The collection of collaboration case studies between industry, academia and government

# TMU·Beyond

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FIRST ISSUE

## A Fresh Breeze into the World of Materials Chemistry
# Gold nanoparticles

Applying the World's Finest Water Supply Technology to Provide Safe, Secure Water

Establishing Technologies for Safely Treating Rubble and Tree Bark Containing Radioactive Contaminants

A Scientific Investigation of Tourism and Tourism's Contributions to Local Societies

Applying Information Technology to Help Create Resilient Communities as Disaster Mitigation

Compiling and Linking Variegated Data on Google Earth to Create New Value

TOKYO METROPOLITAN UNIVERSITY

Feature

## A Fresh Breeze into the World of Materials Chemistry

# Gold nanoparticles

Gold nanoparticles: Wide-ranging applications from environmental purification and chemical product synthesis to biotechnology

**Masatake HARUTA**

Department of Applied Chemistry, Graduate School of Urban Environmental Sciences, Tokyo Metropolitan University
Professor/Doctor of Engineering

2012 Thomson Reuters Citation Laureate (Chemistry)

### Hydrophilic gold catalysts which work at room-temperature show remarkably high performance in purifying air and water

Gold particles with diameters of 2–5 nm are called gold nanoparticles (NPs). I found their catalytic activity for the first time in 1982. The catalytic activity of gold NPs has three outstanding features.

The first is that gold NPs exhibit catalytic activity at room temperature, a significant advantage in purifying common substances that occur naturally in our environment, such as water and air.

The second feature is the hydrophilic nature of gold NPs. Usually, water depresses catalyst performance. In contrast, the hydrophilic nature of gold catalysts means that there is no need to remove water before catalytic reaction. In addition to room-temperature activity, this hydrophilic nature makes the gold catalyst extremely useful in deodorizing and purifying air and drinking water.

The third feature is the unique selectivity to a specific product among possible products. For example, the raw material for polyurethane used in car bumpers, home appliances, and sofas is a compound called propylene oxide, whose conventional manufacturing process involves the use of chlorine and necessitates treatment of hazardous byproducts. If we can replace conventional processes with a manufacturing process using gold clusters (with several tens of gold atoms per cluster), we can allow propylene oxide synthesis to proceed with molecular oxygen alone. Since no hazardous byproducts are generated, the process would be environmentally friendly. In addition to enabling a resource-saving and energy efficient process, gold NPs allows one step propylene oxide synthesis, compared to the two- or three-step process required by conventional methods, thereby allowing more compact manufacturing plant designs. Although time will be needed before gold NP catalysts can be incorporated into actual production processes, the selectivity of this catalyst will revolutionize the world of chemical synthesis.

CO oxidation reaction experiment: Glass tube is filled with sample catalyst and immersed in a constant temperature bath.

From the thermodynamics point of view, some reactions favor low temperature/high pressure conditions or high temperature/low pressure conditions. For the latter reactions, catalysts other than gold are still preferred.

An example of a general-purpose product for gold nanoparticle catalyst research from Haruta Gold Inc.

### The expanding potential of gold nanoparticles in chemistry and biotechnology

Commercial application of gold catalyst has already begun in chemical industries. In Japan, since 2008, Asahi Kasei Chemicals Corporation has manufactured methyl methacrylate, a raw material for transparent acrylic boards, by a gold NP catalyst. Research is also underway to develop a method for the production of mesh-type gold catalysts, which are applicable to filters for air purification systems. If all goes according to a plan, the first products will appear on the market in 2014 to early 2015. Outside Japan, DuPont in USA is currently testing a purification plant for drinking water.

In biotechnology, gold colloids with particle diameters of about 50 nm are already being used as diagnostic drugs for diabetes and pregnancy tests. In the future, gold clusters may even replace conventional drugs. Gold NPs offer promise not only in industrial products, but also in food, medical, pharmaceutical, and other fields.

