

Newsletter

NanoSky

From KING SKYFRONT to the world - NanoMedical Innovation

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COINS A Future Created by “In-Body Hospital”

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– Expectations towards Japan’s future leaders, COINS

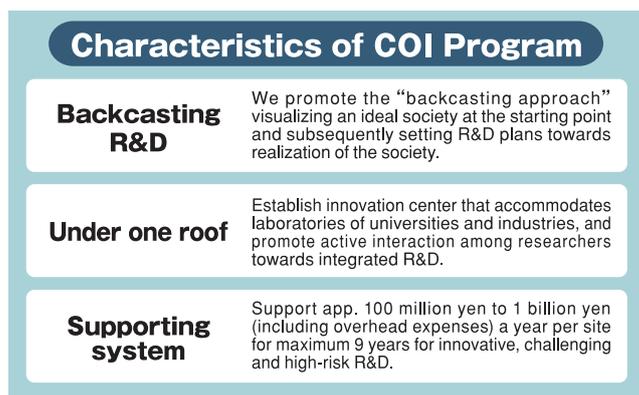
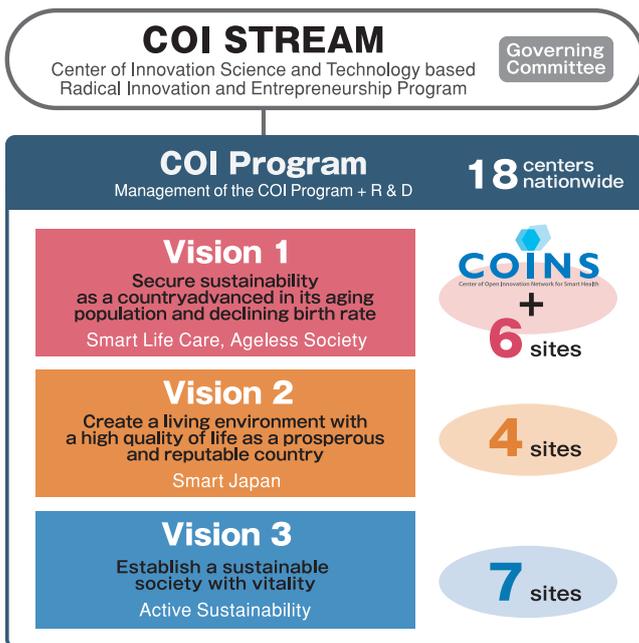


Hiroshi KOMIYAMA
Chairman,
COI Stream Governing Committee

COI Makes a Successful Example of Implementing Innovation in Society

In order for Japan to survive future international competition and to achieve economic revival, it is necessary for revolutionary innovation to be continuously created. The Ministry of Education, Culture, Sports, Science, and Technology’s ‘Radical Innovation and Entrepreneurship Program (COI STREAM)’ is a collaborative research and development support program integrating different fields and is aimed at practical application right from the basic research stage for the purpose of developing an innovation platform for the creation of radical innovation in Japan. Currently, with 3 established major visions, 18 centers are being supported nationwide beginning with COINS (Center of Open Innovation Network for Smart Health). The requirements for a center are twofold; defining the shape and way of life of society derived from future needs and the establishment of a 10-year research and development theme based on this, and the implementation of a research and industry-academic cooperation system that removes the walls between the existing areas and organizations. At about the time this program is completed, it is hoped that Japan will build a foundation as a globally renowned nation for innovation. My own view is that we are working on the management of a program with a sense of mission.

Producing social value by a combination with social system reform and not just renewal of science and technology innovation is the essence of ‘innovation’ as described by J. A. Schumpeter’s ‘new bonds.’ The foundation of advanced science and technology in Japanese academia has produced 16 Nobel prize winners as we enter the 21st century and is clearly second only to the US. Many problems remain,



however, in the practical application and social implementation of the study results. For example, in industry-academic cooperation which should primarily be a place for creation of innovation according to research results, the wall between organizations formed by a division of roles such as academia = research and development and business = social implementation has become an obstruction to the creation of innovation.

Silicon Valley solves many problems that hinder social implementation and will lead to one of the world's leading innovation platforms. More specifically, people with ideas and research results can easily obtain the human and financial support necessary to try social implementation, the regulations and organizations are flexible and the point that a re-challenge is easy even in failure is a feature of Silicon Valley. The wall between the above organizations is probably also present in Silicon Valley but problems are thought to be unlikely to surface because of the above advantages and because renewal of businesses and personnel are ongoing.

The creation of innovation in Silicon Valley is a good example showing that renewal and changes in the social system in science and technology are working well with each other but it is not practical to introduce these into Japan with its differences in history and culture. Therefore, while COI takes up a good portion of the existing innovation platform, it is exploring a solution to move forward in Japan. If Japan positively embraces advanced technology and culture and also the many existing problems, I think an environment beyond Silicon Valley can be achieved. A successful example of innovation must first be created in society and this is the target for COI. Therefore, a structured team will be organized in COI and a system for problem accumulation and solving such as for regulations impairing analysis and innovation used to find key success factors is being maintained.

A lot is expected of COINS to quickly produce a successful example.

I hope this will become a driving force for creating a mutually beneficial cycle to improve quality of life and to create new industries.

COINS, with one of the major visions, "Secure sustainability as a country advanced in its aging population and declining birth rate: Smart Life Care, Ageless Society," has set a future vision aimed at 'smart life care society' that can achieve autonomous health in daily life free from disease and treatment without being conscious of the effort, cost and distance needed for medical treatment. For the realization of this vision, an extreme sense of creation of innovation is being felt in the concept of "In-Body Hospital" deduced from back

casting.

With smart nanomachines that are the research seeds of Prof. Kataoka, the research leader, and nano-sized micelles encapsulating a named drug coursing through the body, "In-Body Hospital" aims at early detection and treatment of, for example, major diseases like cancer and Alzheimer's disease before the individual is aware of them.

If "In-Body Hospital" is realized, patients are healthy until right up to their death. Like an incredible story, nanomachines loaded with anticancer agents are already at the practical stage and the realization of revolutionary new drugs with few side effects has come to the fore.

"In-Body Hospital" will also soon be realized. I think many products and services will emerge in the steps up to the realization of "In-Body Hospital." If ventures and new businesses appear thick and fast, a way through will likely open up in the conservative Japanese mind. Prof. Kimura, the project leader, is playing a major role and, as Prof. Kimura has management experience in global businesses and has operated venture capital management businesses, he is expected to bring about certain success.

For some time, I have said that Japan should aim at being a 'problem-solving developed country.' The challenges facing Japan now will, before long, be problems facing the world. In developed countries, although materially rich, demand will plateau and economic growth will continue to slow down. For the continuation of civilization, Japan must present strategies to overcome problems and requires the attitude to lead the world.

Quality of life is then sought. Henceforth, an era aimed at an affluent society in terms of quality rather than quantity will arise. In Japan at the moment, an ecosystem giving rise to a virtuous circle of industrial creation is needed and we hope that COINS becomes the major driving force.

The Innovation Center of NanoMedicine (iCONM) was completed in April last year as a core institute of COINS. An institution was set up that combined spatial design directed at Under One Roof and Open Innovation with equipment that can be used from organic synthesis to clinical studies in one go.

Kawasaki City Tonomachi KING SKYFRONT, where iCONM is located, is full of businesses and research institutes and has already begun to function as an international strategic special zone in order to create new industries from research and development at the world's highest level. It will be easy to build a national and international network as it is close to Haneda airport and there is a sense that a stage to accelerate the realization of a hospital inside the body is in place.

Although previously referred to as Silicon Valley and an example of an earlier innovation platform, the land in Kawasaki based around iCONM will become "Bio Valley" and it is strongly hoped that COINS will be the driving force.

COINS - A New Open Innovation Platform

It has been two years since the Center of Open Innovation Network for Smart Health (COINS) commenced operations as a part of the Center of Innovation Science and Technology based Radical Innovation and Entrepreneurship Program (COI STREAM). Project leader Hiromichi Kimura and research leader Kazunori Kataoka welcomed Dr. Yuzuru Matsuda, visionary leader of COI STREAM's Vision 1: "Secure sustainability as a country advanced in its aging population and declining birth rate: Smart Life Care, Ageless Society" and chairman of the Kato Memorial Bioscience Foundation. They talked about the origins and future vision of COINS. Here are some highlights of the three-man talk that lasted over two hours.



