics, is applied to mechanical elements of a micro-machine, electrical phenomena should be pronounced in ultra low load and low speed friction. This study will contribute to the development of the basic technology of the micro-machine.

### 53. A New Quantum Computation Algorithm with Adiabatically Evolving Hamiltonian

Shigeo Sato
Research Associate, Research Institute of Electrical Communications, Tohoku University
¥2,000,000; 2002-2003

It has been known that a quantum computer can break the cryptosystem on the internet. A quantum computer, which realizes real parallel computation, is expected to be implemented. However, only a limited number of algorithms are proposed and they are not applicable for general computation. Then the development of general-purpose quantum computation algorithm is an urgent research subject. The purpose of this research is to develop a new general-purpose quantum computation algorithm. I focus on adiabatic evolution of Hamiltonian and study a new algorithm and its performance. The method developed in this research can be applied to other general problems which have been considered as impossible to be solved.

## Area 3 (Architecture and Urban Engineering)
***5 grants***

**Research Areas**

* *Technologies for healthy buildings and urban development*
* *Management of the environment*
* *Construction material recycling technologies and their feasibility*

## Specific research assistance B:
*3 grants*

### 54. An Investigation of Evaluation Methods and Preventive Measures for Sick House

Hiroshi Yoshino
Professor, Department of Architecture and Building Science, Graduate School of Engineering, Tohoku University
¥4,000,000; 2002-2003

Polluted indoor air from chemical substances, which may cause a hazardous influence on human being such as Sick House Syndrome, has become a serious problem in our daily life. In Japan, this problem has been looked into several years ago, but a lot of uncertainties are still not yet clarified. Especially, data about the actual living conditions in houses, where the occupants have Sick House Syndrome, is not enough. Due to this reason, questionnaire survey and measurement of indoor air quality will be conducted to the houses, which suspected as a sick house. And a medical examination by the doctor will also be given to the occupants who were suspected of having Sick House Syndrome. From the results of this investigation the relation between indoor air quality and occupantsÆ health condition will then be clarified. And the measures for

preventing sick house are proposed. Finally, the measurements for preventing Sick House Syndrome will hereby propose.

### 55. Study on Methods for Lighting Design Based on Physiological Rhythms

Toshie Iwata
Professor, School of Engineering II, Tokai University
¥4,000,000; 2002-2004

The goal of this study is proposing guidelines for planning illuminace levels based on the time in a day and season, because light has an effect on not only visual aspects but also physiological rhythms. The daily amount of light entering oneÆs eyes, the change in the amount of light, and the relationship between the amount and the change of the exposed light and human responses, e.g. physiological fatigue, are shown by field investigation and experiments. The amount of light in a day, the change in the amount of light and the change in light color through a day which are adequate for physiological rhythm will be identified. In general this study revises the fixed idea on the role of lighting. Applying the results to buildings such as community facilities for the elderly, this study can contribute to physical and mental health. Moreover energy saving can be achieved by reducing the unnecessarily excessive amount of light in nighttime.

### 56. Development of Support System of Selecting the Most Environmentally-friendly Building Materials Based on Multi-objective Optimization Algorithm

Takafumi Noguchi
Associate Professor, Department of Architecture, Graduate School of Engineering, The University of Tokyo
¥4,000,000; 2002-2003

In this study we aim to develop a system of selecting the most environmentally-friendly building materials, which meet basic required performances such as strength, durability, etc., in the country or the region in consideration of such local conditions as natural environment, industrial structures and legal regulations. The results of this study will progress both the assessment method of environmental impact of building materials and the effective utilization of natural resources, most of which are used for building materials, accordingly directing the sustainable development in building material industries in the future. The system that enables to find optimal solutions simultaneously satisfying a lot of conflicting requirements will be profitable for decision-making problems in not only natural science but also social science.