### Follow-up on research by providing reference samples of gold catalysts to industries through a venture company launched in Tokyo Metropolitan University

Haruta Gold Inc. was founded in July 2013 as a venture company launched in Tokyo Metropolitan University. The company provides reference samples of gold catalysts to industries and pursues sponsored research and development. This is a prime example of a pioneering effort in industry/academic collaborations. Through Haruta Gold Inc., we can provide industries and research institutes which are facing various challenges with labor- and cost-saving solutions and other support.

# Applying the World's Finest Water Supply Technology to Provide Safe, Secure Water

Joint research with commercial enterprises to develop pipe cleaning technologies
Creating a human resource network for Asia's future

## The ultimate issue facing 21st century society: A cyclical renovation scheme for water supply and sewage systems

We can compare the role of waterworks in the urban environment to the roles played by blood vessels in the human body. Our water supply and sewage systems are essential elements of industry and our daily lives. We need to adopt a cyclic renovation strategy to maintain this infrastructure. This involves performing regular health checks of waterworks and fixing or replacing old pipes. Personally, I believe my mission is to establish a framework for such strategies before the next century.

In 2002, as part of these efforts, we launched the Seoul-Tokyo Forum, a joint project with the University of Seoul in Korea intended to pursue research on water supply, sewage works, and environmental preservation. Since 2007, participation has broadened to include the government bureaus of waterworks and waterworks associations of both countries. As an ideal organization for collaboration among individuals associated with waterworks, this forum has become a venue for presenting both theoretical and real-world achievements.

One of the leaders of the forum on the Korean side, Professor Jayong Koo, earned his doctoral degree at my laboratory, a personal bond that helped establish this forum. Japan's current water supply technologies are regarded as among the world's best. We are confident Japan can help improve water supply technologies worldwide and demonstrate leadership in Asia. The joint forum with Korea is a first step in these international collaboration efforts.

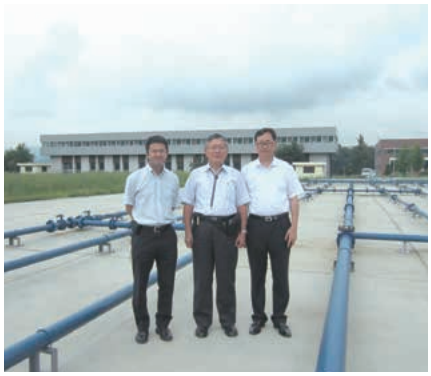
Group photo from 12th Seoul-Tokyo Forum at the University of Seoul

## Human networks essential for technological development: Promoting human resource exchange with support from the Tokyo Metropolitan Government

The key to further advances in Japan's technologies and to distributing them worldwide lies in cultivating trained human resources. In 2008, the Tokyo Metropolitan Government founded the Asian Human Resources Fund to train individuals who will support Asia's future. Our university is actively seeking out motivated students from Asia who wish to pursue advanced studies at our university. In our advanced research program on Asia's water problems (representative: Prof. Akira Kawamura), 12 students to date from Vietnam, Korea, Philippines, Indonesia, India, and other Asian countries have entered our doctoral course and are currently hard at work on their studies. To expand human resources networks around Asia, we must maintain a dialogue with students who earn their doctoral degrees and return to their home country by establishing joint research projects. Such efforts are essential for continuing technological progress.

Our laboratory also supplies numerous graduates each year to the Bureau of Waterworks of the Tokyo Metropolitan Government. Additionally, staff members from the bureau come to our laboratory to work on their doctoral degrees. Such close collaboration with the Tokyo Metropolitan Government is among the key features of the Tokyo Metropolitan University.

Success in developing a cyclical renovation scheme for waterworks will also require contributions from commercial entities. In the past, our laboratory has pursued joint research with commercial enterprises to develop pipeline cleaning technologies. One of our laboratory's focus areas is the promotion of such collaborative efforts with businesses, mediated by the Tokyo Metropolitan University Liaison Office, which serves as our university's technical contact to the commercial world.



