



# OPACK Mail

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## Greetings for the New Year

Organization for Promotion Academic City by Kyushu University President /Tomokazu Odahara

It is our pleasure to wish everyone a Happy and Prosperous New Year on behalf of the Organization. We thank you for your continued support of our effort to promote the Kyushu University Academic City Plan.

In the year of 2011, Kyushu University, a core of Kyushu University Academic City Plan, marked the 100th anniversary of its foundation. In March of the same year, the Experimental Center for Social System Technologies, which is expected to serve as the base for providing support to conduct experiments on social system verification, was established at the Itoshima Research Park, where the Research Center for Three-Dimensional Semiconductors started operation as a facility for R&D research, product testing, as well as assembly of semiconductors in that same year. Furthermore, construction of the Center of Excellence facility of the Center for Organic Photonics and Electronics Research (OPERA) was completed in October at the Itoshima campus of Kyushu University. It was truly a year that continuous developments of industrial-academic collaborative facilities have been made in Kyushu University Academic City.



We will continue to strive to make further developments this year to create a knowledge base in this area. As a part of such effort, the Research buildings at the Next-Generation Fuel Cell Research Center (NEXT-FC) and the International Institute for Carbon-Neutral Energy Research (I2CNER) are to be completed on the Ito Campus, while the Industry-Academia collaborative R&D Center for Industrial Use of Organic Photonics and Electronics (tentative name) is scheduled to be launched in Motooka district, which is near the Ito Campus. Aside from these facilities, a guest house for overseas researchers will be built on the same campus. It is expected that R&D institutions, as well as a business environment for the companies, will be developed further and we will attract as many leading researchers as possible from both at home and abroad in this area.

Toward achieving the Kyushu University Academic City Plan, which aims to establish a knowledge base, we will redouble our efforts to enhance industry-academia-government collaboration, that with us is strength, and proactively promote PR activities and support R&D, networking and establishment of new businesses. We would appreciate your continuous support and cooperation.

### In Kyushu University City, active progress is being made in developing industry-academia research institutions (Facility photos · images)



【Left】 Research Center for Three-Dimensional Semiconductors(left) and Experimental Center for Social System Technologies (right) (opened March 2011 at Itoshima Research Park)  
【Middle】 New research building in International Institute for Carbon-Neutral Energy Research (left)  
New research building at the Next-Generation Fuel Cell Research Center: NEXT-FC (right) at Kyushu University Ito Campus, to be completed at the end of October 2012.  
【Right】 Industry-Academia Cooperation Research Center for Organic Photonics and Electronics Industrial Use(tentative name) at the Motooka district in the Nishi Ward of Fukuoka City (Construction starts in 2013)

## Center of Excellence facility of the Center for Organic Photonics and Electronics Research (OPERA) on Ito Campus of Kyushu University now open!

Upon completion of the Facility of Organic Photonics and Electronics Research, the Center of Excellence facility of the Center for Organic Photonics and Electronics Research (OPERA), an opening ceremony was held on Wednesday, October 5, 2011.

The ceremony was attended by about 200 people who are involved in the center. OPERA Project Leader Chihaya Adachi delivered a speech saying, "We have steadily achieved impressive research results since its establishment, and it is our earnest wish to promote discussion and research among researchers here at the facility. I hope this will serve as an international center of excellence toward industrialization of next-generation organic EL devices".



OPERA was established in April 2010 when Professor Chihaya Adachi's research project, "Challenge for Electroluminescence Super Device Through Innovation of Organic Materials" was selected as one of the thirty research projects for the Funding Program for World-Leading Innovative R&D of Science and Technology (FIRST) of the Cabinet Office in the 2009 fiscal year. The center has been carrying out research and development to industrialize next-generation organic EL devices in collaboration with about twenty institutions, including other universities and corporations, such as the Institute of Systems, Information Technologies and Nanotechnologies.

Upon completion of the facility, further enhancement and promotion of education research in the area of organic optical electronics is expected at Kyushu University, which has been a research leader in that area.