## Encouragement research assistance: 2 grants

### 57. A Development of a Passive Cooling System Having Double Roof and Its Exergy-Analysis

Itaru Takahashi
Lecturer, Faculty of Social and Environmental Study, Fukuoka Institute of Technology
¥1,700,000; 2002-2003

The author develop a passive cooling system using double roof and explicitly show how the occupants can feel comfortably cool in the house having the system and the most adequate condition to operate the system by field measurement of the indoor thermal environment and the observation of the behavioral patterns and thermal sensations of the occupants. The upper roof of the system is made of thick thermal insulation boards and functions as shading and the lower roof, namely the ceiling is a thin metallic panel. Therefore its temperature can decrease immediately because its thermal resistance is small, when the rainwater evaporates upon the ceiling. The ceiling works as a radiant cooling panel and absorbs heat from the indoor space. A development of this passive cooling system enables us to provide a comfortably cool indoor space avoiding the use of electricity and the health problem that is caused by air conditioner by the combination among shading, panel cooling, natural ventilation and heat capacity of the building envelope.

### 58. Development of Humidity Controller and Adsorber of Chemical Substance Using the Charcoal Drawn up by the Woody Waste from Construction

Aya Hagishima
Research Associate, Interdisciplinary Graduate School of Engineering Sciences, Kyusyu University
¥1,900,000; 2002-2003

The quantity of waste from construction accounts for 20 percents of total industrial waste in Japan. Also the quantity of both the final disposal and the unlawful dumping from construction account for 40 percents and 90 percents of total of that. Under these circumstances, both the reductions of the quantity of waste and the acceleration of recycling are anticipated in construction. In this research, followings will be investigated in order to development of humidity controller and adsorber of chemical substance using the charcoal drawn up by the woody waste from construction.

- Experiments of characteristics of vapor absorption on charcoal
- Experiments of characteristics of absorption of chemical substances causing "sick-house syndrome" on charcoal
- Trial manufacture of passive systems of both the humidity controller and the adsorber of chemical substance using the charcoal
- Experiments for evaluating the characteristics of passive systems

## 2. Human and Social Sciences Research Assistance
*11 grants*

## Key subjects: Environment, Organizations, Information, and Humanity

**Specific research assistance: 5 grants**

### 1. Culture, Environment and Poverty in the Process of Economic Growth: A Case of Ethnic Minority People in the Central Highlands of Vietnam

Yukio Ikemoto
Professor, Institute of Oriental Culture, The University of Tokyo
¥1,900,000; 2002-2003

Life style of people is on equilibrium as a result of co-evolutionary process of society, institutions, culture, and so on, adapted to the environment. When the market economy is introduced to a society, the equilibrium is broken and some people who cannot adapt to the new situation will become poorer. If the income-oriented poverty alleviation policy, which is widely adopted all over the world now, is applied to this kind of poverty, the poverty may worsen due to the inability of the people to adapt. The poverty among the ethnic minority people in the Central Highlands of Vietnam is of this type. In order to alleviate this type of poverty, we need a more comprehensive approach such as the capability approach that is proposed by Amartya Sen. The aim of this research is to apply the capability approach to the poverty among the ethnic minority people in the Central Highlands of Vietnam.

### 2. An Alternative Approach for the Legal Recognition of Nontraditional Relationships

Toshiaki Hayano
Associate Professor, Faculty of Humanities and Social Sciences, Iwate University
¥1,900,000; 2002-2003

In spite of a gradual increase in single parenting, stepparenting, and unmarried cohabitation among heterosexuals and homosexuals, since the definitions of family, spouse, and parent in our legal system still encompass only the traditional nuclear family, these nontraditional families are often denied important benefits associated with legal family status. The purpose of this research is to propose an alternative approach, based on social science findings, for the legal recognition of nontraditional relationships compared with traditional nuclear relationship. Namely, it is to redefine parenthood deserving the legal recognition and its accompanying benefits. As a result of this research, it will also serve to establish parenthood including artificial insemination, in vitro fertilization, and surrogate motherhood that are under legislative deliberation, and corporate parent that is drawing public attention by a sharp rise of child abuse.