Experimental pipe network facility in the Seoul suburbs (on right, Prof. Jayong Koo; on left, Assoc. Prof. Yasuhiro Arai)

**Akira Koizumi**
Division of Civil and Environmental Engineering, Faculty of Urban Environmental Sciences, Tokyo Metropolitan University
Professor Emeritus/Doctor of Engineering
Professional Engineer (Water Supply & Sewerage)
Liaison Office Diretor Substitute

# Establishing Technologies for Safely Treating Rubble and Tree Bark Containing Radioactive Contaminants

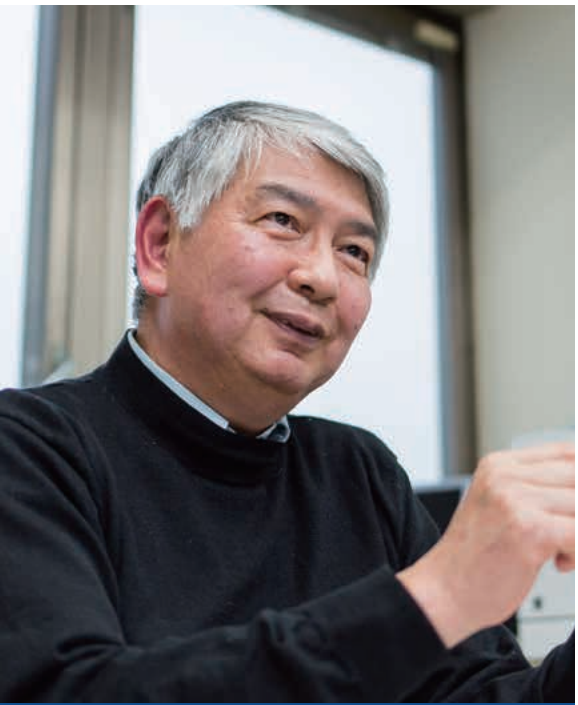
Joint research development with small- to mid-sized enterprises: Technologies to manage and reduce the volume of radioactive rubble and remove radioactive contaminants from tree bark

## Joint research project with the Fukushima Prefectural Forestry Research Center, Identifying the status of contamination in forests, fields, and trees

On March 12, 2011, following the Great East Japan Earthquake, a nuclear plant disaster resulted in the release of massive volumes of radioactive materials into the atmosphere. In the following April, our laboratory submitted a proposal titled “Designing a Framework for the Safe Treatment of Contaminated Rubble and Contaminated Agricultural and Forestry Resources” in response to a call for disaster-area support programs from the Tokyo Metropolitan Government. This program marked the start of joint research with the Fukushima Prefectural Forestry Research Center.

Agriculture and forestry are two major industries in Fukushima prefecture, 70% of whose land surface is covered by forest. How far the contamination is spreading is one of the most serious concerns among local residents. To investigate the extent of the contamination, a Japanese cedar tree on the grounds of the Forestry Research Center was cut down and analyzed, together with soil specimens. The results showed high concentrations of radioactive substances in the tree bark, in contrast to the interior wood.

The tree bark generated as a byproduct of timber production at the sawmills is processed into compost. While using the interior part to produce lumber appeared to have no issues, this investigation indicated contaminated bark cannot be used as compost. A method therefore needed to be established to treat the massive volumes of contaminated tree bark produced at the sawmills and to enable the forestry industry to restart operations. Additionally, the Abukuma region in Fukushima is famous for its high share of the *shiitake* mushroom market; the contamination of the seed logs (*genboku*) stopped cultivation of *shiitake* mushrooms and shipments of seed logs.

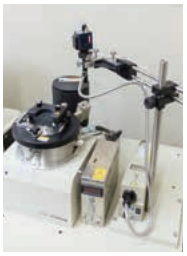


**Hirohisa Yoshida**
Department of Applied Chemistry, Graduate School of Urban Environmental Sciences, Tokyo Metropolitan University
Professor/Doctor of Engineering

## Sophisticated technologies from small- to mid-sized enterprises help develop an incineration system for contaminated rubble and a cleansing instrument for a tree bark

Contaminated rubble is piled up high at temporary rubble dump sites throughout Fukushima prefecture. This is because an efficient method to treat such has not been established. Though incinerating such rubble will increase the concentration of radioactive substances, it can dramatically reduce waste volumes. We therefore proposed a method to reduce rubble volumes by incineration and to manage the resulting highly-concentrated incineration residue and ash in a specialized storage facility operated by specialists. We also developed an instrument to safely incinerate contaminated rubble and to treat the smoke, ash, and residue produced by this process to avoid adverse effects on the surrounding environment. The instrument and management method proposed by our laboratory also addresses the problem of voluminous tree bark waste faced by the forestry industry.