### Activity Report

#### The 16th OPACK Networking Event

**Development of rapid and reliable cell-based evaluation technology for efficacy prediction of anti-cancer and anti-metabolic syndrome compounds**



Photo: OPACK networking event

On September 7 2011, a lecture was given by invited guest speaker, Professor Toshihiro Ona, an Associate Professor of Agro-environmental Sciences, Faculty of Agriculture, Kyushu University, who has conducted original research on the development of a rapid, highly sensitive, label-free and non-invasive cell-based sensing technology for reliable efficacy prediction of anti-cancer and anti-metabolic compounds in their physiological concentration. This technology senses dynamic cellular reaction against target compounds (including combined use) and determines their efficacy within 1 hour of addition of the compound regardless of the pharmaceutical mode of action. He also spoke about

other issues including latest research achievements, and challenges of science technology while he has been actively promoting collaboration between industry and academia.

Please refer to last page for details of achievements made by Professor Ona.

#### The 7th "Kyushu University Academic City Seminar" held in Tokyo



Photo: Seminar in Tokyo

With about 190 people both from public and private sector in attendance, OPACK hosted a seminar on Wednesday, September 12, 2012 at the Shinagwa prince hotel, on the topic of "Aiming to become a Knowledge Base, from Kyushu University Academic City, the "bridge" of advanced technology".

In his keynote speech, OPERA Project

Leader Chihaya Adachi introduced innovations in research of organic EL devices brought about by molecular organic semiconductors, as well as trends and the latest research results of organic EL technology.

After his keynote speech, other speakers including Hisashi Yamauchi, Associate Professor of the Liaison Group Intellectual Property Management Center of Kyushu University; Dr. Kei Sakanoue, OPERA Administrative deputy leader; Mr. Seiji Imoto, Secretary General of Fukuoka Industry, Science & Technology Foundation; Mr. Yasuo Morinaga (Secretary General of Hydrogen Energy Test and Research Center), spoke about various efforts, including research on advanced technology which has been developed at Kyushu University Academic City, as well as institutions and initiatives to act as a bridge between public and private sectors. At the same seminar, OPACK introduced cutting-edge research projects along with the current status of ongoing industry concentration in Kyushu University Academic City area.

The seminar ended with great success as the participants enjoyed a lively exchange of information with lecturers.

We express thanks to all those who attended the seminar despite bad weather.

## Joined Bio Japan 2011



Photo:Exhibition booth

From October, 5 (Wed) until October,7(Fri), 2011, OPACK and Professor Ona, an Associate Professor of Agro-environmental sciences, Faculty of Agriculture, Kyushu University, jointly exhibited at Bio Japan 2011.

Professor Ona made a presentation on the development of rapid, high sensitive, label-free and non-invasive cell-based sensing technology for reliable efficacy prediction of anti-cancer and anti-metabolic compounds in their physiological concentration with the use of surface plasmon resonance: SPR. At the exhibition booth, OPACK displayed a panel exhibition of Professor Ona's achievements alongside ongoing developments at Kyushu University Academic City, where world-class advanced R&D projects are being conducted with collaboration between industry and academia.

The presentation and the booth attracted many people from companies and other R&D institutions, thus we could successfully convey the charms of academic city.(Details of Professor Ona's research are on the last page of this report)

## Information session for the site for business held at Kyushu University Academic City



Photo:Information session for the site for business

An information session for the site for business at Kyushu University Academic City was held on October 31 and November 1, 2012 with 11 participants joined from companies and R&D institutions.

On the first day, participants visited the Center for Organic Photonics and Electronics Research (OPERA), Fukuoka Industry--

Academia, Symphonycity on the Ito Campus of Kyushu University, and heard about an industrial site that Fukuoka city has been jointly developing with Itoshima City. At the meeting, mayors and local municipal leaders, those concerned with this event and people from Kyushu University participated and actively exchanged information.

On the second day, participants visited the Hydrogen Energy Test and Research Center, the Research Center for Three-dimensional Semiconductors and the Experimental Center for Social System Technologies, all of which are located at Itoshima Research Park, where the hub of these research institutions is being formed. They were also introduced to the industrial site that has been developed by Fukuoka Prefecture. With the partnership of research institutions, which we introduced at the 7th Seminar on Kyushu University Academic City in Tokyo, we organized this on-site information session. All those who attended the meeting enjoyed it very much

## Auto-parts design seminar ; this was an 18-day training course to attain required skills for design of auto parts



Photo :Lecture

From Monday, November, 14 until Thursday December 8, 2011 OPACK hosted an Auto-parts design training seminar for companies and the general public.

