

Global COE Programs

The Global COE (Centers of Excellence) Program was launched by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT), to provide funding support for research and education centers of the highest international standards. Thirteen projects among the diverse scientific fields Kyoto University were selected to receive support. Seven of the thirteen projects are still currently ongoing.

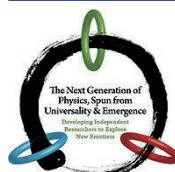
【Ongoing Projects】



Category : Medical sciences (Since 2008)
 Title : **Center for Frontier Medicine**
 Leader : Professor Syu Narumiya,
 Graduate School of Medicine
 URL : www.med.kyoto-u.ac.jp/GCOE/E



Category : Mathematics, physics, earth sciences (Since 2008)
 Title : **Fostering top leaders in mathematics - broadening the core and exploring new ground**
 Leader : Professor Kenji Fukaya,
 Graduate School of Science
 URL : gcoe.math.kyoto-u.ac.jp/english



Category : Mathematics, physics, earth sciences (Since 2008)
 Title : **The Next Generation of Physics, Spun from Universality and Emergence**
 Leader : Professor Hikaru Kawai,
 Graduate School of Science
 URL : www.scphys.kyoto-u.ac.jp/gcoe/index_e.html



Category : Mechanical, civil engineering, architectural and other fields of engineering (Since 2008)
 Title : **Global Center for Education and Research on Human Security Engineering for Asia Megacities**
 Leader : Professor Yuzuru Matsuoka,
 Graduate School of Engineering
 URL : hse.gcoe.kyoto-u.ac.jp



Category : Social sciences (Since 2008)
 Title : **Global Center of Excellence for Reconstruction of the Intimate and Public Spheres in 21st Century Asia**
 Leader : Professor Emiko Ochiai,
 Graduate School of Letters
 URL : www.gcoe-intimacy.jp



Category : Interdisciplinary, combined fields (Since 2008)
 Title : **Energy Science in the Age of Global Warming -Toward CO₂ Zero-emission Energy System**
 Leader : Professor Takeshi Yao,
 Graduate School of Energy Science
 URL : www.energy.kyoto-u.ac.jp/gcoe/en



Category : Interdisciplinary, combined fields (Since 2009)
 Title : **Sustainability/Survivability Science for a Resilient Society Adaptable to Extreme Weather Conditions**
 Leader : Professor Kaoru Takara,
 Disaster Prevention Research Institute
 URL : ars.gcoe.kyoto-u.ac.jp/index.php?id=3

Among the thirteen Kyoto University projects selected for the Global COE Program, the six below ended in March 2012. This issue of *Research Activities* is a special Global COE edition, introducing the objectives and achievements of the six finished projects. The projects' achievements include joint research, publications, international symposia, workshops, and exchange programs.

Together with MEXT, Kyoto University has supported these six projects, which have greatly enhanced the university's education and research undertakings.

www.kyoto-u.ac.jp/en/research/capital/global_coe/global.htm/

【Finished Projects】



Category : Life sciences (Since 2007)
 Title : **Formation of a strategic base for biodiversity and evolutionary research: from genome to ecosystem**
 Leader : Professor Kiyokazu Agata,
 Graduate School of Science
 URL : gcoe.biol.sci.kyoto-u.ac.jp/gcoe



Category : Chemistry, material sciences (Since 2007)
 Title : **International Center for Integrated Research and Advanced Education in Materials Science**
 Leader : Professor Mitsuo Sawamoto,
 Graduate School of Engineering
 URL : www.mtl.kyoto-u.ac.jp/gcoe/E



Category : Informatics, electrical and electronic sciences (Since 2007)
 Title : **Informatics Education and Research Center for Knowledge-Circulating Society**
 Leader : Professor Katsumi Tanaka,
 Graduate School of Informatics
 URL : www.i.kyoto-u.ac.jp/gcoe



Category : Informatics, electrical and electronic sciences (Since 2007)
 Title : **Center of Excellence for Education and Research on Photonics and Electronics Science and Engineering**
 Leader : Professor Susumu Noda,
 Graduate School of Engineering
 URL : www.kuee.kyoto-u.ac.jp/gcoe/eng



Category : Humanities (Since 2007)
 Title : **Revitalizing Education for Dynamic Hearts and Minds**
 Leader : Professor Masuo Koyasu,
 Graduate School of Education
 URL : www.educ.kyoto-u.ac.jp/gcoe/en



Category : Interdisciplinary and combined fields (Since 2007)
 Title : **In Search of Sustainable Humanosphere in Asia and Africa**
 Leader : Professor Kaoru Sugihara,
 Center for Southeast Asian Studies
 URL : www.humanosphere.cseas.kyoto-u.ac.jp/en



Formation of a Strategic Base for Biodiversity and Evolutionary Research: From Genome to Ecosystem

The Global COE project, “Formation of a Strategic Base for Biodiversity and Evolutionary Research: From Genome to Ecosystem,” was launched in 2007. The major difficulty in studying the evolution and diversity of organisms lies in the fact that various factors must be taken into account, which can result in a loss of focus. Traditional studies have had limited approaches, focusing on only one individual level or factor.