### 3. Construction of Scaling Method for the Psychological Evaluation of Environmental Sounds in Relation to the Noise Criteria

Sonoko Kuwano
Professor, Department of Environmental Psychology, Graduate School of Human Sciences, Osaka University
¥1,800,000; 2002-2003

Physical values based on sound energy are generally used for the evaluation of environmental noise as in the Environmental Quality Standard of Noise. However, the subjective impression of noise is affected by various factors as well as sound energy. In this study, method for scaling will be constructed using various environmental sounds and electronically modified sounds in order to evaluate subjective impressions. The relation between subjective impression and physical parameters will be examined on the basis of the results of psychological experiments and criteria for environmental sounds will be discussed. The result of this study is expected to contribute to the design of comfortable sound environment.

### 4. Networking between International Non-Governmental Organizations (NGOs) and Governmental and the United Nations' Organizations in the Relief Activities for Internally Displaced Persons in the Sudan

Toshio Sugiman
Professor, Faculty of Integrated Human Studies, Kyoto University
¥1,900,000; 2002-2003

The Sudan has more than three million internally displaced persons (IDPs) and refugees from neighboring countries due to both the natural disasters like drought and famine and the man-made disasters like a civil war that has continued since the mid of 1980s. In the present study, we carries out an intensive field work to investigate the relation between international non-governmental organizations (NGOs) and several governmental and the United Nations' organizations and examine the effect of the networking between the two parties on their relief activities for IDPs and refugees. It is expected that the study provides useful basic information for the increasing number of Japanese NGOs to try to extend international relief activities and also contributes to our understanding of current social situations of the country with which political and economic exchange has been decreased in recent ten years, in which an academic exchange like the present study serves as a help to maintain the relationship between the two countries.

### 5. Study on Method of Improving Information Literacy Education

Yoshiro Kawakami
Professor, Faculty of Arts and Literature, Seijo University
¥1,800,000; 2002-2003

The purpose of this research analyzes the learning effect of the information literacy education for the citizens and clarifies the social-psychological factors to obstruct or facilitate its educational effects. Such social-psychological factors give an effective finding to policy-making and policy-execution of the administration for the citizens to solve their disadvantage. And it is also planned to use this research for the international policy of the digital divide dissolution in Asia.

## Encouragement research assistance: 6 grants

### 6. The Bank and Corporation's Liability for the Environmental Contamination

Tsuyoshi Yamada
Associate Professor, Law Faculty, Niigata University
¥800,000; 2002-2003

In the U.S., The Bank and Corporation's Liability for the environmental Contamination are becoming very hot issues. Because their liability may be pursued by the Comprehensive Environmental Response Compensation and Liability Act, or CERCLA or case law etc. The purpose of this research is that I will research this legal area in the U.S., and try to compare the situation in the U.S and Japan. So that I will suggest some solutions concerning environmental contamination, by admitting bank and corporation's liability to lend loans toward the companies which caused environmental contamination.

### 7.International Comparative Econometric Analysis on the Second Demographic Transition: Delayed Marriage and Birth Process causes Catching up Effect?

Kohei Wada
Associate Professor, Faculty of Economics, Chuo University
¥1,000,000; 2002

The purpose of this research is analyzing econometrically what social and economical reasons delay the marriage or birth timing and catch up on the refrained births at the advanced age. And this analysis is based on the theory "The Second Demographic Transition" whose attention has been paid to in recent years by explaining the permanently and extraordinarily low state of fertility in advanced nations. Because the part of the demographic mechanism in connection with the modernization of the developing countries, or the fertility decline that has occurred in the present developed country is to be investigated, the outcome of this research is expected as the helpful thing for planning the population policy.

### 8. What Should We Cope with "KAROUSHI" (Death from Overwork) Legally and Practically? - Mainly through Reconsidering "Duty to Care in Employment Contract"

Hisaaki Fujikawa
Associate Professor, Faculty of law, Aoyama Gakuin University
¥1,000,000; 2002-2003

"KAROUSHI" in Japan is very famous for all over the world, because it is considered as the symbol for working style of Japanese workers. To be sure, the law doctrine of duty to care and the workers' compensation system have been developing to some extent recently in Japan. However, such developments are not necessarily sufficient, because "KAROUSHI" cases are increasing and getting serious. This research is aimed at reconsidering "duty to care" doctrine fundamentally, through respecting practical and medical aspects of "KAROUSHI", from the viewpoint of humanization of labour.