Kazunori KATAOKA

Professor, Department of Materials Engineering, Graduate School of Engineering / Center for Disease Biology and Integrative Medicine, Graduate School of Medicine, The University of Tokyo
Director General, KAWASAKI INSTITUTE OF INDUSTRY PROMOTION Innovation Center of NanoMedicine (iCONM), COINS Research Leader



Hiromichi KIMURA

Professor, Pharmaco-Business Innovation, Graduate School of Pharmaceutical Sciences, The University of Tokyo
COINS Project Leader, KAWASAKI INSTITUTE OF INDUSTRY PROMOTION Innovation Center of NanoMedicine (iCONM)



Yuzuru MATSUDA

Chairman, Kato Memorial Bioscience Foundation
Visionary Leader of COI STREAM Vision 1

Received a PhD in engineering at Graduate School of Engineering, The University of Tokyo in 1979. After serving as an assistant at the Tokyo Women's Medical University and a professor at the Tokyo University of Science, he took his current position in 1998. Between 2001 and 2004, he took up the additional post as Director of the Biomaterials Center, National Institute for Materials Science. From 2004, he also began serving as a professor at Center for Disease Biology and Integrative Medicine, Graduate School of Medicine, The University of Tokyo. Since then he has held various posts such as Project Leader of the University of Tokyo Center for NanoBio Integration, Project Leader of the Global COE "Medical System Innovation through Multidisciplinary Integration," and principal investigator of the FIRST program "Development of Innovative Diagnostic and Therapeutic Systems Based on Nanobiotechnology." From 2013, he began supervising research under the COI program. His areas of expertise include development of drug delivery systems (DDS) through macromolecular nanotechnology and material design for regenerative medicine.

Received a PhD in pharmaceutical sciences at Graduate School of Pharmaceutical Sciences, The University of Tokyo in 1979, and received an MBA at Graduate School of Business, Stanford University in 1985. He has held various positions, at Kyowa Hakkō Kogyo in 1979, J.P. Morgan in 1986, Amersham Pharmacia Biotech in 1997, and served as President and Representative Director of Monsanto Japan Ltd. from 1998 to 2000. He founded Life Science Management in 2000, and is currently serving as CEO and Partner of Fast Track Initiative, Inc. since 2004. He is also a co-sponsor of the FIRST program "Development of Innovative Diagnostic and Therapeutic Systems Based on Nanobiotechnology," Executive Director of the Japan Association of Corporate Executives, and Vice Chairman of the Japan Stanford Association. He specializes in the fields of life science, pharmaceutical management theory, and medical management.

Received a PhD in agricultural sciences at Graduate School of Agricultural and Life Sciences, The University of Tokyo in 1977, and then joined Kyowa Hakkō Kogyo. Having served as a principal investigator at the Tokyo laboratory, he rose through the ranks as Director of the Medical General Research Center in 1999, Executive Officer in 2000, Managing Director in 2002, and President and Representative Director in 2003. Following the merger with Kirin Pharma in 2008, he was made President of Kyowa Hakkō Kirin, and served as corporate advisor from 2012 to 2014. In 2012, he became chairman of the Kato Memorial Bioscience Foundation. After joining the Japan Association of Corporate Executives in 2003, he has held posts on various important committees, such as the Committee for 100 Million Inhabitants in Japan, the Committee for Promoting Measures against the Declining Population, and the Strategic Project for Improving Innovation and Competitive Power.

The concept of “In-Body Hospital” born from the backcasting approach of COI STREAM

How was the COINS's concept of “In-Body Hospital” conceived when selected for COI STREAM ?

Matsuda: The COI STREAM program envisions how society and people should look 10 years in the future. In the program, which is run by MEXT and the Japanese Science and Technology Agency (JST), three visions for reaching this goal are set, including Vision 1: “Secure sustainability as a country advanced in its aging population and declining birth rate,” where COINS is included (p. 2).

The most prominent feature of COI STREAM is the use of a way of thinking known as backcasting, a planning method that starts by defining a desirable future, and then identifying what should be done in the present in order to realize that future, and putting that into practice. The COI STREAM program requires that all departments envision the shape of society 10 years from now, and always keep in mind what needs to be done now.

Kimura: This is where our concept of “In-Body Hospital” comes in. With our platform of open innovation leading the reform into a smart life care society, we came up with this concept as our vision of a “desirable future” (Fig. 1).

If one of the goals of humanity is to live long and healthy, disease is a big problem. If we are able to completely solve this problem, then we would no longer need hospitals. Having to go to the hospital when you get sick is an old medical model, and a truly rich society is one structured so that people can be healthy even without worrying about their health. With home healthcare and wearable devices rapidly evolving, we think that the logical endpoint will be a “hospital of smart nanomachines inside the body.” Before reaching this point, however, we are first aiming to eliminate diseases with a heavy social

burden, such as cancer, using smart nanomachines.

Kataoka: You would always have a hospital nearby. In fact, you would be carrying it with you, inside your body. However, since it would be difficult to introduce all manner of devices into a healthy human body, we will open the way to realize this concept by using nanotechnology to diagnose and treat diseases, or offer faster, affordable treatment that would not require hospitalization or quitting one’s job (Fig. 2).

Kimura: The cutting-edge technology we strive for should not be overly expensive, but would be available to a lot of people in large amounts and at a low cost. We are putting molecules together into machines, which will cost just a couple of yen each.

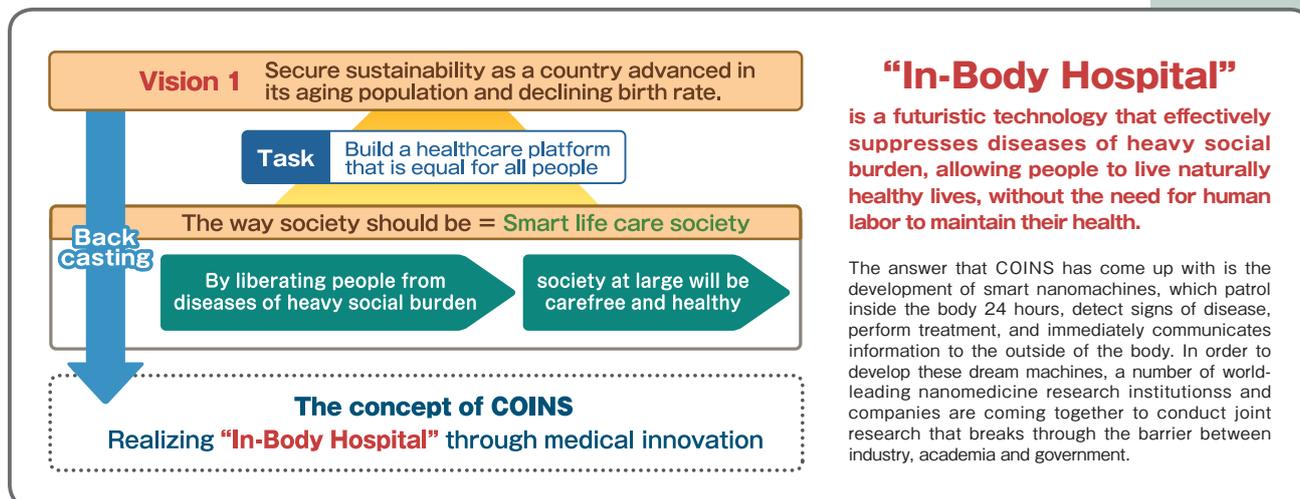
Matsuda: After all, the whole point of innovation is to provide something that is as cheap as possible, available to everyone, and which also gives great satisfaction.

Kimura: We have held several meetings where we repeatedly went over the goal of “In-Body Hospital” using the backcasting approach. We started with our goal, without any means for achieving it. Of course, not having any means is a problem. On the other hand, at universities, where you may have the means, the concept of working toward a goal is easily lost. COI STREAM became a wake-up call to the importance of approaching a goal that cannot be found in a university.

