

Tokku – Three Super Special Consortia led by Kyoto University Supporting the Development of Cutting-edge Medical Care

Super Special Consortia are centered around particularly innovative research discoveries with the potential of making a great impact on humanity. They are chosen as research areas of high priority by the Ministry of Health, Labor and Welfare.

With the full support of the government, these projects enjoy a freedom from certain time-consuming controls, paving the way for rapid development. In addition to the easing of regulations on research fund usage, consortia formed through this program enjoy the ability to communicate directly with the Ministry of Health, Labor and Welfare, about applying to have pharmaceuticals and/or medical devices approved while still in the developmental stages of the project.

A public call for entries and selection of projects was conducted by the Council for the Promotion of Health Research, which consists of four ministers, including the State Minister in Charge of Science and Technology Policy, and other experts.

Drug discovery projects based on control of intercellular signal transduction, targeting intractable diseases

This Special Research Initiative for Drug Discovery for Intractable Diseases is aimed primarily at the development of new therapeutic approaches for patients with intractable diseases, which consists of 3 internationally reputed projects as follows. Because of the very small number of patients with rare intractable diseases, the development of treatments for such diseases would provide limited business benefits to pharmaceutical companies. Therefore, this issue must be addressed by the national government and society, and especially by universities, as a priority area of medical research.

Project 1: Research project for bioactive peptides expected for effective drugs toward intractable diseases.

Project 2: Research project for controlled-release DDS selectively elevating local concentration of active substances.

Project 3: Research project for innovative anti-cancer immunotherapy with cell therapy.

Principal Investigator: **Kazuwa Nakao**,
M.D., Ph.D.
Director, EBM Research Center
Professor, Graduate School of Medicine,
Kyoto University



Innovative Medical Imaging Device Development Projects

Medical imaging technologies led the medical care of the 20th century, together with genetic medicine. The following four projects, based on innovative “imaging” technologies, promote the development of two diagnostic and two therapeutic systems for early diagnosis and advanced treatment respectively, in order to meet the needs of society.

Project 1: Optical Imaging System Development

Project 2: PET (Positron Emission Tomography) System Development

Project 3: Four-dimensional Radiotherapy System Development

Project 4: BNCT (Boron Neutron Capture Therapy) System Development

Principal Investigator: **Masahiro Hiraoka**,
M.D., Ph.D.
Professor, Graduate School of Medicine,
Kyoto University



iPS cell Projects

For their pluripotency, iPS cells (iPSCs) can be potential sources for cell-based therapy. Patient-specific iPSCs can be generated from the cells which can easily be sampled from an appropriate part of a patient's body. Theoretically, the target cells for transplantation can be made available from these iPSCs which can avoid rejection by the immune system when they are returned to the patient. In addition, expectations are high for such generated iPSCs to contribute to drug development and modeling for intractable diseases.

Based on this innovative technology which originated in Japan, we aim to realize advanced regenerative medicine for healthy longevity in the coming ageing society.

Project 1: Establishment of evaluation system for side effect and/or toxicology of drug candidate, which is more effective than conventional methods with animal models.

Project 2: *In vitro* modeling of intractable diseases and establishment of drug screening systems based on the patient-specific iPSCs.

Project 3: Establishment of the strategy for cell-based therapy for nerve, cardiovascular, and blood diseases.

Principal Investigator: **Shinya Yamanaka**, M.D., Ph.D.
Director,
Center for iPS Cell Research and Application (CiRA)
Professor, Institute for Integrated Cell-Material
Sciences, Kyoto University



Medical Innovation Center

The Kyoto University Graduate School of Medicine established the Medical Innovation Center (MIC) to promote the study of human medicine through integrated medical research conducted between university and pharmaceutical companies with state-of-the-art technologies for the discovery of new drugs, leading the way for the creation of new health care systems, particularly in innovative therapeutics.