As the first step, to demonstrate the power of integrative approaches to young researchers, the project team conducted several pioneering research projects, such as genome analyses of dark fly and genome sequencing of individual chimpanzees together with the construction of an on-line primate genome database. Through these programs they were able to demonstrate the importance of combinatory approaches for new scientific developments in the future.

The team launched an integrative education program, with projects ranging from genomics studies to field science, called the Yakushima Field Work and DNA Study Training Course. Through the program they took an average of twenty-six PhD students to Yakushima Island every summer, and divided them into three or four classes, each with separate study foci: monkeys, plants, mushrooms and insects. Each class visited different locations on Yakushima Island and collected plants, mushrooms, insects or monkey (Japanese macaque) stools. After returning from the island, the students purified the DNA from the collected samples and analyzed their sequences in the DNA study component of the training course. They compared the DNA sequences detected in the monkey stools to those of the collected plants, mushrooms and insects, and thereby identified the foods of the Yakushima monkeys. They found that the Yakushima monkeys may have an ability to distinguish poisonous from nonpoisonous mushrooms.

Through these projects, we believe that each individual student was instilled with an integrative approach to science, which will enhance their international potential.



International Center for Integrated Research and Advanced Education in Materials Science

OBJECTIVES

This **GCOE Program** has two major objectives, based on the recognition that traditionally trained experts with a narrow area of specialization can no longer cope with complex global problems, such as sustainability and environmental issues.

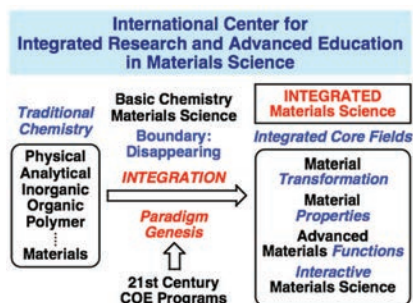
- **A New Paradigm:** “Integrated Materials Science” is a new paradigm in research that integrates basic chemistry and materials science beyond disciplines, faculties and geographical borders.
- **A New Breed of Scientists:** Cultivation of young scientists, internationally competent, scientifically creative, globally respected and trained under the concept of integrated materials science.

ACHIEVEMENTS

Joint Research in Integrated Core-Fields: The field of integrated materials science was established by integrating all of Kyoto University’s chemistry faculties, with 1986 original publications, eight international symposia, and four workshops.

Embryonic Research Project Support: Granted to 139 graduate students and 114 young assistant professors.

International Academic Exchange Program: Total 92 students and 32 assistant professors were sent to major institutions around the world, and 186 leading scientists were invited to participate in seminars, research collaborations and discussions.





Informatics Education and Research Center for Knowledge-Circulating Society

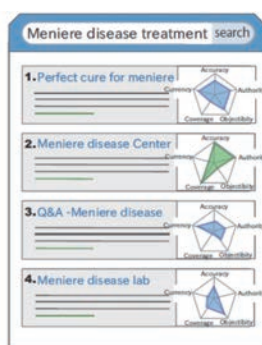


Measuring human communication behaviors and developing communication robots.

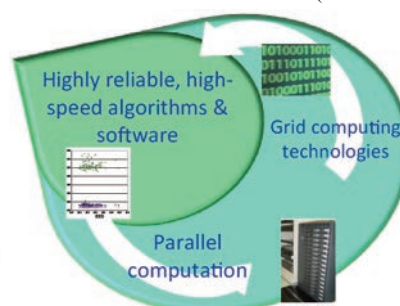
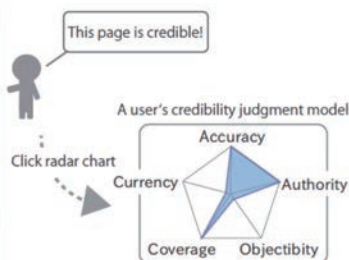


Development of an online multilingual service platform of online dictionaries, bilingual corpora and machine translations. Participants comprise 144 organizations from seventeen countries (as of Dec.2011).

Language Grid



Development of a credibility-oriented Web search engine.



Development of a parallel algorithm for singular value decomposition (SVD), one of the fastest (bidiagonal) SVD algorithms with $O(N)$ memory space.