Matsuda: That’s right. It has been about three years since COI STREAM started. Right now, I’m visiting the involved research institutes and heartily telling them to use backcasting again to check how their current situation fits the vision of the future they are working towards.



Fig. 1



Companies, Universities and Research institutions can come and go as they please

“COI STREAM” puts a lot of effort into collaboration between industry and academia.

Matsuda: With COI STREAM, we want to create a platform to support a continuous flow where industry-academia collaboration leads to the creation of new start-up companies, launching new technology and service enterprises. One feature that sets this program apart is that universities, research institutes and companies are free to join whenever they want, and then leave if they do not feel that there is anything in it for them. This approach is quite radical compared to ordinary national projects that on principle follow an initial plan.



Kimura: In the real world, during the time it takes to reach the goal, you keep running into one unexpected problem after another. This is doubly true if that goal is highly innovative. To face that kind of challenge, there is a need for a dynamic organizational management that allows people from both the industrial sector and academia who can contribute

to achieving the goal to assemble, and then leave once their contribution is finished, to be replaced with new members. In the COI STREAM program, budget and progress management of the project is discussed with a governing committee, and work proceeds while receiving advice from a visionary group. This support system is very reassuring.

Matsuda: If you think of the speed of commercialization, it is probably best to let companies take over once you have made some progress. That way, you can avoid wasting tax money, and can put innovations into practice quicker.

Kataoka: In COINS, the topics of starting businesses and production are always close at hand. In the autumn of last year, a sonodynamic therapy method being researched at COINS, which combines a focused ultrasound machine with a drug delivery system, was selected by the Japan Agency for Medical Research and Development (AMED) as a project under the Research on Development of New Medical Devices program. Investigator-initiated clinical trials will soon be underway.

Conducting research using the central facility iCONM

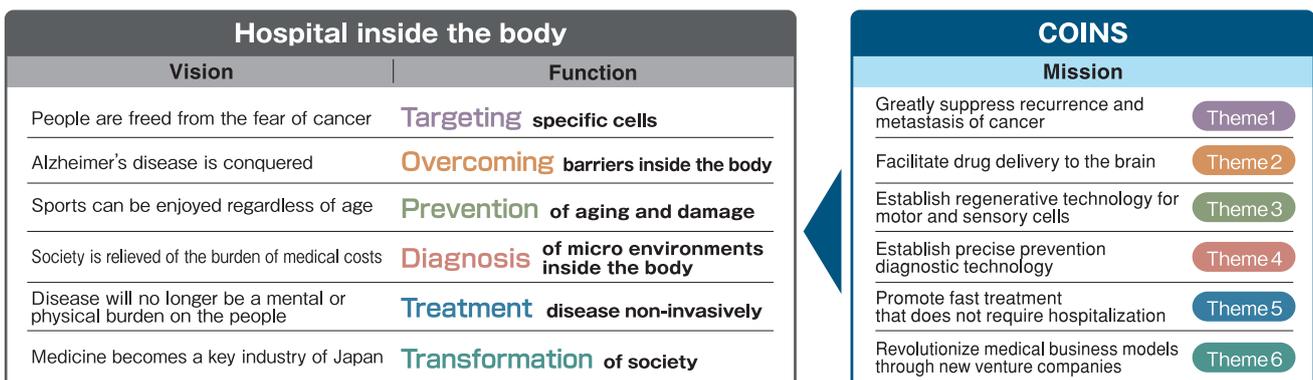
Out of the seven COI programs under Vision 1, what distinguishing features does COINS have?

Matsuda: Vision 1 has a well-balanced selection of research themes, combining monitoring of physical data such as diet and exercise and disease risk assessment before getting sick with information and communication technology (ICT) like remote medicine. COINS has been assigned the most challenging and time-consuming task. With its advantageous location near Haneda airport, and support from the city of Kawasaki, expectations on COINS as an open innovation platform are high.

Kimura: It takes only 10 minutes by taxi from Haneda airport. The bridge over the Tama River is scheduled to be completed by 2020, providing a direct connection from Kawasaki KING SKYFRONT to Haneda airport. That will make things even more convenient. Another characteristic of COINS is that several universities and companies are participating. We are making the best possible use of the Innovation Center of NanoMedicine (iCONM), where COINS resides, to let a wide variety of people gather, discuss, and share new ideas under one roof.

Kataoka: iCONM consists of four floors, each with its own functions: The first floor has micromachining facilities and clean rooms, the second floor has facilities

Fig.2 The vision and mission of COINS (See p.8 - 9 for details)



for material evaluation and organic synthesis, the third floor has laboratories for cell and genetic experiments, and the fourth floor has animal laboratories. Since these facilities follow different regulations, it is actually quite rare to have them concentrated in one building like this. Even in large companies, it is quite common that for example organic synthesis plants and genetic engineering labs are in different locations, and that the researchers are separate from each other. In order to create close bonds between people and technology, iCONM is designed like a big apartment complex with a concierge, aggregating multiple functions in one building. This is beneficial for start-up companies wishing to reduce initial costs, since they do not have to employ new people for each stage of the R&D process, but can simply conduct joint research with other tenant organizations at iCONM.

Matsuda: The National Institute of Health Sciences, responsible for regulations of life sciences, is also transferring to KING SKYFRONT. Housing and optical companies, which until now had little involvement with life sciences, are also gathering here. With this combination of different industry types, regulations and laws will also be revised. If Japan is to become a role model for the world in how to deal with the declining birthrate and aging population, we hope to build up iCONM into a platform to enable a prolific stream of innovations.

COINS as a place to develop human resources

COINS is expected to facilitate interaction between researchers from many different backgrounds.

Kataoka: COINS will also be a good case study in terms of developing human resources. As of now, we have over 100 researchers, about half of which are graduate or undergraduate students. They will gain experience that would not be possible at a single university or company, and will also learn valuable skills for shaping their career, like the backcasting approach.

Kimura: By sharing an ultimate goal with their project companions and keeping the social implementation^{*1} of their research in mind, the young researchers can gain new perspectives on role delegation and cooperation with people in other fields. They will get training in intellectual property, raising funds, networking with legal experts, and management skills. By familiarizing themselves with these things while they are young, they will be more productive as project leaders in the future.

Kataoka: This is why we at COINS are putting a lot of effort into our yearly training retreat, where the young researchers don't just give a presentation on their research, but also do backcasting together. When we first

told them to think of a goal, and then come up with ideas for reaching that goal, the young researchers were a bit puzzled, but once they make a habit of this, I am sure that they will come up with some amazing ideas.

Matsuda: Something I want young researchers to understand is the importance of acquiring patents and having your papers published in major publications. This is something I learned when starting up an in-house venture, and is called the 3 P's: Platform, Patent, and Paper. These are essential for the success of a start-up company.

Kataoka: For a researcher, writing a paper is an important milestone of one's research. Patents serve as security for commercializing the technology you have developed, and is indispensable in gaining the trust of the public.

Kimura: Patents and papers are also important criteria from the investors' point of view. Here at iCONM, we employ patent experts, and make it easy to consult with patent attorneys. We are planning to devise patent strategies with a robust system as a business entity.

Matsuda: I think both researchers and managers have a greater chance of success if they are firmly aware of the purpose of their research and the PDCA cycle^{*2} from a young age. In this sense, iCONM provides a good place for young researchers to study, with the chance of conducting joint research and collaboration with partners overseas, and learn management skills.

Kimura: We would like to show people that putting your field of expertise to use in management is a valid career path. COINS is a place where you can study the real society, with a diverse blend of engineering, life science, management, humanities and social sciences.

Kataoka: Indeed, there is no point in separating science and humanities to make society better. What I wish is for young people to embrace high-soaring goals, acquire unique skills and knowledge, and realize their full potential.

(Interviewer: Ayumi KOJIMA, science writer)



Terminology

***1 Social implementation**

To apply and develop one's research results to solve social problems.

***2 PDCA cycle**

A management concept for continuous improvement of processes and quality, consisting of a repetition of four sequential steps: Plan, Do, Check, Act.