To decontaminate *shiitake* seed logs, we have developed an instrument jointly with Macoho Co., Ltd. that will cleanse seed log bark and remove radioactive substances adhering to it. The instrument is based on a wet blast technology developed by Macoho Co., Ltd., a company we first made contact with at a technology seminar for business partners organized by the Tokyo Small and Medium Business Investment & Consultation Co., Ltd. in cooperation with our university.



Atomic force microscope (AFM) with molecular-level resolution under controlled environment used to clarify the mechanism of radioactive contaminant removal

This wet blast technology has proven remarkably effective in removing radioactive contaminants from tree barks. Cultivation experiments with seed logs cleaned with this method began in April 2014 to determine whether the *shiitake* mushroom produced from such logs will be free of radioactive substances. If the results are favorable, both *shiitake* cultivation and shipments of seed logs can restart, contributing to the recovery of forestry industries in Fukushima.

The nuclear disaster in Fukushima has brought enormous damage. By linking to Fukushima prefecture through the Tokyo Metropolitan Government and by undertaking joint research with small- to mid-sized enterprises offering advanced technologies, we believe our laboratory is contributing to recovery efforts among the people of Fukushima. With respect to technological development and social contributions, we believe this represents a prime example of the potential benefits of industry/academic collaborations facilitated by administrative programs. To help rebuild Fukushima, we plan to continue with these efforts, including industry/academic joint efforts.

Fibers for efficient elimination of radioactive cesium from contaminated wastewater from the seeded log decontamination instrument and combustion gas removal instrument

# A Scientific Investigation of Tourism and Tourism's Contributions to Local Societies

## Cultivating the human resources needed to support local tourism and local revitalization

### Fostering the next generation of farmers
### Launching the TAMA NEXT Farmers Program in the Tama Region, a school for future farmers

Urban and agricultural functions differ fundamentally in nature. Formulating management strategies for farmland located in urban settings poses many difficulties. However, Urban farmland are highly productive and have a key role in urban society. Farmland is not just land on which agricultural products are grown; it provides greenery and creates suitable urban relaxation and recreation spaces. It can also serve as evacuation centers in the event of disasters. These are some of the reasons why it is important to preserve urban farmland and agriculture.

TAMA NEXT Farmers Program, an initiative to preserve urban farmland by cultivating the next generation farmers. It is a school in the Tama region which was launched in fall 2013 via joint project involving our laboratory and its partners, Tama Shinkin Bank and the Tokyo Development Foundation for Agriculture, Forestry and Fisheries. The program of study consists of 10 lectures and two fieldwork sessions. Major study topics include techniques to prepare good soil, mechanisms necessary to distribute production, strategies for farm management and global marketing, and laws and regulations associated with agriculture. New ideas have emerged from this school, including plans to network multiple farms to help run farmers' markets previously set up and operated by individual farms.

We expect the results of these efforts to expand joint efforts with commerce and industry and to promote the foundations of a new type of academic cooperation with local community through contributions to agriculture.

Research of rural tourism and rural resource utilization in England's Lake District

Field research of farming activities at Green Leaf Akagi Kogen Farm in Showa Village, Gunma prefecture, part of the TAMA NEXT Farmers Program

### Student exchange programs that contribute to environmental preservation and local revitalization in ASEAN Countries

The Asian overseas initiative to educate next-generation leaders in environmentally-friendly food supply, technological innovation, and regional planning seeks to expand our school's aim of cultivating future farmers to global scale. Partners include the Tokyo University of Agriculture and Technology and Ibaraki University. This initiative has already been accepted as a project for the Re-Inventing Japan Project, a series of efforts supported by the Ministry of Education, Culture, Sports, Science and Technology. Through student exchange programs, this project aims to promote environmental preservation and local revitalization in the ASEAN region, which supplies Japan with food and timber.