The seminar mainly focused on fostering design technology skills that are particularly lacking in the automobile industry, one of the fields in which Kyushu University Academic City leads as a knowledge creator.

At the seminar, participants mainly learned about three dimensional CAD (CATIA V5). It also provided various training programs, including assembly and disassembly of the engine, design practice and a presentation on vehicles equipped with electric motors that is considered as the requirement of next-generation vehicles, through which participants successfully completed all programs as they worked hard to acquire and improve needed skills for design and development.



## Information

### Participation in Exhibitions

OPACK will participate in the following exhibitions where a large number of relevant companies, universities and organizations are attending. We will exhibit panels and other materials. Our staffs will also introduce the charms of Kyushu University Academic City, where concentration on research institutions is rapidly progressing. We welcome you to visit our booth

#### ◆ Nanotech 2012 ◆

It is the world's largest international synthesis show about nanotechnology. State-of-the-art technology and products from various fields, including nano materials, nano-micro-system technology, and measurement and evaluation areas are showcased.

Date & Time : Feb.15(Wed)-Feb.17(Fri)  
Venue: Tokyo Big Sight

#### ◆ FC EXPO 2012 ◆

The World's largest trade show featuring all kinds of technologies, products, equipment, etc. related to the manufacture and R&D for fuel cells and hydrogen.

Date & Time : Feb.29(Wed)-Mar.2(Fri)  
Venue: Tokyo Big Sight



### Subscribe to our Email Newsletter

OPACK offers e-mail subscriptions which provide a variety of information about events taking place at Kyushu University Academic City, as well as reports on activities carried out by the local government, universities, industry-academia cooperation initiatives and research institutions.

#### Application form procedure

Newsletter subscription application form can be found at <http://www.opack.jp/>



Information about companies and research institutions located in Kyushu University Academic City

Experimental Center for Social System Technologies



Advance of ICT has brought about a significant paradigm shift in social structure and its impacts are not limited to individual lives, corporate activities, and sovereignty, but even determine the future course of international society.

Throughout the life cycles of systems, LSI, ICT devices and other products, from their planning, design, manufacture, testing, sales, operation to disposal, business model, which focuses on operational phase has grown into the major industry and created new social model. In various industrial sectors, new social and economic structures are being built where value creation and investment return play a critical role at the stage where consumers actually use these

products.

In order to address such changes in social and economic structure, Experimental Center for Social System Technologies serves as a center of technological development to evaluate and improve products and services through social experiments using new products and devices. The center offers effective and efficient services with the use of an authorization infrastructure, wireless communication technology, design technology for new embedded software and others. It is our sincere wish that as many as companies and organizations as possible will take advantage of services we offer for development, commercialization, expansion of technologies and services required to create a new social information infrastructure for the 21st century.

Center Details

### Social information infrastructure



【Server forexperiment】  
Storage of demonstration tests data

【Environment to develop common infrastructure for Social experiment】  
Development environment and test devices for common components (card reader/writer/IC card and others)

Examples of Use

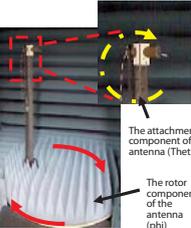


Multi card reader and internal circuit board

### Wireless data communication



【Anechoic Chamber】  
Basic testing environment of measuring equipment for wireless devices



【Wireless evaluation system】  
Characteristics measuring equipment for wireless devices

The attachment component of the antenna (Theta)

The rotor component of the antenna (phi)



【System to measure the quality of wireless communication】  
Inspection and measurement of communication load

### Embedded software

【HALT testing apparatus】



【Control functions development kit for peripheral LS】  
【Monitor of CPU performance】  
【Analysis equipment for communication data】  
【Development device for Control software】



Development device for DSP control software



Development device for Flash memory control software

Center Details

Center Details
FPGA Development device
DSP control software development device
Development device for flash memory control software
Development device for I2C communication software
CPU performance monitor equipment
Logic Analyzer
Oscillo-Scope

1F Server Room
Development and evaluation system for demonstration tests of social information infrastructure
Room for product and prototype improvement
Printed circuit board processing machine
Constant temperature and humidity chamber
3D prototype production system