Six approaches toward the “In-Body Hospital”

1 Theme Development of nanomachines that can target and eliminate intractable cancer



Theme Leader
Kanjiro MIYATA

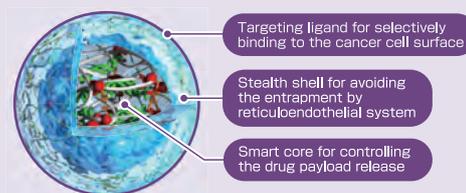
Associate Professor,
Department of Materials Engineering,
Graduate School of Engineering,
The University of Tokyo

The first generation of anticancer drug-loaded nanomachine is already in a Phase III clinical trial and are soon to be approved. In this theme, a next generation of nanomachines will be developed to target and cure intractable cancers, such as brain tumors, metastatic cancers and cancer stem cells. Our goal is to reduce the mortality rate from cancer.

Participating institutions

Innovation Center of NanoMedicine (iCONM)
Shimazu Corporation, Kowa Company Ltd.,
JSR Life Sciences Corporation, NanoCarrier Co., Ltd.,
Nippon Kayaku Co., Ltd., Japan Radioisotope Association,
National Cancer Center, The University of Tokyo

Structure of Nanomachines



2 Theme Innovative technology for the treatment of central nervous system diseases



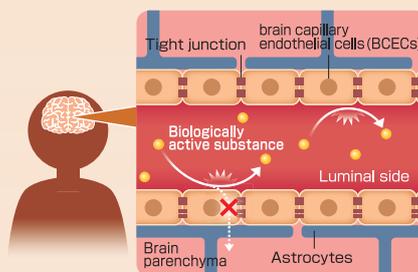
Theme Leader
Yasutaka ANRAKU

Assistant Professor,
Department of Bioengineering,
Graduate School of Engineering,
The University of Tokyo

The brain is strongly protected by the blood-brain barrier (BBB), a construct that primarily consists of brain capillary endothelial cells (BCECs) and astrocytes, through which it is difficult to deliver a biologically active substance.

An effective therapeutic approach has not been found although our aging society is suffering from a high prevalence of central nervous system (CNS) diseases. This research theme aims to develop an innovative therapeutic technology for CNS diseases, such as Alzheimer's disease, by creating a nanomachine that can deliver diverse biologically active substances to the brain.

Blood-brain barrier (BBB)



Participating institutions

Innovation Center of NanoMedicine (iCONM)
Tokyo Medical and Dental University, The University of Tokyo

3 Theme Development of nanomachines that carry messenger RNA (mRNA) for tissue reconstruction and vaccination



Theme Leader
Keiji ITAKA

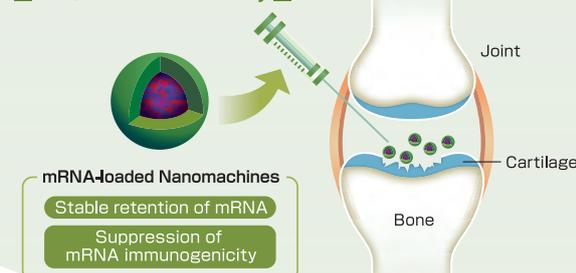
Associate Professor,
Center for Disease Biology and Integrative Medicine,
Graduate School of Medicine,
The University of Tokyo

A nanomachine for delivering messenger RNA (mRNA), which is next-generation “nucleic acid-based therapeutics,” is currently in development. By delivering mRNA to the necessary place at the necessary time to produce proteins that can improve and/or restore the functions of motor and sensory cells, definitive treatment will be actualized against intractable diseases such as central nervous system disorders and age-related motor and sensory disorders.

Participating institutions

Innovation Center of NanoMedicine (iCONM)
Teijin Limited, NOF Corporation,
Central Institute for Experimental Animals, The University of Tokyo

DDS for mRNA delivery



Targeting
specific cells

Overcoming
barriers
inside the body

6 Appr

Prevention
of aging and
damage

realization of

Targeting cancer, dementia and other ailments that tend to develop with human aging, COINS has six approaches (or themes) for the realization of "In-Body Hospital."

6 Theme Social system for implementation of the results into society



Theme Leader
Tomohiro ANZAI

Assistant to Leaders,
Innovation Center of NanoMedicine Kawasaki
Institute of Industry Promotion

With an aim to achieve smart healthcare society by "In-Body Hospital," we will conduct several researches: Open innovation management, Regulatory science of nano-medicine, and Business model generation in the field of preventive medicine.

Participating institutions

Innovation Center of NanoMedicine (iCONM)
Fujifilm Corporation, Medical Industry Innovation Institute (MI3)
Tokyo Institute of Technology, The University of Tokyo

5 Theme Ultra-minimal invasive treatment through the development of a theranostic system that combines nanomachines and medical equipment

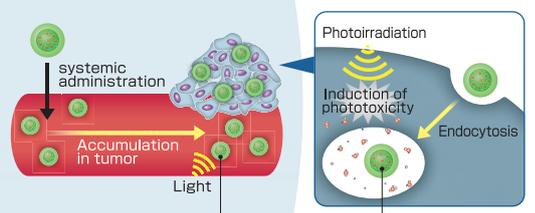


Theme Leader
Nobuhiro NISHIYAMA

Professor,
Laboratory for Chemistry and Life Science,
Institute of Innovative Research,
Tokyo Institute of Technology

This theme aims to develop a pinpoint diagnostic and therapeutic technology that removes the diseased area while minimizing damage to the healthy tissue by combining a nanomachine that delivers imaging molecules or an agent that is activated by light, ultrasonic waves or neutron irradiation with medical equipment, such as MRI and allay-type ultrasound transducer.

Light or ultrasound-mediated surgery



The nanomachine releases the photosensitizer in response to the acidic condition in the lysosome.

Participating institutions

Innovation Center of NanoMedicine (iCONM)
Ajinomoto Co., Inc., Kowa Company Ltd.,
National Institute of Radiological Sciences,
Tokyo Institute of Technology,
Tokyo Women's Medical University, The University of Tokyo

4 Theme The system for in-home cancer diagnosis, which requires no blood sampling

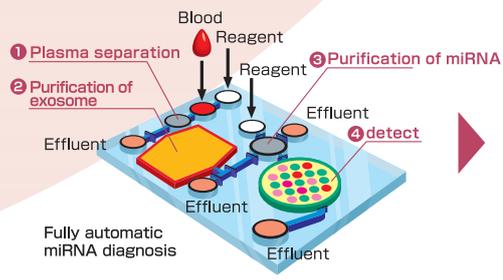


Theme Leader
Takanori ICHIKI

Associate Professor,
Department of Bioengineering,
Graduate School of Engineering,
The University of Tokyo

A quick cancer diagnostic device will be developed that separates, purifies and detects circulating microRNAs in the blood with high sensitivity. Noninvasive diagnostic devices will also be developed that determine the profiles of microRNAs and amino acids in urine and saliva. The research team will lead in creation of innovative diagnostic technology that will support future preventive medicine and home healthcare.

Biodevice



Participating institutions

Innovation Center of NanoMedicine (iCONM)
Nikon Corporation, National Cancer Center, RIKEN,
Tokyo Medical and Dental University, The University of Tokyo

Transformation of society

Approaches

Treatment without burden

Diagnosis of microenvironments inside the body

iCONM supports COINS' cutting-edge research



The Innovation Center of NanoMedicine (iCONM) was adopted by the Ministry of Education, Culture, Sports, Science and Technology's (MEXT) "Improvement of international science innovation bases using local resources via industry-university collaboration," and started operation in Apr. 2015. Equipped with state-of-the-art facilities and experiment apparatus that allows for carrying out R&D related to organic synthesis, fine processing and preclinical studies, it is a one-of-a-kind research center that aims to promote open innovation through industry-university-government and medical-engineering collaboration.

iCONM's Vision

iCONM aims to:

- Become the hub of Keihin-area Health Kombinat;
- Be the civic pride of Kawasaki;
- Continuously create new medical technology realizing human dream;
- Become the world's most innovative research center.