Exchange students from ASEAN learn methods for achieving sustainable agriculture and environmental preservation in Japan, while Japanese students learn what Japan can do to help local communities in ASEAN countries. Full-scale program activities began in 2014. Around 150 students from ASEAN countries are expected to visit Japan within the next five years, while the same number of Japanese students is expected to visit ASEAN countries.

Our theme, local revitalization, also focuses on tourism. The tourism industry generally tries to use available environmental resources to develop effective tourist attractions, while we believe developing a truly feasible plan for tourism will require a multi-disciplinary, multi-faceted assessment of tourist resources, one that integrates conventional social and cultural perspectives (which tend to emphasize the beauty and appeal of tourist destinations) with a scientific and engineering understanding of geography, agriculture, ecosystems, and urban design. We call this field "tourism science," a field in which no other university offers programs of study.

**Toshio Kikuchi**
Department of Tourism Science, Graduate School of Urban Environmental Sciences, Tokyo Metropolitan University
Professor/Doctor of Science

# Applying Information Technology to Help Create Resilient Communities as Disaster Mitigation

Joint research development with commercial enterprises for a concierge robot

## TMU proposes new earthquake disaster mitigation measures as a think tank of the Tokyo Metropolitan Government

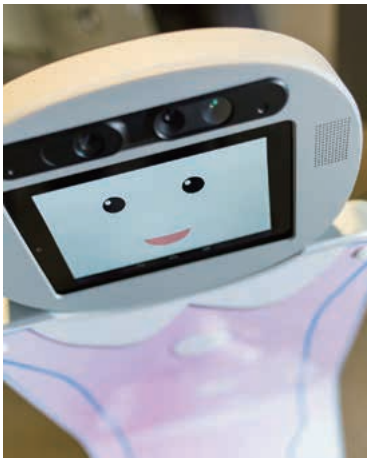
In August 2013, our university launched its Comprehensive Research Project on Disaster Mitigation Measures, an initiative involving three teams from the social sciences and five from natural sciences and engineering. The project is intended to make anti-disaster measures more efficient, in preparation for future earthquakes in the Tokyo metropolitan area. Disaster-related researches have been tackled separately by researchers in different fields since the Great East Japan Earthquake in 2011. The project integrated such researches, in effect acting as a one-stop shop. The project's major focus is on restoring the infrastructure and economy following such earthquakes. In a joint effort with the Tokyo Urban Planning and Development Corporation, we have a plan to submit a proposal compiling research results to the Tokyo Metropolitan government in 2015. My role in this project is unit leader of the science and engineering teams undertaking QOL (Quality of Life) research. We pursue research on measures to create resilient communities, with a special focus on disaster mitigation.

After the Great East Japan Earthquake, major issues arose in regions where relief efforts were directed based on top-down decisions by the municipal government. For example, one evacuation center received 100 bottles of water, but refrained from distributing any of them because the number of the refugees at the center was 110. Such issues did not occur in well-functioning communities where relief efforts were governed by leaders of neighborhood associations (*chounaikai*). In these regions, neighborhood associations had prepared in advance through emergency evacuation drills, and regional community halls had served as evacuation centers. In these cases, community members considered the needs and concerns of those affected from a bottom-up perspective, facilitating the effective distribution and sharing of resources among those needing them.

**Toru Yamaguchi**
Department of Information and Communication Systems, Graduate School of System Design, Tokyo Metropolitan University
Professor/Doctor of Engineering

## Working with commercial enterprises to develop robots capable of concierge and communication functions

In order for a community to remain functional during times of emergency, circles of co-operation need to be established before disasters strike. To promote such efforts, we work with commercial enterprises to develop concierge robots capable of gathering information on the local area and other useful information for residents and providing a range of services. Examples include providing the latest information on the local community or mapping a walk suitable for a given individual. These robots can be deployed in locations where local residents assemble—for example, the community hall—helping people become acclimated to the presence of the robots and helping residents keep in touch. This allows local residents to learn how to make the most effective use of these robots during emergencies, thereby making the best use of the circles of co-operation established among themselves.



