



# COINS

Center of Open Innovation Network for Smart Health



## Message

Project Leader of COINS

KAWASAKI INSTITUTE OF  
INDUSTRIAL PROMOTION  
Innovation Center of  
NanoMedicine (iCONM)

**Hiromichi KIMURA**

Professor,  
The University of Tokyo



Located in the Keihin manufacturing district, a praised area for industrial promotion, and facing Tokyo Haneda International Airport, a hub of Japan, a new healthcare industry has been established, whose first few steps have been attracting worldwide interest.

A diversity of human resources, funds and cutting-edge technologies has been brought together from around Japan and the world with the aim of “making the impossible possible”. Smart nanomachines, which is designed based on unconventional ideas, is created to serve as “In-Body Hospitals”, and solves the problems of curing and preventing intractable diseases. Researchers from private companies, research institutes, and universities joined under one-roof and fully dedicated to this mission. From this, the management strategy team is constructing a globally recognized cutting-edge social system. It is the arrival of start-up companies, products and services to be born one after another.

Director General and  
Research Leader of COINS  
KAWASAKI INSTITUTE OF  
INDUSTRIAL PROMOTION  
Innovation Center of  
NanoMedicine (iCONM)

**Kazunori KATAOKA**

Professor,  
The University of Tokyo



A truly innovative element of this project is that it realizes an autonomous health society (smart health society) by liberating anyone, anywhere and anytime from diseases of heavy social burden without any regards to psychological, physical or economic uncertainty. We aim to realize “In-Body Hospitals”, which provides necessary diagnosis and treatment inside the required parts of the body at the precise time, by creating “smart nanomachines the size of a virus size, which autonomously patrol the microenvironments in the body”. This has been mere science fiction until now, but will be made a reality by self-organization of macromolecules integrated with functionals elements required for pin-point diagnosis and targeted therapy.

## Vision/Mission

### “In-Body Hospitals” — future technology COINS aims for

COINS (Center of Open Innovation Network for Smart Health) is a research center of an entirely new idea for developing “products and services that changes the future” by anticipating social needs in the future and integrating cutting-edge technologies, human resources and ideas from universities and private companies in and outside Japan.

COINS thinks that an answer is development of dream-like smart nanomachines that patrol around the body 24 hours a day, detect sign of a disease, treat the disease and immediately communicate the information to the outside body. Cutting-edge nanomedical research institutes have joined from all parts of Japan and the world to facilitate industry-academia-government collaboration toward development of nanomachines.

“In-Body Hospitals”	
Vision	Function
People are freed from the fear of cancer	<b>Targeting</b> specific cells
Alzheimer’s disease is conquered	<b>Overcoming</b> barriers inside the body
Sports can be enjoyed regardless of age	<b>Prevention</b> of aging and damage
Society is relieved of the burden of medical costs	<b>Diagnosis</b> of micro environments inside the body
Disease will no longer be a mental or physical burden on the people	<b>Treatment</b> disease non-invasively
Medicine becomes a key industry of Japan	<b>Transformation</b> of society

COINS	
Mission	
Greatly suppress recurrence and metastasis of cancer	Theme1
Facilitate drug delivery to the brain	Theme2
Establish regenerative technology for motor and sensory cells	Theme3
Establish precise prevention diagnostic technology	Theme4
Promote fast treatment that does not require hospitalization	Theme5
Revolutionize medical business models through new venture companies	Theme6



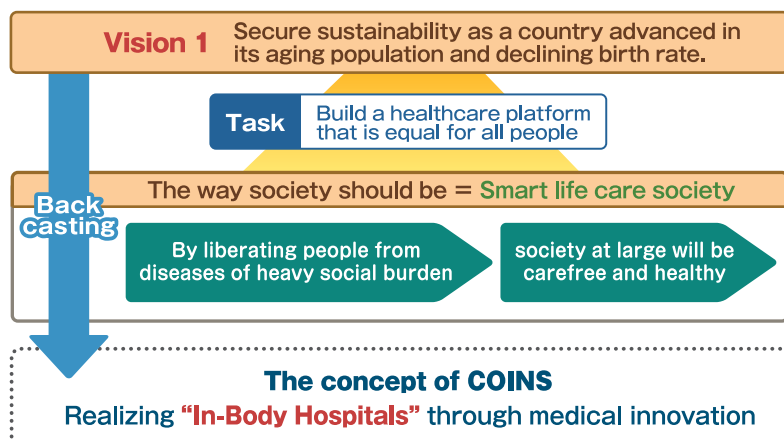
COINS is an initiative under the Center of Innovation Science and Technology based Radical Innovation and Entrepreneurship Program (COI STREAM) of the Ministry of Education, Culture, Sports, Science and Technology, Japan.