Latest facilities at the core of nano medical research

iCONM is equipped with the latest analysis devices such as organic synthesis functions, biochemical experiment functions, a bio hazard countermeasure chamber, an industrial clean room, precision processing, a bio-clean room, labs for conducting experiments on SPF animals, MRI facilities for animals, NMR, scanning type electron microscope and in vivo confocal microscope. A research center with these integrated facilities is extremely rare worldwide - this has become a hub of R&D towards the realization of "In-Body Hospital."



Material evaluation area
(Non-biosample analysis area)



Biosystems experiments area



Synthesis system experiments area



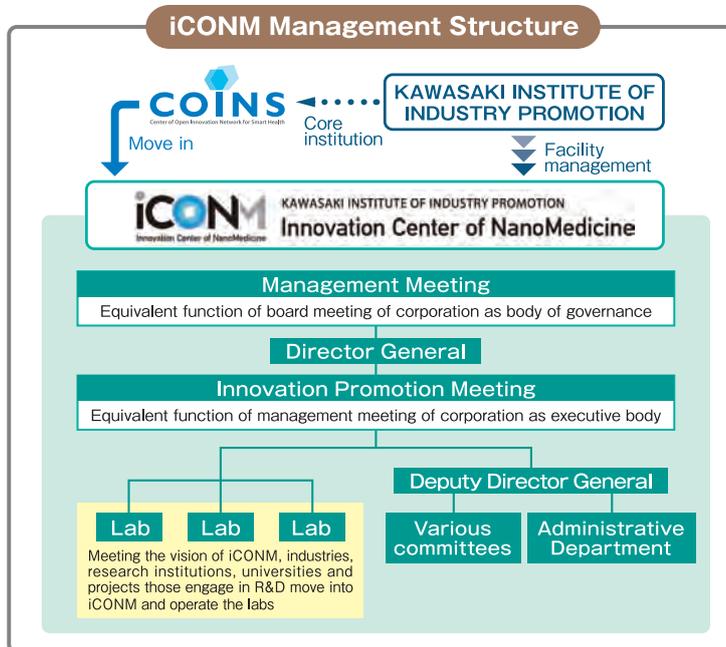
Clean room area (Class 1000)

The world's first research system that realizes "In-Body Hospital"

For the realization of "In-Body Hospital," it is essential to promote cross-field integration and collaboration, and move forward to create sustainable innovation. It is crucial to have a "place" where world-class ideas, technology and human resources can come together for the aim of social implementation, and a system that supports this effort. As a core center of COINS, iCONM has the following characteristics.

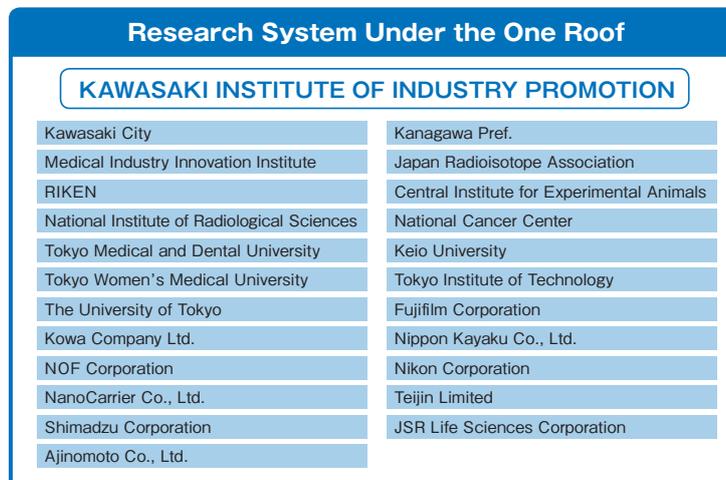
01 The world's first open innovation system that takes advantage of an excellent location

There are various companies and research institutions, from life sciences to iron and steel industries, near iCONM. The conditions for various people and ideas to gather are met, since Haneda International Airport is in close proximity, providing easy access in and out of Japan. In order to maximize the environment and to continuously create high social value, the KAWASAKI INSTITUTE OF INDUSTRY PROMOTION manages the facility, and harmonizes the public nature of municipalities and the autonomy of research institutions by introducing the concept of corporate governance to R&D management.



02 Being "under the one roof" accelerates innovation

With the concept of "under the one roof," iCONM tries to establish the shared use of research equipment, research spaces and dry laboratories to promote active interaction among researchers. Researchers from COINS-participating institutions constantly challenge one another in open innovation, and social implementation is expected to accelerate via new breakthroughs.



Magnet Areas

These communication areas are located on the second, third and fourth floors in the center of the building, and are called "Magnet Areas." These areas are designed for researchers to increase the number of opportunities to engage with each other, to share information and exchange fruitful ideas through coffee breaks and meetings.



Message for iCONM

From iCONM

Junichiro SONE

Director,
KAWASAKI INSTITUTE OF
INDUSTRY PROMOTION



“Sending Messages From Kawasaki to the World” Cutting-edge Research Facilities

Last April, Innovation Center of NanoMedicine (iCONM) began its operation. As a core center of the life-science and environment field at KING SKYFRONT, the KAWASAKI INSTITUTE OF INDUSTRY PROMOTION developed, and now manages the facility. Taking advantage of the theme of “Monozukuri-city” Kawasaki, via facilitating industry-academic government collaboration, it is our project that led to the promotion of academic research and creation of new industries to implement the research outcomes of iCONM, which realize diagnosis and treatment of diseases such as intractable cancer and Alzheimer’s disease in society.

With the kind understanding, cooperation and valuable support of our related members, including hometown Tonomachi, we will do our utmost to “send messages from Kawasaki to the world” and maintain this research environment, including the smooth administration of the various facilities.

Hiroaki KINOH

Principal Research Scientist,
Innovation Center for NanoMedicine



Establishment of Innovation Center of NanoMedicine-Expectations and Goals for the New Facility

Before the opening of iCONM in Jul. 2015, I moved into the center with a few staff members and worked together to lay down a foundation for research, and moreover to create a circumstance where further research would be able to move forward. As a research center, iCONM is regarded as a new social experiment.

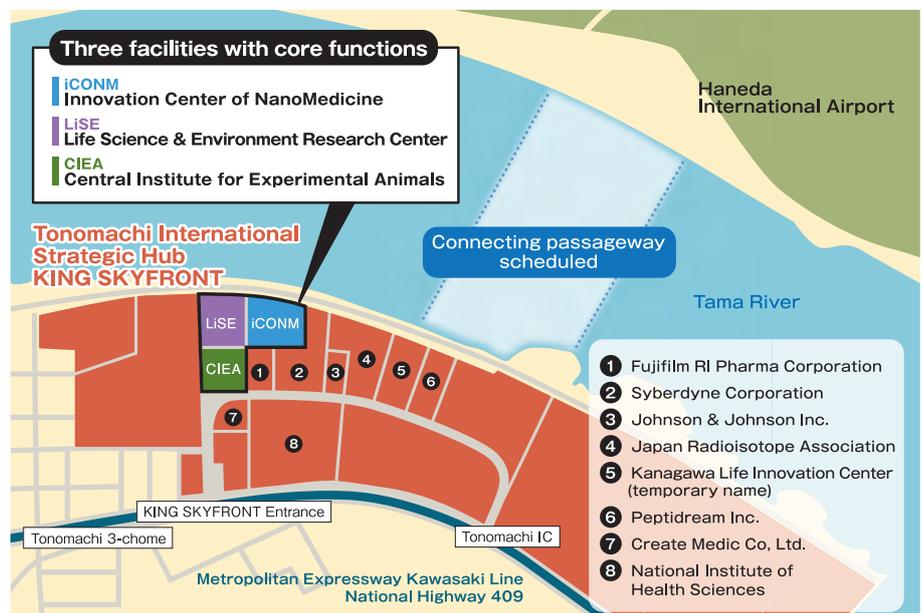
We aim to benefit society with budding drug discoveries by developing innovative nano-therapeutic agents, and subsequently setting up new venture companies effectively at this center. To make this possible, the center is an innovative and one-of-a-kind (nowhere in the world does this exist) facility, looking ahead to the construction of a social system for social implementation where creation of nano devices, organic chemistry synthetic and disease model experiments can be conducted in the same building.