1F Room for Measurement of electric field
Anechoic Chamber
Wide Band Antenna

Room for development of software to evaluate wireless communication
Single analyzer
Vector single generator
MIMO receiver tester
Signal source analyzer
Microwave downconverter
Noise figure analyzer
Network analyzer
Handheld spectrum analyzer

1F HALT test room
Testing machine

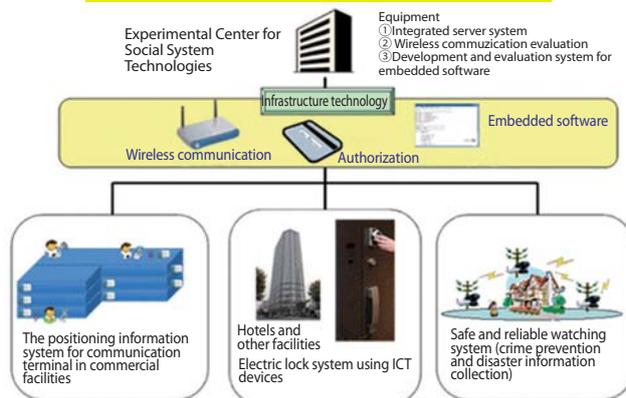
2F Network quality evaluation room
Conformity assessment of telecommunications standard
Communication data monitor for SAS/SATA
Communication data monitor for I2C
Communication data monitor for PCI EXPRESS
Communication data analysis apparatus for USB3.0
Network load test automation system

3F Wireless communication quality evaluation room
Wireless LAN communication log storage /analysis equipment
Conformity assessment equipment of wireless LAN communication standard

Projects outline

The mission of the center is to provide a place for social experiments on semiconductor products. It also offers services and expertise to evaluate and improve these products developed for the purpose of promoting development and commercialization of the advanced semiconductors that underpin a new social system required for the future. As the center of R&D activities, it facilitates collaborative projects among universities, research institutions and industries that are already being carried out in terms of research, application and development, and testing these products before putting them into practical use.

Image of demonstration test utilizing the center



Room charge at Experimental Center for Social System Technologies

◆ Research Lab ◆

◆ Room charge ◆

Area(m <sup>2</sup> ) (Number of rooms)	Rent rate (monthly*incl.tax)	Room	Area(m <sup>2</sup> ) (Number of rooms)	Room Charge (1hour)
20m <sup>2</sup> (3rooms)	¥63,000	Business meeting room 1・2	18m <sup>2</sup> (2rooms)	¥800
26m <sup>2</sup> (1room)	¥81,900	Meeting room 1	24m <sup>2</sup> (1room)	¥1,100
31m <sup>2</sup> (5rooms)	¥97,650	Meeting room 2	22m <sup>2</sup> (1room)	¥1,000
35m <sup>2</sup> (1room)	¥110,250	Meeting room 1, 2	46m <sup>2</sup> (simultaneous use of two rooms)	¥2,100
38m <sup>2</sup> (1room)	¥119,700	Seminar room 1	78m <sup>2</sup> (1room)	¥3,600
38m <sup>2</sup> (1room)	¥122,850	Seminar room 2	46m <sup>2</sup> (1room)	¥2,100
40m <sup>2</sup> (5rooms)	¥126,000	Seminar room 1, 2	122m <sup>2</sup> (simultaneous use of two rooms)	¥5,700
50m <sup>2</sup> (1rooms)	¥157,500	Shared office (room#207)	9m <sup>2</sup> each pace(7booths)	Rent rate: (monthly・incl.tax) ¥11,340

Fukuoka Industry, Science & Technology Foundation (Fukuoka IST) Experimental Center for Social System Technologies Research Center for Three-Dimensional Semiconductors

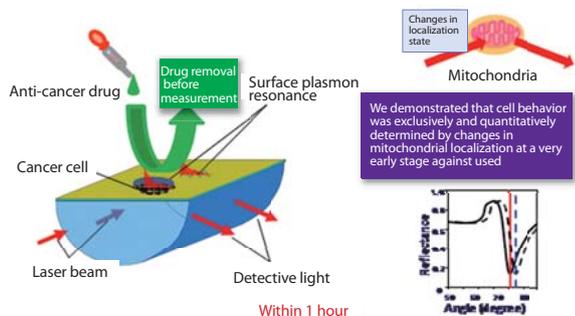
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### Highly reliable screening of the functionality of compounds utilizing reactions of the mitochondria in live cells to light

We successfully developed a rapid, highly sensitive, label-free and quantitative screening technology for reliable efficacy prediction, including safety of functionality of compounds. By using mitochondrial reactions to light, this method enables us to sense mitochondrial cellular reaction against target compounds and determines their efficacy within 1 hour of addition of the compound regardless of the pharmaceutical mode of action.