Based on collaborative research conducted between whole companies and the university focusing on specific disease areas, the MIC aims to identify drug targets that are truly useful in clinical research, using the technologies available to analyze the extensive patient information and clinical samples collected at the university's medical school and hospital. This creates links between the discoveries on the basic structures and mechanisms of living organisms – a tradition at the Kyoto University Graduate School of Medicine – with the elucidation of the mechanisms behind human diseases.

www.med.kyoto-u.ac.jp/mic/



Director
Shu Narumiya



Medical Innovation Center

Ongoing Joint Research Programs with Private Companies

TK project – with Takeda Pharmaceutical Co. Ltd

The Takeda-Kyoto University (TK) project was begun in April 2011 as a five-year R&D project focusing on the discovery of new drugs that act on the central nervous system to treat obesity and schizophrenia. Obesity has become a leading preventable cause of death worldwide and one of the most serious public health problems in the 21st century. As of 2011, around 24 million people worldwide have been affected by Schizophrenia. Under the supervision of Profs Nakao, Kangawa and Sawa of Kyoto University, this project provides a great opportunity to develop innovative drugs to cure patients through the discovery of new targets, indentifying translational biomarkers and conducting clinical research by utilizing all findings, knowledge, research capabilities and assets from Kyoto University, Takeda and their worldwide networks.

DSK project – with Dainippon-Sumitomo Pharma Co. Ltd

Cancer is thought to be inevitable in organisms that have flexible mechanisms in regulating development, growth and tissue repair. The malignant behavior of cancer cells, however, must be controllable in some way. In this project sponsored by Dainippon Sumitomo Pharma Co. Ltd. we have focused on promising areas of cancer research (e.g. angiogenesis, invasion, metastasis, hypoxia-response, epigenetics, alternative splicing, and bioinformatics) to elucidate the common features and molecular bases of malignant phenotypes associated with cancer cells. Our aim is to develop this knowledge for clinical use as rapidly as possible.

www.dsk.med.kyoto-u.ac.jp/english/index.html

TMK project – with Mitsubishi Tanabe Pharma Co. Ltd

Chronic kidney disease (CKD) is a worldwide public health problem, and the number of patients affected with this disease has continued to increase. One of the reasons for the increase is the lack of effective treatments with which to deter the progression of CKD.

Our aim is to clarify the molecular mechanisms underlying kidney disease progression and to identify the potential therapeutic targets for CKD.

We further try to generate relevant animal models for human CKD, which will provide us with important information to explore the molecular pathogenesis of CKD.

The TMK project consists of three projects selected from applications, and two additional internal labs within Kyoto University.

MIC Related project: AK project – with Astellas Pharma Inc.

Kyoto University and Astellas Pharma Inc. has conducted research at the innovation center for immunoregulation technologies and new drugs for future generations incorporating the most advanced, fundamental and clinical immunology research and drug discovery technologies for the global needs in the field of innovative immunoregulation drugs. This project has started since 2007, in response to the adaptation to the program – “Formation of Innovation center for fusion of Advanced Technologies” – funded by the Japan Science and Technology Agency (JST) under the MEXT. The AK project has its own research laboratories on the medical school campus, with basic research scientists from the university and drug discovery scientists from Astellas working with clinical research scientists from clinical departments.

Kyoto University Medical Science and Business Liaison organization (KUMBL) is an organization set up in 2004 in conjunction with the Kyoto University Office of Society-Academia Collaboration for Innovation (SACI), and has contributed to promotional activities in collaboration with industries ever since. The volume of work is wide-ranging and includes assistance for the set-up of material transfer agreements and technology transfers, support for the development of practical applications of technologies, as well as the enrichment of education on intellectual property rights and management.

www.med.kyoto-u.ac.jp/KUMBL/e/index.html

Center for iPS Cell Research and Application (CiRA)

The Center for iPS Cell Research and Application (CiRA) was established in April 2010 as the world's first institute focusing on induced pluripotent stem cells or iPS cells. Professor Shinya Yamanaka, who pioneered the research field of iPS cell technology, leads the institute as director. Equipped with a cell processing facility and laboratory animal research facilities, CiRA is comprised of four research departments – Reprogramming Science, Cell Growth and Differentiation, Clinical Application and Regulatory Science and 26 principal investigators work here to realize medical and pharmaceutical applications using iPS cells.

www.cira.kyoto-u.ac.jp/e/index.html



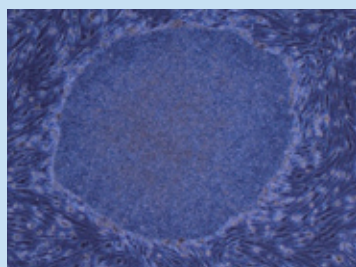
Director
Shinya Yamanaka

iPS Cell Bank Project

CiRA's focus for fiscal 2012, which starts on April 1, 2012, is placed on the establishment of an iPS cell bank for cell transplantation. The bank will store clinical-grade iPS cells from somatic cells of donors who have particular HLA (human leukocyte antigen) types. We plan to use the Facility for iPS Cell Therapy (FiT), a cell processing center built inside our research building, for the iPS cell bank project.