Molding research into shape requires patience, however I will make an effort so that our research will be good news for people who are suffering from cancer and Alzheimer’s disease, by promptly turning new ideas into commercial realities in this blessed environment.

KING SKYFRONT: Tonomachi’s International Strategic Hub

iCONM is situated at KING SKYFRONT, a designated national strategic special zone. The approximately 40-hectare site is located to the southwest of Haneda International Airport, on the opposite shore of the Tama River. The international strategic hub’s formation is in full progress, and new industries are being created through R&D at the highest level in the fields of life sciences and environment.

The area was named “KING SKYFRONT” in Mar. 2011- the “King” is an acronym of “Kawasaki INnovation Gateway” and “Tonomachi” (“Tono” referring to the Japanese word “king”)- and will lead in Japan’s progress as a nation, and contribute to global sustainable development.



■ From participating companies

Wataru KUROSAWA

Chief Scientist,
Institution for Innovation Frontier Research
Center, AJINOMOTO CO.,INC.,



**Expectations of COINS and iCONM
as a Corporate Researcher**

It was Prof. Kataoka's lecture at a certain conference that encouraged me to participate in the COINS project. "In-Body Hospital," which COINS aims to implement, seems to be a dream world. However, I begin to wonder whether it might be feasible, and I want to make that happen.

To accelerate research development, I am dispatched to research at iCONM as well. The reason why I research at iCONM, even though our research center is located only 20 minutes away, reflects my great expectations of the new open innovation system. It has beneficial effects that allow the researchers of industry-academia-government to do their research, and discuss face-to-face under one roof in the same spirit.

The participating companies have major roles to play in COINS as well, which is aimed at social implementation, and are strongly urged to make a social contribution through converting research outcomes into business. It is challenging and I feel that I have a responsibility to work here as a corporate researcher. I will try my best to work for social implementation through trial and error.

Hirofumi SHIONO

Section Manager,1st Development Section
1st Development Department Medical Business
Development Division, Nikon Corporation



**It all started from the opening,
and will move ahead in a firm
collaboration**

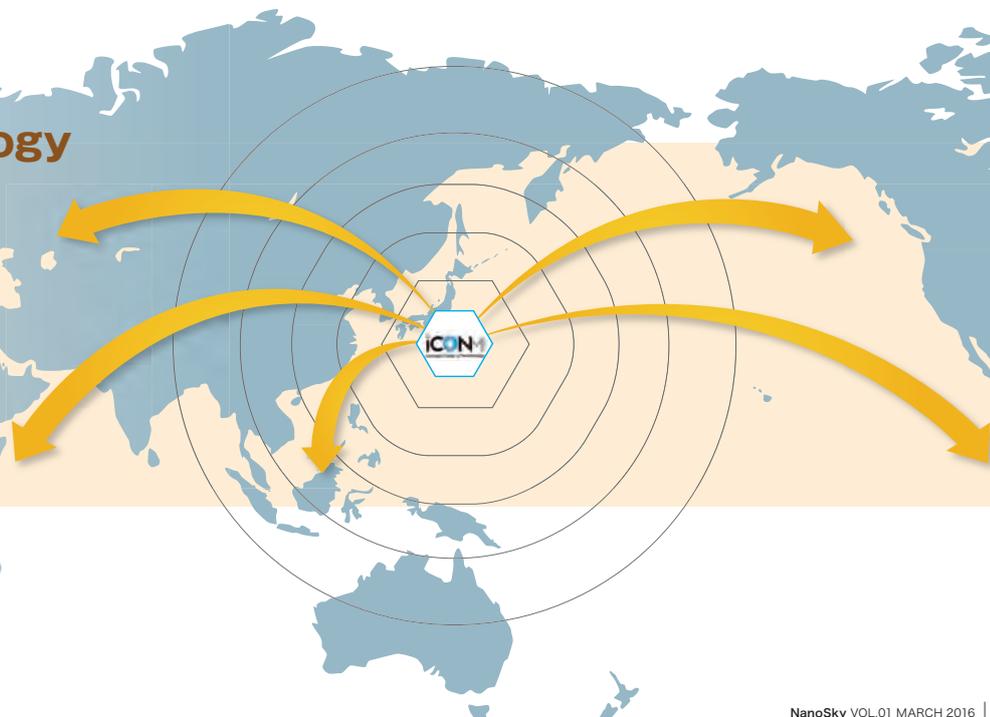
We moved into iCONM under the agreement to be "under the one roof" as the concept. Our company develops and sells optical products such as cameras, microscopes, semiconductor production equipment, and now just before commemorating our 100-year anniversary of the company, we have started to expand our business into the field of medical care.

Additionally, I had the opportunity to express the potential of nano medicine by collaborating with Prof. Takanori Ichiki of The University of Tokyo for some time. At first, I felt awkward and had some anxieties regarding "open innovation," however when I heard of the director general's concept of "It all started from the opening, and will move ahead in a firm collaboration," my working stance became clearer and now I am content working here at iCONM. From within, this environment is excellent for "a person who wants to do" and/or "a person who wants to create," and I am aware that this center is suitable for "monozukuri" in integrated areas of science, biology and engineering.

In future, I will continue to positively cooperate with iCONM towards the realization of its vision.

**Forefront technology
to the world**

KING SKYFRONT is positioned in the Keihin Seaside area, where the Keihin international trade port is also located, near Haneda International Airport. It is connected with major highway network systems such as the Metropolitan Expressway, Tomei Expressway, Tokyo Bay Aqua Line and National Route 1, and is accelerating collaboration between Japan with the rest of the world.



ACTIVITY REPORT

COINS 2nd International Symposium

“Open Innovation Platform for Smart Health Society”

The COINS 2nd International Symposium was held at Ito International Research Center on Tuesday, Nov. 24, 2015 under the theme “Open Innovation Platform for Smart Health Society.” There were three oral sessions, respectively titled “Integration of Research & Technologies,” “Innovation Ecosystem in Kawasaki” and “Global Innovation Ecosystem.” A total of 10 speakers gave fascinating presentations and proposals, and the participants joined in active discussion. For the poster session, there were 23 presentations given mainly by young researchers and audience participation was high.

The panel discussion comprised of four invited panelists, led by moderator Prof. Kimura, PL, and joined by Prof. Kataoka, RL. The symposium attracted over 250 participants and was a fruitful opportunity for the COINS members to reaffirm their determination in promoting research development, and realize the social implementation of its outcome.



Mr. Assaf Barnea



Mr. Dong Wu



Dr. Leonidas Karapiperis



Dr. Muthiah Manoharan



Dr. Sai Kiang Lim

Panelist
Kazunori KATAOKA
Research Leader, COINS, KAWASAKI
INSTITUTE OF INDUSTRY PROMOTION
Professor, Graduate School of Engineering
/ Graduate School of Medicine
The University of Tokyo

Panelist
Takeo ARIMOTO
Japan Science and
Technology Agency (JST)
Senior Fellow

Panelist
Masuhiko KATO
Project Professor,
Translational Research Initiative,
The University of Tokyo

Panelist
Koji NAKAO
Director,
TERUMO Corporation

Panelist
Akiyuki NAGASE
President,
Nagase Corporation

Moderator
Hirohichi KIMURA
Project Leader, COINS, KAWASAKI
INSTITUTE OF INDUSTRY PROMOTION
Project Professor, Graduate School of
Pharmaceutical Sciences,
The University of Tokyo