Human beings can not live without eating. Considered an energy source, human beings heavily rely on mitochondria, which inhabit human cells, in terms of provision of hydrogen from foods and energy (ATP) which is generated by similar way of fuel cell as they supply oxide from breathing. As our diet becomes more westernized, the number of people suffering from lifestyle-related diseases such as diabetes, high blood pressure, and hyperlipidemia, as well as cancer, has risen sharply. As the result of "the more than enough is too much" diet, mitochondria has become reluctant to work regularly, resulting in a vicious cycle where excessive sugar is accumulated in blood while undissolved fat is accumulated in cells, causing genetic anomalies that predispose normal cells to become cancerous tumor cells.



(Fig. HP-SPR method)

In this context, there are growing expectations that highly effective functional foods and healthy diet could inactivate mitochondria in cancer cells or activate mitochondria to work properly. The grounds of effectiveness of most health foods consumed by consumers, however, are based on the results of animal testing or in vitro experiments, thus there are some cases they have done more harm than good, causing serious damage to human health. This can be attributed to differences between human beings and animals. Regarding genetic analysis, it is almost impossible to develop general logics taken from genetic analysis given that various factors interact with others in complex ways, mode of action has large impacts on results, and an enormous amount of money and time are required.

For this reason, at present, cell-based assay is widely used. One such example is implemented to measure compounds of fat stored in cells, labeling compounds that burns fat is added after cultivating human cells on dishes in a certain period of time. However, these conventional methods are often time-consuming (at least 2-7 days) and require tedious fluorescent labeling. Furthermore, the labeling compounds might cause competitive interference with administered compounds and thereby degrade the reliability of results.

In order to solve these problems, rapid, reliable and label-free, quantitative screening methods and devices that also allow us to predict safety of functionality of compounds are greatly needed. Unfortunately, typically commercialized devices have some challenges in the screening phase, as they inflict damage on cells due to the cell's sensitivity to an electrical current and there are also theoretic problems in measurement index. On the other hand, as for cell-based assay experiments, the results of measurement are often influenced by mode of action of compounds, thus there is less correlation between two measurements. Another hurdle of this area is that commercialized devices take more time to cultivate the cells than the cell-based assay; consequently, this area remains very underdeveloped.

In contrast to conventional methods, we used a surface plasmon resonance device as the evaluation method. SPR is the non-label and a type of laser spectroscopy technology to enable real-time measurements of refractive index stemming from interactions between molecules. We quantitatively detected reactions of live cancer cells against anti-cancer drugs with light. When using this, we designed surface plasmon resonance sensor to process more than 1,000,000 times ultra higher sensitivity to a widely commercialized SPR. We put several human cells in solid tumors on sensor chips by taking advantage of their self-adherence character, subsequently we exercised real time detection monitoring (about ten-minutes) one hour after the administration of drugs. The study showed that there was a significant relation between refractive index of HP-SOR signal derived from changes in mitochondrial localization status and cell viability, and it did not change when using different type of human cell lines of each organ. Likewise, we succeeded in evaluating compounds that effectively burn fat in livers.

We elucidated in quantitative manner that cell behavior was exclusively determined by changes in mitochondrial localization that takes place at a very early stage against used compounds.

In case of cancer: mitochondrial localization  $\Rightarrow$  ATP production  $\downarrow \Rightarrow$  death for tumor cells

In case of fat: mitochondrial localization  $\Rightarrow$  ATP production  $\uparrow \Rightarrow$  fat burning

This method enables us to monitor real time data including the effects of multi-drug use in a very short duration without using labeling compounds and regardless of mode of action. The original method we established is expected to pave the way for diets and development of functional foods that make it possible for us to control mitochondria.