Facility for iPS Cell Therapy (FiT)



Human iPS cells

CiRA's intellectual property

CiRA's Legal Affairs and IP Office plays a central role in the management of patents associated with iPS cell technologies at Kyoto University and works closely with iPS Academia Japan Inc., which is authorized to license the use of the iPS cell patents. Kyoto University has obtained 3 patents in Japan, 1 patent in Europe and 2 patents in the U.S.

CiRA's goals over the decade

- Establishing basic technologies and securing intellectual properties.
- Developing new drugs by using patient-derived iPS cells.
- Establishing an iPS cell bank for use in regenerative medicine.
- Conducting preclinical and clinical studies on a few diseases.



CiRA research building



Urban transport policies for sustainable and liveable cities

The Urban Policy Unit for Low-carbon Society conducts research and provides educational courses on urban transport policies with the aim of reducing their negative environmental impact as well as creating safer and healthier communities. Studies focus on developing effective policies to encourage the use of public transport, including subways, tramways and buses over cars, by integrating urban transport and land-use planning. The process of implementing sustainable transport policies requires public-private partnerships to get all stakeholders involved in identifying problems, in finding approaches and solutions, and in evaluating and implementing policy measures. Also, technical innovations including ICT (Information and Communication Technology) and ITS (Intelligent Transport Systems) are helpful in promoting sustainable transport policies. For example, ITS based multimodal transport systems of feeder bus services and LRT (Light Rail Transit) are effective in providing better mobility, reducing CO₂ emissions and traffic congestion. Moreover, the reallocation of road space to public transport, bicycles and pedestrians can contribute to a boost in the culture, communication and sport activities within urban areas. These transport systems encourage the elderly, children and those without driver's licences to these modes of transport. The unit conducts collaborative research with municipalities and industries to form sustainable transport policies, while also offering extended courses to urban transport planners and operators to encourage the development of sustainable and liveable cities.

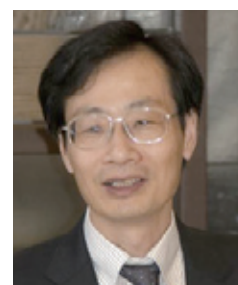


Professor
Eiichi Taniguchi

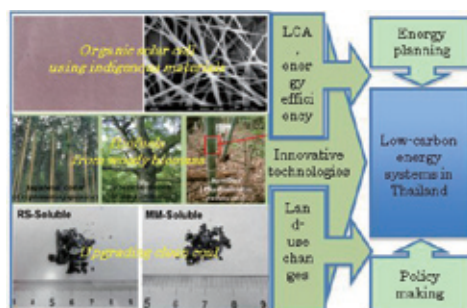
Developing low-carbon energy systems in Thailand

Mitigating greenhouse gas emissions from the economic growth of developing countries (such as Thailand) is of key importance for the global environment. We have been collaborating with Japanese and Thai research groups to develop low-carbon technologies that exploit the natural advantages of Thailand – including organic solar cells, biofuels from woody biomass, as well as by upgrading clean coal and land-use changes. Furthermore, low-carbon energy scenarios have been discussed with stakeholders in Thailand based on life cycle analysis and the technologies that were developed. As a result of the joint project, in 2012 the research team will present two scenarios (moderate and accelerated) projected out to 2030, driving towards a low-carbon society in Thailand. Other participating institutes are King Mongkut's University of Technology Thonburi (TH), Rajamangala University of Technology Thanyaburi (TH), Chulalongkorn University (TH), the National Institute of Advanced Industrial Science and Technology (JP) and the National Institute for Agro-Environmental Sciences (JP). This joint project is partially supported by the MEXT, Strategic Funds for the Promotion of Science and Technology, from FY2009 through 2011.

www.japanthailand.wordpress.com



Planner/Director,
Prof. **Keiichi
Ishihara** Graduate
School of Energy
Science



Global COE Programs:

The Global COE (Centers of Excellence) is a program with an aim to support quality research and education centers of the world's highest order. 13 projects have been selected from the wide range of scientific fields at Kyoto University, and are supported by the MEXT. These are the projects that have been chosen from among hundreds that were established by the previous 21st Century COE program, and continue to contribute to the world's knowledge bank.