Concierge robot that provides various services, including local information

Our laboratory has also been developing communication robots equipped with voice recognition, speaking, image recognition, and other functions to provide security and assistance to the elderly (elderly monitoring robot system) as part of a joint research and development project. The elderly monitoring companion robot can detect unusual states—for example, if an elderly person falls out of bed—and issue an alarm to the concierge robot installed at the community hall. Our current research also includes efforts to develop smartphone applications that offer some of the functions of an elderly monitoring robot system.

Our laboratory mission is to draw on the potential of IT to establish resilient communities.

The ApriPoco (Toshiba), a communication robot that watches over the daily lives of community residents

# Compiling and Linking Variegated Data on Google Earth to Create New Value

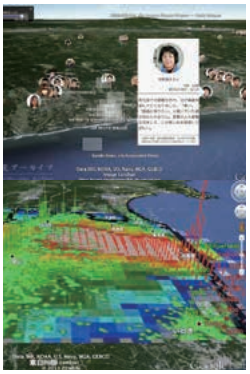
Goals include boosting tourism, local revitalization, history education, and marketing

## Compiling big data on a single platform may lead to revealing associations between data previously unnoticed.

The Internet is flooded with vast volumes of information. However, in many instances, this information exists piecemeal or independently and often represents a single aspect of a larger picture. The main focus of my research is to present the connections and associations yet to be established among such information by collecting a broad range of data and mapping this onto the three-dimensional map known as Google Earth.

Some examples of content have been already created in this way include the Hiroshima Archive and the Nagasaki Archive. These initiatives involve overlaying photos of the atom bomb survivors of Hiroshima and Nagasaki over locations on the map where they were standing at the time of the two bombings. Viewers can click the photos to watch the stories recounted by each survivor or to see interview footage.

In 2013, we were awarded the Good Design Award by the Japan Institute of Design Promotion, a prize given to products and content recognized for their good design. The Great East Japan Earthquake Archive, which visualizes damage caused by the earthquake, won the award in the Tohoku recovery design category, winning recognition for its demonstrated innovation, expressive power, and technical prowess. Our efforts have also won a prize at Ars Electronica, the world's leading media arts festival, reflecting, we are proud to say, both domestic and foreign recognition. We are drawing up plans to begin developing content for the 2020 Tokyo Olympics in 2014.



The Great East Japan Earthquake Archive gives visual form to data associated with the 2011 Earthquake.

The Hiroshima Archive, a digital archive of the Hiroshima atomic bombing

My area of expertise is information analysis and visualization by using Google Earth. The students at my laboratory are at work on visualization schemes for various types of data of various platforms.

## The promise of data with high applicability to map
## Effective use of consumer-sourced data

For the Hiroshima Archive, interviews with bomb survivors were undertaken by local high school students, not professional interviewers working for TV stations or other media outlets. In these interviews, perhaps due to their trust in the students, some survivors recounted episodes they had never related to anyone. We believe data that captures this humanity is most likely to emerge in cases where real bonds are established between the individuals providing and collecting the data.

Among our laboratory's major themes is establishing methods for collecting such valuable and individualized data. Our technology is especially useful for businesses and organizations that already have such data—for example, data on tourism or information on local areas. Indeed, with staff members from the Koshigaya City Society Commerce and Industry, we are currently developing a smartphone application that will allow users in the city to lift their smartphone to a storefront to view relevant information. These applications apply a technology called augmented reality (AR), which superimposes virtual information onto real-world objects. Such techniques may also prove useful in history education.

One business has applied these technologies in one of its marketing campaigns, mapping data provided directly to a platform by consumers via smartphone applications.

Compiling such scattered data makes it possible to, in effect, read between the lines in ways not possible with scattered data. As a method for analyzing and realizing big data's near-infinite potential, this visualization technology offers vast promise.