### 9. State, Local Administration and Inhabitants of a Great City: Belle Epoque's Paris Facing with Environmental Problems

Nobuhito Nagai
Associate professor, Department of human and social sciences, Faculty of integrated arts and sciences, University of Tokushima
¥1,000,000; 2002-2003

At the turn of the 20th century, Paris was confronted with social problems such as widespread poverty and aggravating living conditions, due to demographic expansion fueled by an influx of immigrants and industrial progress. This research aims at studying the attitudes of three actors present in the capital ? inhabitants, municipalities and the State ? toward environmental problems like atmospheric pollution or lack of hygiene. France at that time, just like Japan today, was beginning decentralization and witnessing the organization of citizen movements. A study of the example set by the French capital could be significant for the Japan of the 21st century, seeking after a new style of administration and local society.

### 10. Sociological Study on Infertile Patient

Chiaki Shirai
Research Associate, School of Literature, Waseda University
¥1,000,000; 2002

This study is a part of the project on historical changing mechanism of reproduction process. In the concrete, this study is the sociological study of infertile patient today. The reality of infertile patient has not been clarified, especially the social life on their own, the career of occupation or family, their consciousness about the infertility, the reproductive technology, the family, etc. In this study, I planed to survey them by mailing structured questionnaire. By this research, it must be unraveled not only infertile cure and medicine but also infertile patient as human being.

### 11. Cumulative Innovation/Dynamic Competition and Patent System: Design Rule for Sustainable Innovation

Ichiro Nakayama
Visiting Associate Professor, Department of Intellectual Property, Research Center for Advanced Science and Technology, The University of Tokyo
¥1,000,000; 2002

As knowledge economy evolves, patent system is expanding its boundaries. While patent system provides incentives to creation of new technologies, it imposes constraints on their utilization, which may hamper cumulative innovation and dynamic competition for subsequent innovation. The objective of the research is to explore ways to make new technologies available on reasonable terms without reducing incentives for creation. The research is expected to contribute to the discussion on mechanism to realize sustainable innovation in the knowledge society where knowledge creation and knowledge utilization are both important.

## 3. Comprehensive Research Assistance
*1 grant*

### Key subject: Global environment

### 1. Ocean Environmental Change and Species Succession of Euphausiid Crustacean-Regarding Ocean Mesoscale Eddies as a Large Ecological Experimental Apparatus

Yoshinari Endo
Associate Professor, Division of Environmental Bioremediation, Graduate School of Agricultural Science, Tohoku University
¥11,000,000; 2002-2004

Species succession of euphausiid crustaceans in warm- and cold-core rings, with a diameter of 150km and a depth of 1000m, will be investigated, regarding these mesoscale eddies as a large ecological experimental apparatus. Through this study, how and how fast euphausiid community changes in response to the global environmental changes such as warming or cooling will be clarified. Because body size, tendency of forming aggregations, food habits and food size changes from species to species, the effect of euphausiid succession on their prey and predators can be postulated. Therefore, basic information on changes in the structure of marine ecosystem can be obtained.

## 4. Overseas Research Assistance
*13 grants*

### Chulalongkorn University, Thailand: 7 grants

### 1. Various Cinnamates as UV-Filter: Synthesis, UV-absorption characterization and Photo-stability study

Dr. Supason Wanichweacharungruang
Associate Professor, Department of Chemistry, Faculty of Science
¥700,000

It has been shown that sunscreens prevent erythema and premaligant skin lesions in humans and are considered to be a major defense against skin aging, skin cancer and melanoma. Although octil methoxycinnamate (OMC), a widely used sunscreen, can effectively absorb UVB, however, studies have shown that OMC undergoes isomerization when exposed to sunlight. As a result, decrease in its UV absorbing efficiency was observed when the compound was expose to UV light. In this project, various new cinnamates which electron rich in structure will be synthesized and evaluated for their UV-absorption efficiency and photo-stability.

