

## World Premier International Research Center (WPI)

### WPI Advanced Institute for Materials Research (WPI-AIMR)

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) launched the program of the World Premier International Research Center Initiative (WPI) in the spring of 2007. Our proposal on establishing WPI Advanced Institute for Materials Research (WPI-AIMR) was accepted as one of the five WPI Centers in our country, and WPI-AIMR commenced on October of 2007.

WPI-AIMR has assembled top-grade researchers, from the fields of materials science, physics, chemistry, precision mechanical engineering and electronic / informational engineering, in order to conduct interdisciplinary research which implements new innovative methods of atomic and molecular control which exceeds our existing ones. The Center is committed to pursue the creation of new materials and compounds, developing devices based upon a new fundamental paradigm; it also promotes the application of research projects with the new materials and system architecture which generates direct societal impacts; thus exhibiting qualities of becoming a world-leading international center of materials.

#### Materials Science

Develops advanced non-equilibrium materials facilitated by enlarging, strengthening and activating the properties of metallic glasses through the control of atomic-cluster-assembled structure

#### Nanochemistry

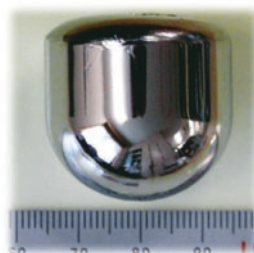
Develops new soft materials studied outside the field of existing hard materials. It includes organic-inorganic hybrid materials which possesses self-assembled molecular structures

#### Nanophysics

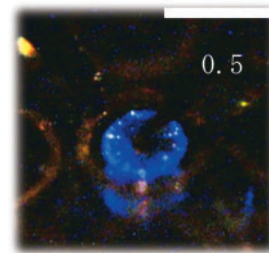
Develops the latest in world computational devices, conducts physical clarification of nanomaterials, and is an incubation area for new nanomaterial groups

#### Device / System

Develops multiple functional materials for Micro Electro Mechanical Systems, pursues new magnetic material, establishes advanced optical communication, produces high-quality LSI and all necessary needs for sustaining the 21 century's cybernation industry



Zr-based bulk metallic glasses (max. of 30mm diameters)



Ultraviolet Light Source, the first light source made with an ecological light material

## Research Programs

### Global Centers of Excellence Program (Global COE Program)

The "Global Centers of Excellence (COE) Program" was based upon and established by Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) with results carried out on assessments and verifications of the FY2002, "21st Century COE Program." The program provides for funding support and for establishing educational and research centers which perform at the apex of global excellence, elevating international competitiveness of universities in Japan. The program is aimed to strengthen and enhance the educational and research functions of graduate schools. It is also to foster highly creative young researchers, those who become world leaders in their respective fields; through experience and practical research in the highest of world standards.