**Hidenori Watanave**
Department of Industrial Art,
Graduate School of System Design,
Tokyo Metropolitan University
Associate Professor

## Research Topics

Four research centers attached to their respective departments were recently established at the Tokyo Metropolitan University, part of an initiative to promote the work of research groups characterized by unique research perspectives embodying our university mission and/or remarkable research achievements and connections to global research centers.

### Research Center for Gold Chemistry

Head of research center: Masatake Haruta

Professor, Department of Applied Chemistry,
Graduate School of Urban Environmental Sciences

An Overview of the Research Center: No other research center anywhere in the world focuses solely on research related to the chemistry of gold. The Research Center for Gold Chemistry is a world pioneer in its unique and innovative efforts to create novel functions by combining gold and biotechnology. We expect that our current efforts to develop a catalyst using gold nanoparticles and clusters will eventually lead to a commanding position in the field of green chemistry. The Center is currently investigating the following themes: (1) structural analysis and surface chemical properties of gold clusters; (2) simple chemical processes that will allow efficient use of resources and energy without generating unnecessary byproducts; (3) synergies between artificial gold nanoparticle catalysts and natural biocatalyst enzymes; and (4) investigating the pharmacological effects of gold clusters and applying the findings to synthesize medicines entirely free of side effects.

### Research Center for Artificial Photosynthesis

Head of research center: Haruo Inoue

Professor Emeritus, Department of Applied Chemistry,
Graduate School of Urban Environmental Sciences

An Overview of the Research Center: Artificial photosynthesis research encompasses diverse disciplines, including biology, biochemistry, molecular biology, chemistry, materials science, physics, engineering, and computational chemistry. In the past, Japan led the world in the fields of scientific principle of photosynthesis, artificial photosynthesis in organic and complex systems, and artificial photosynthesis of semiconductors. A study undertaken at the center led to the discovery of two-electron activation by one photon radiation, a key advance in artificial photosynthesis in organic and complex systems, one of two major fields of artificial photosynthesis. This achievement has been acclaimed as a major breakthrough with the potential to provide a solution to the bottleneck of water oxidation in artificial photosynthesis. We expect this center will achieve important connections to other research centers around the world.

### Research Center for Space Science

Head of research center: Takaya Ohashi

Professor, Department of Physics,
Graduate School of Science and Engineering

An Overview of Research Center: This center features the joint and collective efforts of research teams drawn from physics and chemistry departments currently active in space research. The four participating teams from the physics department are the astrophysics experimental group, high-energy experimental group, atomic physics experimental group, and theoretical astrophysics group. Research currently undertaken by the center includes X-ray astronomical observations with the Suzaku and ASTRO-H (scheduled to launch in 2014); particle physics experiments such as B factory and Double Chooz; atomic physics experiments, including highly-charged ion collision experiments; and theoretical astrophysics studies focused on high energy processes. The astrochemistry and physical chemistry groups are two teams drawn from the chemistry department; they are engaged in studies that involve analyzing meteorites and asteroid samples from the Hayabusa and Hayabusa 2 missions, as well as experiments involving ion storage rings and highly-charged ion collisions carried out jointly with the atomic physics group.

### Research Center for Genomics and Bioinformatics

Head of research center: Kouichiro Tamura

Professor, Department of Biological Sciences,
Graduate School of Science and Engineering

An Overview of the Research Center: The progress achieved in DNA sequencing in recent years has been nothing short of astounding, including a near order of magnitude improvement in sequencing efficiency over the past two years. In light of these circumstances, there has been growing interest in developing information processing technologies that will facilitate the application of DNA sequencing data to life science research. From the commercial perspective, it has become vital to train a corps of young researchers with full command of these bioinformation analysis technologies. The center is currently at work on the following themes: (1) developing bioinformatics and analysis software with a special focus on genomic analysis; (2) life science studies with a focus on bioinformation data analysis; (3) training bioinformation scientists through postgraduate programs; and (4) establishing an international collaborative research framework for bioinformatics studies.