### 2. Runaway Reaction from Oxidation of Hydrogen Peroxide

Dr. Khantong Soontarapa
Assistant Professor, Department of Chemical Technology, Faculty of Science
¥350,000

In the chemical process industry, raw materials are converted into commercial products. Exothermic chemical reactions can lead to a thermal runaway if the heat generation rate exceeds the heat removal rate. Apart from the loss of reactor inventory due to an uncontrolled conversion process, a runaway reaction may lead to severely damaged equipment or a physical explosion if pressure build-up inside the reactor exceeds the design pressure. Thermal instability or incompatibility of materials may result in considerable gas production or temperature increase due to heat production. This research present DSC (Differential Scanning Calorimetry) technique to characterize the thermal instability.

### 3. Effects of Dentine Matrix on Human Periodontal Cell Differentiation in vitro

Dr. Tussanee Yongchaitrakul
Associate Professor, Department of Anatomy, Faculty of Dentistry
¥700,000

The major goal for the treatment of periodontitis is the induction of new periodontal attachment apparatus. Our interest is to develop materials for clinical application in

combination with periodontal surgery in order to facilitate the regeneration of periodontal tissue. Since the interaction between root dentin and follicular cells, the cells that will differentiate into cells of periodontium, is the initial step for the periodontium formation during development, we propose that dentin matrix might be the material of choice. We intend to prepare dentin matrix, especially the non-collageous part, and study its ability to induce differentiation of periodontal ligament cells by Examming the upregulation of bone makers.

### 4. Utilization of Spent Silica-Alumina in the Production of High Alumina Cement

Dr. Petchporn Chawakitchareon
Associate Professor, Department of Environmental Engineering, Faculty of Engineering
¥850,000

The objective of this research is to produce High Almina Cement (HAC) from spent silica-alumina. The major components of HAC are $Al_2O3$ (48-51%), $SiO_2$ (5-8%) and CaO (39-42%). According to the specifications for HAC, it would be possible to use spent silica-alumina as a source for $Al_2O_3$ and $SiO_2$ with a lime source of CaO to produce this cement. The procedures for carry out this research would be as follows: The temperature for burning HAC raw materials would be set at about 1600°C which is very high, however, if the raw materials are ground and mixed together beforeburning, the temperature can be reduced. Therefore, this experiment will use a burning temperature between 1300-1500°C. To find the optimum temperature (Selected by the highest compressive strength) and to find the optimum burning time we use the interval of 0.5 - 2.0hrs. HAC to reach a strength in 24 hours equal to that achieved by an ordinary Portland cement in 28 days and which will be remarkably inert to chemicals. However, a disadvantage of HAC will occur when it is used in humid and high temperature conditions. Under those conditions, the phase (CA.10H) in HAC will convert to another phase (C3A.6H) more dense than the former which is called "conversion". Therefore, compressive strength may be considerably reduced at later times. This research will add ground granulated blast furnace slag (GGBS), a by-product of the smelting iron ore industry, in HAC to decrease this conversion and compare the hydraulic property of HAC with and without the mixture of GGBS.

### 5. The Laboratory Predictors of Clinical Severity in Patients with Green Pit Viper Bites

Dr. Ponlapat Rojnckarin
Assistant Professor, Division of Hematology Department of Internal Medicine, Faculty of Medicine
¥850,000

Green Pit Viper (GPV) bite is not only an important public health problem in Thailand, but also a dilemma in clinical management. Although most patients experience only mild coagulation defects, some may suffer from severe bleeding that can be delayed for several days after bits. Potentially fatal allergic reactions to the antivenin preclude its universal usage. Therefore, decisions for antivenin administration rely upon prolonged observation and repeated coagulation t4ests, resulting in economic loss from absence from work in addition to the hospital and transportation expenses. The applicant proposes 3 initial laboratory values as potential predictors for subsequent severe coagulopathy; 1) venom level, 2) fibrinogen level and 3) fibrin degradation products (FDP). Plasma venom level will be measured initially to estimate the amount of venom absorbed. Additionally, it will be measured serially to determine the envenomation kinetics of GPV, which has never been reported in human. Fibrinogen and FDP levels are much more sensitive than routine coagulogram and probably precede severe coagulation defects. Those data will help us tremendously in reducing patient morbidity and saving cost incurred by this common problem.