Center of Excellence for Education and Research on Photonics and Electronics Science and Engineering

Under the motto of “challenge the limitations of current technology and create new functionalities,” the Global Center of Excellence (GCOE) Program for Photonics and Electronics Science and Engineering aims to investigate and develop innovative technologies to achieve the arbitrary manipulation of photons (light) and an ultimate control of electrons. Its extensive and systematic education programs have garnered a significant number of doctoral students, and provided training for self-reliant young researchers with strong leadership capability. The program actively pursues international collaboration with world-renowned research groups, constructing platforms for international exchange programs for young researchers. The accomplishments of the program’s doctoral students and other young researchers have been acknowledged by the conferral of over 100 awards, and over 470 papers have been published in academic journals. The program’s seventeen core faculty members have received over thirty awards, including the IEEE Nanotechnology Pioneering Award, the Leona Esaki Prize, and the MEXT Prize. More than 800 papers have been published in international journals such as *Nature* and *Science*, and their citation counts are rapidly increasing. In terms of achievements and performance, the program was rated as one of the best in its field by the GCOE Programs evaluation board in 2009. With support from MEXT, the program continues to encourage the activities of young researchers.



One example of the program’s research activities: a project on on-chip beam steering photonic crystal lasers, which was featured in *Nature Photonics*.



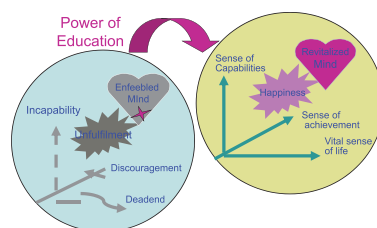
The Seminar Dojo: one of several education programs offered



Revitalizing Education for Dynamic Hearts and Minds

RESEARCH RESULTS: Under this project, a cross-national study on the sense of happiness was conducted by collecting 8,122 data samples from thirteen countries (Japan, South Korea, China, Australia, New Zealand, South Africa, United Kingdom, Germany, Spain, Canada, U.S.A., Mexico, and Brazil). The data was collected by means of an online survey. The participants from each country comprised approximately 600 people, with almost equal numbers of males and females, and ages ranging from adolescence to maturity. The questionnaire consisted of ninety-seven items in total.

Structural equation modeling revealed that happiness is composed of a sense of capability, a vital sense of life, and a sense of achievement. The results also showed that Japanese and Korean people are the least happy, while Mexican and Brazilian people are the happiest, with the other nine countries falling in between. The same pattern of results – unhappiness and low self-esteem among Japanese and Koreans versus happiness and high self-esteem among Mexicans and Brazilians – was also consistently found in the other surveys that formed this research. One phenomenon which is closely related to the survey results is the suicide rate (measured by the number of suicides per 100,000 people). According to a statistical analysis of suicide rates for thirty-five OECD member countries, the suicide rates for both genders in Japan and Korea are much higher than the average rate for OECD countries. On the other hand, the country with the lowest suicide rate is Mexico. Although Brazil is not an OECD member country, its suicide rate is known to be low. The suicide rates for the remaining seven countries are higher than Mexico, but lower than the average rate in OECD countries, with the exception of China and South Africa. The above result correlates with the sense of happiness in the respective countries. In order to prevent suicide, it is important to have methods to reduce unhappiness at the individual as well as at the societal level.



In Search of Sustainable Humanosphere in Asia and Africa

This program was designed to create a new field of research that addresses the question of environmental sustainability for the human society. An important feature of the program is the involvement of researchers from an extraordinary range of disciplines, and the serious intellectual interactions among them. In a six-volume series on the study of the humanosphere (published in Japanese; several English versions are currently in preparation), major science-related topics, such as natural disasters, energy security, biodiversity and the use of biomass, have been linked to equally urgent issues that are more closely related to the humanities and social sciences. One example of the program's findings was the need to refocus the 'intimate sphere' (as opposed to the public sphere) in order to deepen our understanding of humanity's connections with nature through the lens of the life-cycle (including ageing) and reproduction. The authors have argued that it is essential to recognize the centrality of the tropics as a region of historically accumulated knowledge on life and sustainability, and made their case by using historical studies, as well as through the presentation of in-depth field work. In addition, the Humanosphere Potentiality Index was constructed to show the combined potentiality of the geosphere, biosphere and human society. In contrast to the Human Development Index, the HPI suggests that the countries in the tropics often have a higher potential for sustainability than those in the temperate zones.

With the Center for Southeast Asian Studies as a collaborating institution, this program has mobilized the resources of the university's area studies institutions, such as the Graduate School of Asian and African Area Studies and the Center for Integrated Area Studies, as well as scientists working on frontier technology, particularly those at the Research Institute for Sustainable Humanosphere.