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



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 : Information sciences, 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 : Information sciences, 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



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

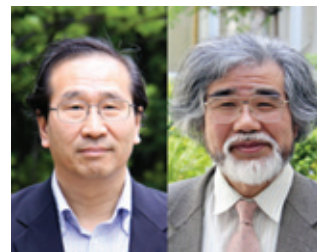
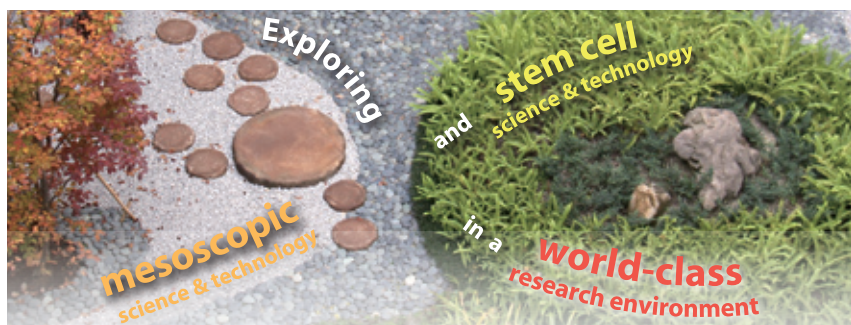


Category: Interdisciplinary, combined fields (Since 2008)
 Title : **Energy Science in the Age of Global Warming -Toward CO₂ Zero-emission Energy System**
 Leader : Professor Takeshi Yao,
 Graduate School of Energy Science
 URL : www.energy.kyoto-u.ac.jp/gcoe/en



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

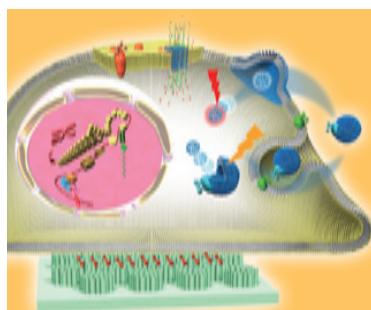
Institute for Integrated Cell-Material Sciences (iCeMS)



[left] Deputy Director **Susumu Kitagawa**,
[right] Director **Norio Nakatsuji**



- Launched in 2007 as part of a science ministry initiative
- One of six forefront research institutes nationwide
- Led by **Norio Nakatsuji**, Japan's human ES cell pioneer
- **Susumu Kitagawa**, **Shinya Yamanaka**, and others on staff



pathmaking science

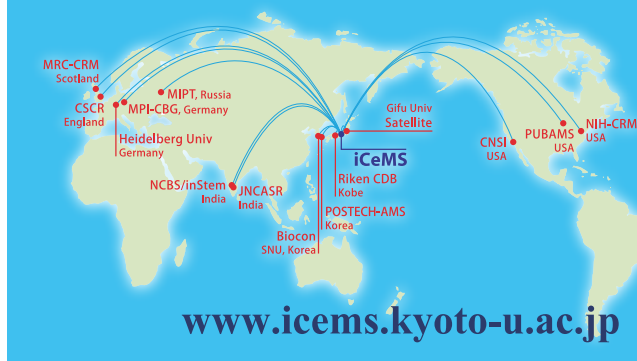
- Combining cell biology, chemistry, and physics
- Investigating multimolecular structures within cells and artificial materials
- International research groups
- Ample opportunities for young scientists to take the lead
- Work leading to innovations in medicine, pharmaceuticals, the environment, and industry



global outlook

- Active partnerships with a wide range of influential international research institutions
- Sponsoring joint symposia, short and long term researcher exchanges, and satellite labs
- New journal, *Biomaterials Science*, launched with the Royal Society of Chemistry (UK)

Photos: Welcoming the NCBS director (above) and attending a joint symposium at Heidelberg Univ.



Kyoto University Research Administration Office (KURA)

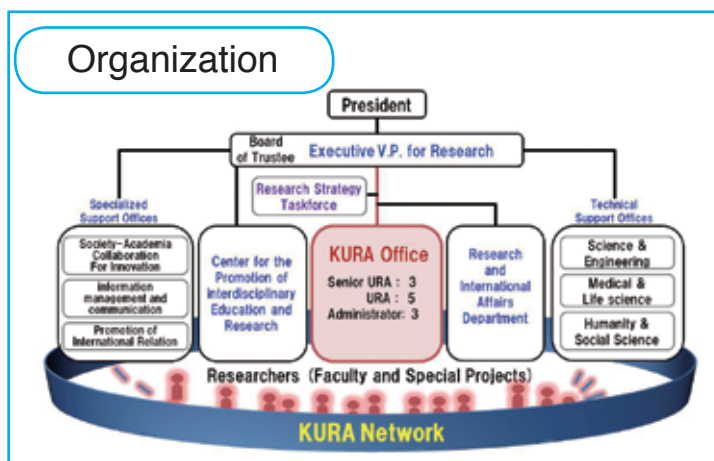
As part of a new national governmental movement, the KURA office will open in April 2012 as an organization to provide consistent research support for the planning of projects, obtaining of research funds, project execution and conducting of public relations. The aim behind the establishment of the KURA office is to ease the non-research related burden (administrative work) currently imposed on researchers, by formulating a well organized research support network. To achieve this aim, the KURA office strives to network and collaborate with the existing research support offices at Kyoto University.