### 6. The Glutathione Antioxidant Metabolism in Pregancy Induced Hypertension

Dr. Wilai Anomasiri
Assistant Professor, Department of Biochemistry, Faculty of Medicine
¥850,000

This is a comparative study of the blood level of glutathione (GSH) and glutathione-related enzyme in normal pregnancy and pregnancy induced hypertension. Twenty five subjects in each group will be recruited, i.e., normal subjects, normal pregnancy subjects and pregnancy induced-hypertension subjects. Everyone will be tested for liver function test enzymes. The collection of data in this analytical study of GSH and GSH-related enzyme such as glutathione peroxidase and gultathione-s-transferase will be compared to the blood level of superoxide disumutase and other enzyme in the antioxidant defense system. The significant increase level of any parameters in the experimental group will be considered to be a candidate for early biomaker for reproduction-related non-oncologic disorders or diseases.

### 7. Cow's Milk Protein-Specific and Cow's Milk Protein Fraction-Specific IgG and IgG Subclasses in Cow's Milk Allergy: Laboratory Characterization and Diagnostic Significance

Dr. Pantipa Chatchatee
Lecturer, Department of Pediatrics, Faculty of Medicine
¥700,000

Up to 8% of children less than 3 years of age and approximately 2% of the adult population experience food-induced allergic disorders. Cow's milk is one of the leading causes of food allergy. Diagnosis of cow's milk allergy (CMA), especially in delayed allergic reactions can be extremely difficult because most patients and parents cannot recalled the allergens ingested. More importantly, diagnostic test is not available for this types of reactions. Since food allergen-specific IgG may play an important role in pathogenesis of food allergic reactions. The applicant proposes several laboratory methods to detect and charac-

terize cow's milk protein-specific and cow's milk protein fraction-specific IgG and IgG subclass. Data on characterization of those antibodies and clinical data will be analyzed to define the role of food allergen-specific IgG in CMA with regards to their clinical significance and diagnostic applications. The information will help develop a more effective tool for the diagnosis of CMA.

## Institute Technology Bandung, Indonesia: 6 grants

### 8. Interdiffusion and Oxidation Behavior of Aluminide Coated γ-TiAl at High Temperatures

Eddy Agus Basuki
Researcher, Department of Mining Engineering, Faculty of Earth Science and Mineral Technology
¥600,000

Over last ten years research on the development of γ-TiAl as a low density and high strength material for high temperature applications have been extensively carried out. Some studies showed that application of γ-TiAl above 800°C is limited due to rapid oxidation of this material. Solution to this problems leads to the implementation of aluminide coatings with higher aluminium content. This study investigates the interdiffusion and oxidation behavior of Cr-modified TiAl3 coatings on γ-TiAl at 900, 1000 and 1100°C.

### 9. Paternal Methoxyacetic acid Exposure Induces DNA Damage and Alters the Expression of DNA Repair Genes in the Preimplantation Embryos of Swiss Webster mice

Lecturer, Department of Biology, Faculty of Mathematics and Natural Sciences
¥750,000

Methoxyacetic acid (MAA) is a metabolite of di (2-methoxyethylIphthalate (DMEP), which is one of the most toxic and potent teratogen among the phthalate esters. DMEP are commonly used as plasticizers in the manufacture of flexible plastics. Previous studies showed that MAA is embryotoxic, and induced mainly limb malformations in mices and rats. MAA also interfere spermatogenesis, which consequently decrease its fertility. We hypothesize that chronic low-dose treatment of male mices with MAA will damage DNA male germ cells. The DNA damage to the male genome will be then transmitted to the zygotes, resulting peri-implantation progeny loss or malformations. Furthermore, the DNA damage leads to alterations in the expression profiles of DNA repair genes during preimplantation development. Therefore, we focus our work to study the paternal exposure to MAA on the DNA damage in the zygotes using the alkaline comet assay; and determine the effect of such a genotoxic insult on the expression profiles of DNA repair genes in the early emblyo using the in situ transcription/antisense RNA amplification (IST/aRNA amplification) method.