FY 2007

Program Leader	Research Fields	Program Title	Contents
Life Sciences Professor Noriko Osumi	Neuroscience	Basic & Translational Research Center for Global Brain Science	The mission of this center is to educate and produce academics that are capable of integrating brain sciences, solving the fundamental problems of life science and/or solving various problems of social base. To accomplish our mission, we shall promote new brain science fields within and out of Japan through our cooperative research programs: (1) "Genomic Behavioral Neuroscience," which covers the range from genes to the behavior of animals, (2) "Embodied Cognitive Neuroscience," as understood from the mutual operations of brain functions and the body, and (3) "Interdisciplinary Brain Science," which encompasses the range from environments surrounding people to the relationships among people. Moreover, we will provide outcome-oriented educational programs for the participating student to present achievements of individual goals in the fields of neurosciences. It will promote fostering of human resources in new disciplines from Japan; researchers in the fields such as brain imaging diagnostic, mathematical neuroscience, mental illness diagnostic treatment, and neuroeconomics, educators and welfare/care workers, the developers of new drugs and health care devices, and workers of health service, who can link the advancements of the neuroscience's and educating the society.
Chemistry, Material Sciences Professor Masahiko Yamaguchi	Chemistry	International Center of Research & Education for Molecular Complex Chemistry	The characteristic features of chemistry, in fields of natural science and technology, are its capability to adopt a bottom-up methodology regarding sizes of substances. This program is aimed at proposing various research studies, of larger molecular systems ranging from 10nm to 0.1mm, by establishing giant molecules and complex systems. The programs focus upon the study of three-dimensional and time-dependent functions of various molecular systems, and are called the research fields of "Molecular Complex Chemistry". Chemists who participate in this research field and along with this program will be involved in the next generation PhD education of chemists, who take the leadership in both national and international fields of advanced chemistry and their various related sciences.
Chemistry, Material Sciences Professor Takashi Goto	Materials Science	Materials Integration International Center of Education and Research	Materials science covers the infrastructure in every industry and without its development, our society cannot progress. Tohoku University has been leading in the position of materials science in the world. However in today's society, more global competition and collaboration in research and development are inevitably urged. The Global COE focuses on four of the following research fields: (A) infrastructural and bio-materials, (B) electronic materials, (C) energy and environment-related materials, and (D) those of basic materials science. It also carries out educational activities on the basis of the materials integration concepts (creation of fields for interdisciplinary research collaboration in materials science). This education strengthens to foster international young researchers with a multilateral viewpoint which forms the next generation of researchers. We aim to innovate new functions and materials, and to develop new materials science.
Information, Electrical and Electronic Sciences Professor Fumiyuki Adachi	Electrical and Electronic Engineering	Center of Education and Research for Information Electronics Systems	With the idea that education and research are equally important disciplines, this center aims to foster young researchers who have a broad outlook, can create innovative science and technology, and conduct ground-breaking world-class research in wide ranging areas from basic science and technology to system applications. We will also conduct a wide range of collaborative NT/IT research from devices to information systems for realization of a global network for human-centric communications.
Interdisciplinary, Combined Fields, New Disciplines Professor Takami Yamaguchi	Biomedical Engineering	Global Nano-Biomedical Engineering Network Center	As is widely recognized, nano-biomedical engineering is the major key to 21st century civilization of the world. Tohoku University Global COE program, "Global Nano-Biomedical Engineering Network Center" aims at organizing nano-biomedical engineering activities within the East Asia and Pacific Rim countries. This is not literally restricted to those areas but our intention is to start to organize the most active institutions in the hope that eventually worldwide collaboration will be implemented on the most rapidly growing area of the globe not only in terms of economics but also science and engineering. In order to maintain that infrastructure and growth, our country and partner countries need to encourage our younger scientists and engineers to participate in a global environment. This will clearly help in the continued well-being of the nation's and international health and economy.