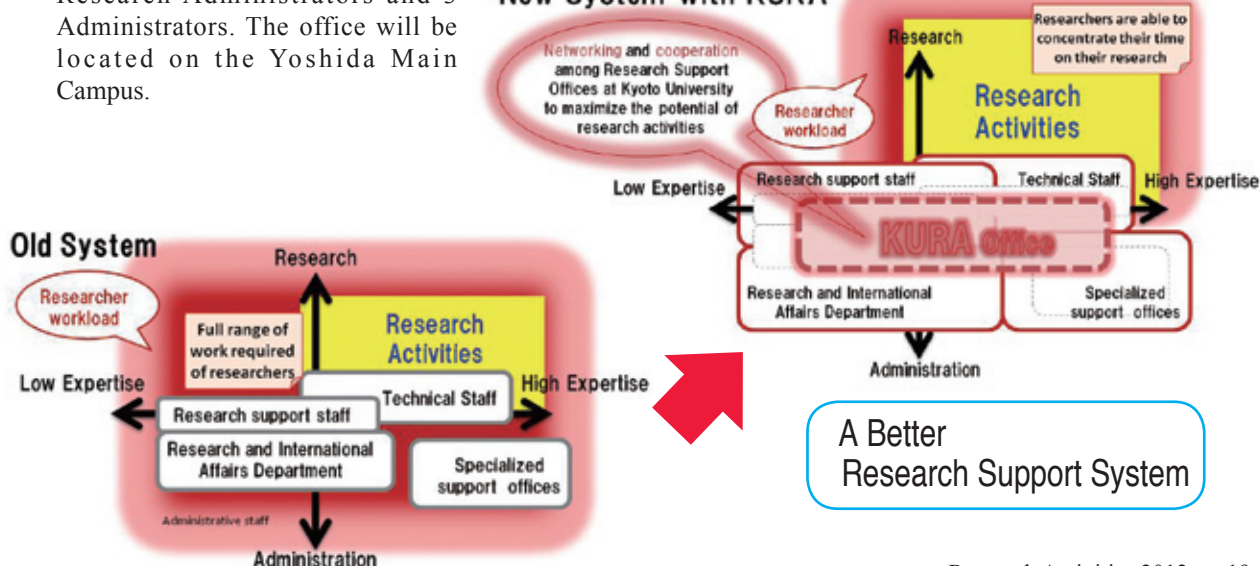
KURA office member as of February

For the promotion of research, the KURA office collaborates with the faculties, institutes and research centers within Kyoto University, as well as with external national/international research organizations including industries. Through these activities the KURA office is expected to form a firm basis of URA system which is not well recognized at the moment in Japan and to develop training programs for URA.

As of April 1, 2012, the KURA office is scheduled to consist of 3 Senior Research Administrators, 5 Research Administrators and 3 Administrators. The office will be located on the Yoshida Main Campus.



New System with KURA



Hakubi Project

The *Hakubi* Project welcomes applications from researchers all over the world regardless of the applicant's nationality. It is a project to support young researchers in any range of basic and applied studies in all academic fields. The following are introductions to recent research activities produced by two *Hakubi* researchers.

Business Groups: Challenging the Anglo-American Multidivisional Enterprise?