## Introduction—University Research Administrator, Liaison Coordinator, Intellectual property manager

**Masataka Sakurai**
(Head of Research Administration Office & Liaison Office)

**Place of birth:** Nagoya. Graduated from the Faculty of Economics, Hitotsubashi University. **Career:** Worked for 20 years in investment and loans, management consulting, and joint industry/academic projects. At current position since 2011. Also an outside director of venture businesses; instructor at the Japan Patent Office; former external board member of METI. **Interests:** Watching NFL, heavy metal.

**Hiroshi Kunimasa**
(International support group, Chief URA)

**Place of birth:** Kumamoto. Graduated from the Faculty of Economics, Kobe University. **Career:** Worked for 21 years in investment and loans and securities at domestic and foreign banks. At current position since 2010. Also a securities analyst. **Area of expertise:** Analysis of financial market and industry trends. **Interests:** Golf; recreational driving.

**Toru Shibata** (Senior research scientist)

**Place of birth:** Okayama. Graduated from the Faculty of Engineering, Yamaguchi University. **Career:** Worked at NEC and a consulting firm before founding his own company. At current position since 2011. Also president of venture company based on TMU and lecturer in Rikkyo University's MBA program and active in many other posts. **Interests:** playing baseball in mornings; dog rescue volunteer.

**Tomohiro Suzuki** (Liaison Coordinator)

**Place of birth:** Tokyo. Graduated from the School of Commerce, Senshu University. **Career:** Formerly worked at Tama Shinkin Bank, mainly as corporate solutions advisor. Active since 2014 as dispatched coordinator for industry/academic/government collaborative projects. **Credentials:** 2nd grade Certified Skilled Worker of Financial Planning, professional cooking license. **Interests:** Angling, recreational driving.

**Hirokazu Fujimoto** (Intellectual property manager)

**Place of birth:** Saitama. Graduated from the Faculty of Science, Tokyo University of Education (currently Tsukuba University). Thereafter studied at the university's graduate school, earning a PhD in Science. **Career:** After working at the Mitsubishi Kagaku Institute of Life Sciences as researcher, worked for seven years in industry/academic joint efforts as patent advisor at Keio University. At current position since 2011. **Interests:** Tropical fish; gardening

**Toshihiko Nakanishi** (Chief Liaison coordinator)

**Place of birth:** Hokkaido. Graduated from the Faculty of Economics, Hokkaido University. **Career:** Became independent consultant after working in the sales department at a sanitary ware manufacturer. At current position since 2013. **Credentials:** Registered Smaller Enterprise Consultant. **Areas of expertise:** Strategy, finance, general affairs and human resource consulting. **Interests:** Travel; cycle racing.

**Kiriko Abe** (Research support group Chief URA)

**Place of birth:** Fukuoka. Graduated from the Faculty of Engineering, Okayama University. **Career:** Followed eight-year stint at patent firm, engaged in industry/academic collaboration projects at the University of Yamanashi, Keio University, and Hamamatsu University School of Medicine. At current position since 2013. **Credentials:** Master of Engineering, 1st grade Certified Specialist in Intellectual Property Management. **Interests:** Visiting shrines and temples; aquariums; dinosaurs

**Yuichiro Matsuyama** (Adviser patent attorney)

**Place of birth:** Miyazaki. Graduated from the Faculty of Engineering, Kanagawa University. **Career:** Worked as chemical engineer before moving on to work for 20 years at patent firm; has served as advisor for Tokyo Metropolitan University since 2011. Holds concurrent positions as part-time lecturer at the Tokyo Metropolitan University and Kanagawa University. **Credentials:** Chartered patent agent, Master of Technology Management. **Interests:** Walking, assembling custom PCs.

**Satoshi Kon** (Intellectual property manager)

**Place of birth:** Saitama. Completed master's degree at the Graduate School of Science and Engineering, Waseda University. **Career:** Worked at patent firm after stint at corporate research institution; subsequently founded own patent firm. At current position since 2012. **Credentials:** Chartered patent agent (licensed to handle legal actions related to patent infringements), Master of Engineering, Master of Technology Management. **Interests:** Reading.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