Total: 5 programs

## Research Programs

### FY 2008

Program Leader	Research Fields	Program Title	Contents
<b>Medicine</b> Professor Yoshitomo Oka	Internal Medicine · Diabetes and Metabolism	Global COE for Conquest of Signal Transduction Diseases with "Network Medicine"	Signals function in a network rather than in a cascade, and that human homeostasis is maintained by networks. We therefore elucidate networks in multiple levels encompassing molecules to organs, even in interactions with environment. We will further integrate these multilayered networks in time and space, and develop innovative medicine, a new way of understanding health and diseases, which is referred to as "Network Medicine". We will strive to bring up young scientists who have broad perspective and to go beyond existing frameworks with a pioneer spirit.
<b>Mathematics, Physics, and Earth Sciences</b> Professor Kunio Inoue	Physics	Weaving Science Web beyond Particle Matter Hierarchy	Based on the experiences of propelling international cutting-edge researches in wide range of hierarchies in the universe, this program attaches great importance to weaving interconnections among the hierarchies with the common language, mathematics, which we call "Science Web". We strongly develop new science fields under the Science Web and also extend our interests to the fields in between the hierarchy such as chemistry, biology and geoscience. We ultimately aim at understanding the entire particle matter hierarchy and a cooperation with Philosophy will bring a wider view necessary toward the goal. These active collaboration and development are used to nature talented students. Students grown with the education will create a new academic culture and contribute to a social innovation.
<b>Mathematics, Physics, and Earth Sciences</b> Professor Eiji Ohtani	Earth and Planetary Science	Global Education and Research Center for Earth and Planetary Dynamics	Tohoku University has conducted globally recognized research into the Earth and planetary science. It has many faculty members whose research interests cover a great variety of topics within these fields. In our Global COE program, we will focus on research targets in Earth and planetary dynamics and Earth environmental change through a combination of multiple disciplines. The Global COE program aims to build upon the achievements of the 21st Century COE program (2003-2007), and to advance further our knowledge in the critical areas of Earth and planetary dynamics and Earth environmental change.
<b>Mechanical, civil engineering, architectural and other fields of engineering</b> Professor Shigenao Maruyama	General Engineering	World Center of Education and Research for Trans- disciplinary Flow Dynamics	The objectives of the Global COE is to establish a world center of education and research for flow dynamics that will create unique research activities and attract and educate talented students who meet the global standard. In order to establish the world center, we will develop new fields of trans-disciplinary flow dynamics. The concept includes the integrations of different academic fields, countries, and cultures. Furthermore, we aim to train young researcher and PhD candidates that contribute to the world community of flow dynamics by developing global perspectives and academic abilities to transcend the global standard.
<b>Social Sciences</b> Professor Yoshimichi Sato	Sociology	Center for the Study of Social Stratification and Inequality	The COE is designed to expand education and research on social stratification, inequality, and disparity internationally based both on the outcomes of the Center for the Study of Social Stratification and Inequality, which was formed by the 21st Century Center of Excellence Program, and on the Social Stratification and Social Mobility Research Project. The COE will archive four research objectives through multi-disciplinary approaches: (1) Developing exact measures of disparity; (2) Analyzing social mechanism that produces disparity; (3) Advancing the study of the effect of disparity; and (4) Making policy recommendations to reduce disparity. The COE will cultivate young, creative scholars who are competitive in the world.
<b>Social Sciences</b> Professor Miyoko Tsujimura	Law and Politics	Gender Equality and Multicultural Conviviality in the Age of Globalization	Our Global COE Program aims to establish a world-class network for education and research on the theme: "Gender Equality and Multicultural Conviviality in the Age of Globalization". Mobilizing an inter-disciplinary approach to social sciences, the strategic orientation of this Program is on public policies and policy-development, thus enabling us to build upon the substantial contributions and fruits of its predecessor, the 21st century COE program "The Law and Policy of Gender Equal Society". Furthermore, in cooperation with the Institute of Social Sciences, University of Tokyo, and other research centers abroad, it aims to nurture the careers of emerging researchers, lawyers and policy-makers through exposure to international and interdisciplinary perspectives on the contemporary challenges of gender equality and multicultural conviviality.
<b>Interdisciplinary, combined fields, new disciplines</b> Tohru Nakashizuka	Environmental Science	Center for ecosystem management adapting to global change	We propose a new research domain consisting of the ecosystem principle, ecosystem technology and socio-economic system for the adaptation of ecosystems to the unavoidable global environmental change. We plan to train not only a highly specialized scientists but also Professional Ecosystem Managers with specialized knowledge and skills to plan and manage ecosystems. We will also establish three scientific field centers for the interdisciplinary collaboration and education, and a consortium among environmental organizations for the collaboration in researches, education and outreach.

Total: 7 programs

### The 21st Century Centers of Excellence Program (COE Program)

The COE Program is a new project introduced in 2002 by Japan's Ministry of Education, Culture, Sports, Science and Technology. It's aimed to promote establishment of the world's top-class universities renowned for their vitality and level of international competitiveness in Japan. At this end, in order to enhance educational and research standards in this country and to foster creative leadership for the international academic community, the COE Program facilitates the development of a competitive academic environment, and supports the establishment of international research and educational centers in all fields of study.

### FY 2004

Program Leader	Research Fields	Program Title	Contents
<b>Innovative Academic Field</b> Professor Yutaka Imai	Clinical Pharmacology and Therapeutics	Comprehensive Research and Education Center for Planning of Drug Development and Clinical Evaluation	For a certain drug to become useful in the health and welfare of mankind, it must pass through various processes, starting from the fundamental science of drug development to clinical application in humans. In particular, a drug in the clinical application requires the accumulations and integration of knowledge and experience covering the ethics and economics in addition to its medical and pharmaceutical values. This center fosters professionals with knowledge and experience, and the aims for establishing an academic research organization capable of proposing ideas for clinical development of drug and management for drug development and evaluation.

Total: 1 program