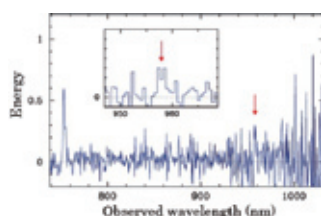
Associate Professor Asli M. Colpan



Business groups have not enjoyed an honorable reputation in social science literature as they are often seen as a second-best functional substitute for the Anglo-American multidivisional enterprise. Despite early contributions to industrialization, their prolonged resilience is argued to be harmful to economic wellbeing. Prof. Asli Colpan, together with her colleagues Professors Takashi Hikino and James R. Lincoln, aimed to strengthen the scholarly and policy-oriented understanding of the business groups in their *Oxford Handbook of Business Groups* published by Oxford University Press in 2010. The volume that underpinned the competitive capabilities of business groups was the first systematic and analytical examination of the complex evolutionary paths followed by the world's largest groups. Prof. Colpan is currently trying to pin down the exact conditions under which business groups can make positive contributions to the economy by thorough examination of the resilience of this organizational form.

Abundant Carbon in a Galaxy at 12.5 Billion Light-years Away

Associate Professor Tohru Nagao



The spectrum of TN J0924-2201 obtained with the Subaru Telescope. The red arrows point to the carbon signature.

The history of the formation of galaxies is one of the world's greatest unsolved mysteries. Understanding the chemical properties of early galaxies is a key to revealing the story of the Universe's evolution. Recently Dr. Nagao and his international collaborators succeeded in obtaining a deep optical spectrum of a galaxy 12.5 billion light-years away (TN J0924-2201, the most distant radio galaxy confirmed), with the Subaru Telescope, to view its chemical properties at a time when the age of the Universe was only 1 billion-years old. They detected a spectroscopic signature suggesting an abundant presence of carbon. The amount turned out to be higher than that which was expected to be present at the earliest phases of the galaxy's chemical evolution. This suggests the age of this galaxy being at least a few hundred million-years old, even at such an early phase of the Universe's timeline. This discovery has been published in *Astronomy and Astrophysics* (Matsuoka, Nagao, et al., 2011, Vol.532, Page.L10), and also appeared in a number of newspapers.



■ What is the *Hakubi* ? How do I apply?

The term, *Hakubi*, literally means "white eyebrows" in Japanese. The project is named after a legend in *Shu* (蜀), one of the states of Three Kingdoms era in ancient China. According to the legend, in the Kingdom lived five brothers with extraordinary talents. Since the fourth brother, who was particularly outstanding, had white hairs in his eyebrows, the term *Hakubi* has come to refer to the most prominent individuals. The call for application for the fourth batch will open in March, 2012.

■ For further information: www.hakubi.kyoto-u.ac.jp/eng

Tachibana Award – for the Most Outstanding Female Researchers at Kyoto University

Kyoto University established the award in 2008, as a system to acknowledge the outstanding research achievements of young women researchers at Kyoto University in the fields of humanities, social sciences, and natural sciences. By publicly honoring researchers who have made excellent accomplishments in their research, the award aims to further motivate them, as well as future generations of women researchers following in their path, to contribute to the diversity of scientific research not only at Kyoto University but throughout Japan and the world.

Award Winners



Year	Name / Current Affiliation	Research Topics
2008	Yoshiko En'yo [right], Assoc. Prof., Yukawa Institute for Theoretical Physics	Mysterious Phenomena in the Micro-World – The Cluster Structure of the Atom Core –
	Sakiko Honjo [left], Doctoral Student, Graduate School of Biostudies	Molecular Mechanism of Life Extension through Dietary Control
2009	Asli M. Colpan [center, right], Assoc. Prof., of the Endowed Chair at the Graduate School of Management	Theoretical and Empirical Cross- national Research on “Business Groups”
	Hiroko Watanabe [center, left], Doctoral Student, Graduate School of Science	Observational Research on Microstructure of Umbra Dot in the Sunspot
2010	Youko Hamazaki [left], Assoc. Prof., Graduate School of Medicine	Study of thymic epithelial cell proliferation and differentiation and self-tolerance mechanism
	Kyoko Kitamura [right], Doctoral Student, Graduate School of Engineering	Extreme micro-scale focusing by photonic crystal laser
2011	Kaori Shiojiri [left], Assistant Prof., Hakubi Center	Ecological interaction networks triggered by plant volatiles
	Sakie Suzuki [right], Doctoral Student, Graduate School of Science	Study on quantum link invariants using universal invariants



■ Origins of the *Tachibana* Award name

The Tachibana, an evergreen citrus indigenous to Japan, has been highly valued since ancient times as a symbol of eternity, and is often the motif in traditional family crests. The Japanese Order of Culture is also designed in the image of the five cyclic petals of the flower, likening the qualities of the evergreen with the longevity of culture. Named with these images in mind, the *Tachibana* Award is conferred in the hopes that the scientific activities of the outstanding female researchers who receive it will remain resilient.