Panel Discussion

Topics 2015.4 ~ 2015.12

- 4.3.2015 [News articles] The Nikkan Kogyo Shimbum "Quest for Advanced Research" Research Leader Prof. Kataoka's research was introduced. "UTokyo, develops gene capsule - deliver to cancer tissue by exposing light"
- 4.9.2015 [News articles] Project Leader Prof. Kimura's Interview Published: "Discussion of Industry Collaboration at General Meeting of Japanese Association of Medical Sciences, Hope for Convenience Stores and Express Parcel Delivery Services"
- 4.10.2015 [News articles] Research Leader Prof. Kataoka's research was introduced. "Bank conveyance of mRNA to nanoparticle"
- 4.14.2015 [News articles] Prof. Kataoka will appear on the news program of TV (BS Nippon TV) at 10pm (Japanese time) on April 14, 2015, explaining the recent achievements of his research on nanomachines (polymeric micelles).
- 4.15.2015 [News articles] Theme5 Leader Prof. Nishiyama's Interview published. Prof. Nishiyama hopes to add value to existing chemical compounds using polymer technology.
- 4.17.2015 [Video] Prof. Kataoka was featured in a Kawasaki SkyFront i-Newsletter special video interview. The research concept of iCONM and what we are expecting of KING SKYFORNT are addressed. Please visit our website.
- 4.23.2015 [Events] COINS seminar #8 was held at iCONM on Thursday, April 23. Lecturer: Dr. Axel H. E. Müller Title: "Self-Organized Multicompartment Nanostructures Inspired by the Cell: Basic Findings and Biomedical Applications"
- 4.30.2015 Associate Prof. Horacio Cabral and Assistant Prof. Yutaka Miura held a press conference on Kataoka lab's "Systemic Targeting of Lymph Node Metastasis through the Blood Vascular System by Using Size-Controlled Nanocarriers" on Tuesday, Apr. 30. Please go to the following website. Research is ongoing to develop nanomachines for practical use.
 - Polymeric micelles for targeting lymph node metastasis (UTokyo Research)
 - Press Release on May 1, 2015 in School of Engineering, The University of Tokyo
- 4.30.2015 [Lecture] Prof. Kataoka was awarded from School of Pharmacy, University of Wisconsin-Madison to have 2015 Louis W. Busse Lectures on April 30 and May 1, 2015. (PDF)
- 5.4.2015 [Award] Prof. Kataoka received Gutenberg Research Award 2015 (article on Jan. 26, 2015) and the award ceremony was held on May 4 at University of Mainz where he presented his award lecture. The Gutenberg Award is a highly prestigious award that is given to outstanding scientists from the field of material sciences every year. Please visit the website below (English) for more details regarding the contents of his award-winning research and the awards ceremony.
 - Gutenberg Research Award 2015 goes to polymer chemist Kazunori Kataoka and theologian Kwok Pui Lan
 - Gutenberg Research College welcomes new members and bestows the 2015 Gutenberg Research Award
- 5.9.2015 [News article] KING SKYFRONT will be featured on TV Kawasaki(tvk)'s "Love Kawasaki" on Saturday May 9, 2015. iCONM will be introduced on the program during Prof. Kataoka's interview. iCONM will be featured for the first time on terrestrial broadcasting, so please watch it.
- 6.3.2015 [News article] Prof. Kataoka and his group's achievements in nanomedicine for cancer treatment was highlighted on "Scientific American."
- 6.4.2015 [News article] Research project on "Polymer Nanomachine" has been carried on "METI Journal" (PDF:Japanese) published from Ministry of Economics, Technology, and Industry, Japan"
- 6.10.2015 [Press release] The University of Tokyo (Prof. Kataoka), Tokyo Institute of Technology (Prof. Nobuhiro Nishiyama), National Institute of Radiological Sciences (Team Reader, Ichio Aoki) and COINS held a press conference on Wednesday, June 10 on MI PENG, Principal Investigator of Innovation Center of NanoMedicine (iCONM) the paper, "Hybrid calcium phosphate-polymeric micelles incorporating gadolinium chelates for imaging-guided gadolinium neutron capture tumor therapy," ACS Nano