### 10. Development of Microsatellites in Gouramy Fish (Osphronemus gouramy)

Diah Kusumawaty
Research Staff, Department of Biology, Faculty of Mathematics and Natural Sciences
¥800,000

We want to help to develop gouramy fish (Osphronemus gouramy) improvement based on genetic marker through microsatellite marker approach. The objectives of the research are to construct microsatellite-enriched libraries and to isolate and characterize microsatellite sequences in gouramy. The results of this research are sequences of pairs of specific primer for gouramy species. These primers are hoped to contribute to be a great utility for identification of gouramy before and after breeding process, to know genetic diversity of germplasm of gouramy in Indonesia and genetics improvement of gouramy. Finally, the breeder can get data in short time and can design more accurate and efficient breeding program.

### 11. Analysis and Synthesis of A New Class of Model Predictive Control Coupled with Hybrid Reference Control

Dr. Ir. Endra Joelianto
Lecturer, Department of Engineering Physics, Faculty of Industrial Technology
¥700,000

This research focuses on analysis and synthesis of a new class of predictive control, which is the integration of predictive control and hybrid reference control. In conventional control system designs, the objective is to seek the best controller parameters in order to achieve the closed loop system performance specifications. However, in this new control scheme, the problem is to find the controller parameters and the reference trajectory that fulfill the closed loop system objectives. The benefit of the HRC strategy is the capability to improve performance of the control system via an optimal reference trajectory without replacing the existing controller. As a result, this new predictive control is able to provide an optimal reference trajectory and renders the properties of predictive control.

### 12. Wave Transmission and Armor Unit Stability on Reef Breakwater for Beach Conservation

Dr. Ir. Krisnaldi Idris
Lecturer, Department of Civil Engineering, Ocean Engineering Laboratory
¥550,000

A reef breakwater is a low-crested (submerged) structure built form piles of stones or artificial armor units. The porous structure provide a safe and friendly environment for fish and various oceanic organism. A reef breakwater protect shoreline by reducing wave energy progressing towards the shoreline. It is an alternative structure to protect a beach without disturbing the beauty of the beach, due to its submerged nature. The proposed study concentrates on reef breakwater built entirely from artificial armor

unit called A-Jack, Tetrapod and concrete cube. Hydraulics parameters related to reef breakwater to be investigated, the parameters to be expressed in terms of wave transmission coefficient and armor unit stability coefficient. The study will be executed through two-dimensional physical model testing, which will be tested in a wave-flume that able to simulate real ocean waves. The hydraulic parameters electronically measured or quantified. Relation of important parameters will be derived through dimensional analysis. Expected findings are hydraulics parameters relationship as a guidelines for design of reef breakwater for beach protection.

### 13. Fishing Ground Prediction in Indonesian Waters based on Upwelling Regions and its Relation to Seasonal Ocean Circulation

Dr. Nining Sari Ningsih
Researcher, Center for Marine Research Laboratory
¥600,000

Marine fish resources in Indonesian waters have not been exploited in the optimal way due to lack of accurate information of fishing ground area. Here, we proposed to predict upwelling regions (the cold and nutrient -rich warters) as an indicator to locate the best area for fishing grounds. The upwelling region will be studied using three-dimensional model of ocean circulation by incorporating the monsoon variability. The model results will be evaluated and verified with satellite image interpretations and secondary data. Based on the results, seasonal evaluation maps of fishing ground location will then be made. Further, it is hoped that a good understanding of the monsoon variability and its biological consequence, namely the upwilling phenomenon, can be used as a predictive tool, which is quite valuable for design both the proper management plan and investment policies for marine fisher's, especially in Indonesia.