- 6.19.2015 [Activity report] 4th COINS General meeting was held on Friday, June 19.
- 6.27.2015 [News article] Research of the Kataoka Lab. was introduced in NHK TV program "Ohayo Nippon" on Saturday, June 27. The title was "Targeting Cancer Cells alone - Development of Nano-scaled capsule. The same topic was reported in the NHK NEWS web as "Targeting Cancer Cells - Development of Nano-scaled capsule" on the same day.
- 6.29.2015 [Activity Report] COINS Semiar #9 was held on Monday, June 29 at iCONM.
- 7.8.2015 [Press release] Tuesday, June 23. Research of Prof. Kataoka was introduced in web page of Advanced Medicine Promotion Organization (AMPO) -movie-
- 7.13.2015 [Activity Report] The Opening Ceremony of the iCONM was held on Monday, July 13.
[News Article] The Opening Ceremony scene was broadcasted on Monday, July 13 on TVK "tvk news." It was also appeared in the Nikkan Kogyo Shimbun, Kanagawa Shimbun and Kanakoro Kanagawa Shimbun News (web.) on Tuesday, July 14.
- 7.21.2015 The theme leader Prof. Nishiyama's reserch was introduced in Nikkei Sango Shimbun on Tuesday, July 21 as an Innovator of Japan. Its title was "A New approach on Drug Delery System by Prof. Nobuhiro Nishiyama, Tokyo Institute of Technology - Detection of Cancer → Treatment in one day (An Innovator of Japan)"
- 7.30.2015 [News article] RL Prof. Kataoka's research was introduced in "How to live in security and safety" corner in Mainichi Evening Paper on Thursday, July 30. The title was "Anticancer Delivery System - Nanomachines - reduce the risk of side-effects and enhance its effect.
- 8.4.2015 [Activity Report] "KING SKYFRONT Summer Science Event 2015" organized by Kawasaki City was held on Tuesday, August 4.
[News Article] Article about "KING SKYFRONT Summer Science Event 2015" was appeared in Asahi Shimbun (P.29) and Kanagawa Shimbun (P.19)
- 8.7.2015 [News article] The Innovation Center of NanoMedicine (iCONM) was introduced in Asahi Shimbun (P.28) on Friday, August 7. The Headline was "Nano Medical Center starts its operation - Innovation Center of Kawasaki"
- 8.13.2015 [News article] News about Gutenberg Research Award given to Prof. Kataoka was published in August 4, 2015 Issue of Angewandte Chmie International Edition, the official scientific journal of German Chemical Society.
- 8.19.2015 [Newspaper] Innovation Center of Nanomedicine (iCONM) was featured in "A corner of analyze advance research center" in Nikkei Sangyo Shimbun on Aug. 19 (Wed.), 2015. The title is "Innovation Center of Nanomedicine Application of capsule - Industry-academic-gervnement collaboration."
- 8.21.1.2015 [Report] The paper entitled "Induction of secondary structure through micellization of an oppositely charged pair of homochiral block- and homopolypeptides in an aqueous medium" from our lab that was published in Macromolecular Rapid Communications, was featured in MaterialsView.
MaterialsView: Understanding higher-ordered structures in polypeptides
- 8.24.2015 [Award] Prof. Kataoka received "Advanced Materials Award 2015" from International Association of Advanced Materials (IAAM). Award ceremony and award lecture were held at Stockholm, Sweden on August 24, 2015.
- 8.26.2015 [Report] "Nano Capsule" being developed by Kataoka lab. was introduced in "A corner of future technology (P.74 - P.76)" in a weekly economic periodical Nikkei Business Aug. 10 and 17 issue. The title is "Drug Delivery System (DDS) hits cancer with nano capsule."
- 8.26.2015 [Report] "Nanomachines" being developed by Kataoka lab. was introduced in "A corner of the life expectancy increases up to 1000 years of age" (P. 37) in a monthly international communication periodical SAPIO September issue. The title is "Cancer treatment - Deliver drug directly by targeting cancer cell alone - Power of smart nanomachines of a virus size."
- 8.27-28.2015 [Activity Report] Japan Science and Technology/Agency Fair 2015 "Exhibition of Future Industries with Technology" was organized by JST and held on Thursday, August 27 and Friday, August 28 at West 3 Hall Tokyo Big Sight.
- 9.01.2015 [Activity Report] Dr. Akira Tsugita, Director for Community Support, Science and Technology Policy Bureau, MEXT visited COINS and iCONM on Tuesday, September 1.
- 9.04.2015 [Newspaper] Nanocapsule developed by Prof. Kataoka's research group was featured on P.20 Nihon Keizai Shimbun on Friday, September 4. The title was "Cancer treatment, clinical trial, drug delivery by nano capsule, targeting cancer with engineering and medical integration."
- 9.5.2015 [Newspaper] Paclitaxel-loaded polymeric micelle achieved successful results in clinical trials, and has been decided to proceed into application for approval in the fiscal year of 2015.(NIKKEI ASIAN REVIEW September 5, 2015 2:00 am)
- 10.2-3.2015 [Activity report] Friday, October 2 – Saturday, October 3: COINS retreat camp was held.
- 10.05、08.2015 [News article] Interview article on Nanomachine appeared in HORIEMON.COM. It is a talk between Prof. Kataoka and Mr. Takafumi Horie.
10/5: "Nano capsule autonomously patrol in the body to diagnose and treat before even we notice." "Nano medicine at present and future Part 1" by Prof. Kataoka, The University of Tokyo
10/8: "Nano capsule autonomously patrol in the body to diagnose and treat before even we notice." "Nano medicine at present and future Part 2" by Prof. Kataoka, The University of Tokyo
- 10.09.2015 [News article] Interview article of Prof. Kataoka, Director General of iCONM on Nanomachine was futured in imidas in October 9.
imidas Jiji Opinon : Realiation of "Drug delivery System" which pinpoints cancer is near at hand! The savior of cancer treatment
- 10.10.2015 [Activity report] On Saturday, October 10, students of Kasumigaoka High School of Fukuoka Prefecture visited Ichiki Laboratory/The University of Tokyo.
- 10.16.2015 [News article] Prof. Kimura, COINS Project Leader's article was appeared in the science portal site of JST in October 16, 2015.
Title was "Creating Innovation Hub<9>COINS (Center of Open Innovation Network for Smart Health) COI towards Smart life care society ~ aiming (hospital inside the body)"
- 10.27.2015 The paper entitled "Hybrid calcium phosphate-polymeric micelles incorporating gadolinium chelates for imaging-guided gadolinium neutron capture tumor therapy" from our lab that was published in ACS Nano, was featured in Phys.org.
Phys.org: Gadolinium-based particles show and treat tumours
- 10.30.2015 [Report] Article about "Nanomachine" that has been developed at Kataoka laboratory was carried out on a website of AKIRAMENAI-GANCHIRYO-NETWORK, Front-line therapy for cancer and support for fighting disease - Information for recurrence and metastasis cancer therapy.
Title [Front-line therapy] Targeting cancer cells alone with "polymeric micelle" anticancer agent.
- 10.31.2015 [News Report] Research results of National Cancer Center was printed in both Nikkei Shimbun evening paper and in Electronic Edition on October 31, 2015.
- 11.05.2015 [News Report] Press Tour was organized by Kawasaki city on November 5, 2015. iCONM and COINS were introduced.
· 11/20 Kagaku Shimbun
· 11/24 Economist (vol. 12/1/2015) Economist view
· 11/25 Nikkan Gendai
· 11/26 Nikkan Kogyo Shimbun etc.
- 11.06.2015 [News Report] Article of Nanomachine which has been developed at Kataoka Lab. was published on the website of Dowwe Matelux LLC. Title is Visiting Kawasaki National Strategic Special Zone - Nanomachine that the world is looking at!
- 11.06.2015 [Activity Report] A group of observers from Janssen Pharmaceuticals visited COINS on Friday, November 6.
- 11.15.2015 [News Report] Assistant Prof. Yasutaka Anraku, The University of Tokyo appeared on 「Mirai no Kigen」 TBS on November 15, 2015 and made a commentary on cancer treatment using Nano capsule.
- 11.24.2015 [Activity Report] COINS 2nd International Symposium was held on Tuesday, November 24.
- 11.27.2015 [Activity Report] COINS Seminar #10 & #11 were held on Friday, November 27 at iCONM.
- 11.30.2015 [Award] Associate Prof. Keiji Itaka received the best poster award at 3rd International mRNA Health Conference. The presentation title is "A disease-modifying strategy for osteoarthritis treatment by introducing mRNA encoding cartilage-anabolic transcription factor."
- 11.30.2015 [News Report] Article of Interview with Prof. Kataoka was published in "athome TIME," At Home Co., Ltd. The title was [Meet the Professor series: passion for academia] "Deliver anticancer drugs by Nano size vehicle"
- 12.04.2015 [News Report] Prof. Nishiyama, Tokyo Institute of Technology appeared on Fuji Television program "Viking" on December 4, 2015 and made a commentary on Nanomachines.
- 12.04.2015 [Activity Report] COINS Semiar #12 was held on Friday, December 4 at The University of Tokyo.
- 12.07.2015 [Activity Report] COINS Semiar #13 was held on Monday, December 7 at iCONM.
- 12.14.2015 [News Report] Interview article on Nanomachines, which has been developed at Kataoka lab, was published in Phronesis.
Title is "Nanomachines create a hospital inside the body."
Phronesis: issued on December 2015.14(Issue in December 2105): "Future Work Style" contents
- 12.16.2015 [News article] The National Cancer Research Center Ochiya laboratory's researcher, Yuji Yoshioka was introduced by the Nikkan Kogyo Shimbun, in December 16, 2015.
The title is a "Researcher to open up : Mark molecular search of cancer disease."

Retreat Camp

A retreat camp, held under the theme “How to create a most innovative center in the world,” took place at Shonan Village Center on Friday, Oct. 2 and Saturday, Oct. 3, 2015. The term “retreat” can be defined as “returning to basics, both in mind and body, in a relaxed environment,” so for the gathered researchers who devote themselves to their research, it was an excellent opportunity for them to share tasks such as social implementation and come up with solutions together, while deepening their exchanges with and challenging other project members.

On the first day, Mr. Yuzo Toda, Managing Director, Fujifilm Corporation gave a talk titled “Corporate R&D strategy and industry-university cooperation-our expectations of COINS/iCONM, and our company’s efforts.”



Yuzo TODA,
Executive Managing Director

On the second day, Mr. Ryo Kubota, CEO, Acucela Inc. gave a talk titled “Build a business from scratch that changes the world - Towards the realization of a broad-minded society of great diversity.” He shared the idea of how to start up a new business alone with the aim of changing the world.



Ryo KUBOTA, CEO

It was a great opportunity to learn about how research activities conducted via industry-university cooperation should be in the future, as well as how to set up new businesses, start-ups and the future direction of social implementation. During the discussion segment, the participants separated into groups and discussed the issue of “What COINS expects from iCONM,” and proposed iCONM’s mission. The retreat, including the reception, was a great opportunity for the participants to deepen understanding beyond their own sub-themes, age, profession and respective research areas.

5th Group Meeting

The 5th Group Meeting was held in the main conference room at the Life Science & Environment Research Center (LiSE) on Friday, Jan. 22, 2016. The meeting is held every six months and invites all participating institutions to present their research progress.

As there will be a mid-term evaluation of Phase 1 to Phase 2 of the COI program in the next FY year (FY2016), the presentations were related to the following: (1) To what degree has the research progressed? Including forecasts. (2) How close to social implementation has the research come to, including intellectual property management? (3) How will you move forward next year? There was a panel discussion based on the topics above, with each theme leader as moderator.

At the conclusion of the meeting, the future roadmap was confirmed, and there was an active yet candid exchange of opinions across each theme.

Additionally, Mr. Satoshi Ogawa, Lawyer, TMI Associates, gave a talk with the title “Dealing with conflicts of interest at an open innovation center,” related to the social implementation of research outcomes. There were also poster sessions of the research results, where there was active discussion regarding the 30 posters that were showcased that day.

Ultimately, it was a fruitful and meaningful group meeting for the members of COINS, which will shift into Phase 2 this April, to strengthen their solidarity towards the realization of “In-Body Hospital.”



Lecture by Mr. Satoshi OGAWA, Lawyer



Poster session

Editor’s note

We created the “NanoSky” publication to feature the ongoing efforts related to the implementation of the idea of “In-Body Hospital.” First, we thought we should answer the question “What is COINS?” The members of the editorial team put our heads together to find the most simple and straightforward ways to communicate our vision to a new readership. FY2016 will see this project, which has started in 2013, move into its second stage. COINS will continue to engage in a wide range of activities towards the social implementation of its research outcomes and issue the newsletter that all of you wait in anticipation.

chief editor: Takashi SUGIMOTO