“COINS” also implies being a center of frequent “coincidences” and many people in the world not needing bills but “coins” to have an access to medical service. The hexagons above the “I” in the logotype represent mutually overlapping wings, connoting “creation of new values and innovation via integration of different fields,” “butterflies gathering to Haneda Airport (which is in the vicinity of the center) and flying to all parts of the world,” and “smoke of innovation rising from a smokestack, symbolizing changes in the Keihin Industrial area”.

## ■ Implementation of “In-Body Hospitals” by open innovation

### Open Innovation system, which facilitates industry-academic-government collaboration.

This project, as “Center of Open Innovation Network for Smart Health” aims to realize a new platform, where each participating research institutes can accelerate their collaboration, and moreover, create new innovation via industry-academia collaboration, which could not succeed in industry and university alone.



“In-Body Hospitals” is a futuristic technology that effectively suppresses diseases of heavy social burden, allowing people to live naturally healthy lives, without the need for human labor to maintain their health.



### Being “under the one roof” accelerates innovation

With the concept of “under the one roof”, The Innovation Center of NanoMedicine (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.

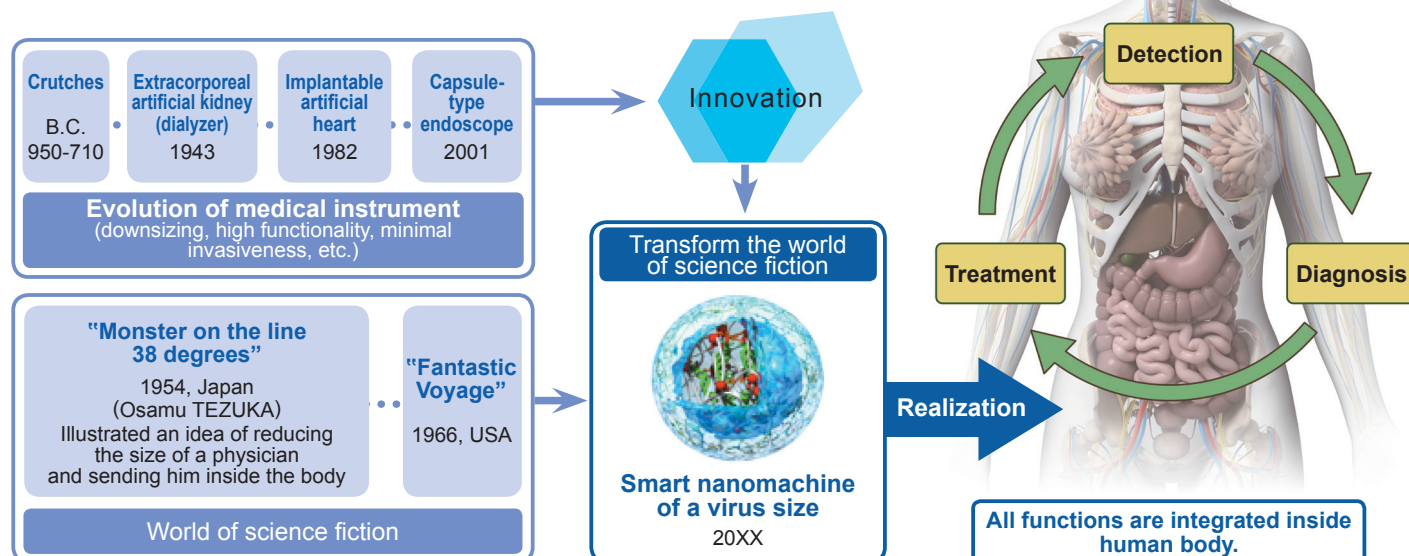
Research System Under the One Roof		
KAWASAKI INSTITUTE OF INDUSTRIAL PROMOTION Innovation Center of NanoMedicine		
SBI Pharmaceuticals Co., Ltd.	Nippon Kayaku Co., Ltd.	Medical Industry Innovation Institute
Kowa Company Ltd.	Fujifilm Corporation	National Cancer Center
JSR Corporation	Braizon Therapeutics Inc.	Central Institute for Experimental Animals
Shimadzu Corporation	The University of Tokyo	Japan Radioisotope Association
Toray Industries, Inc.	Tokyo Medical University	National Institutes for Quantum and Radiological Science and Technology
NanoCarrier Co., Ltd.	Tokyo Medical and Dental University	Kanagawa Pref.
NOF Corporation	Tokyo Institute of Technology	Kawasaki City
Nitto Denko Corporation	Tokyo Women's Medical University	
Nitto Boseki Co., Ltd.	Tokyo University of Science	

\*As of September 2020

## ■ Research goals and approaches at COINS

### Toward realization of “In-Body Hospitals”

COINS aims to realize “In-Body Hospitals”, which integrates all medical functions within the body. Smart nanomachines of a virus size will autonomously patrol the microenvironments in the body and provide diagnostic and therapeutic services 24 hours a day.





# Six approaches toward the realization of “In-Body Hospitals”

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 Hospitals”.

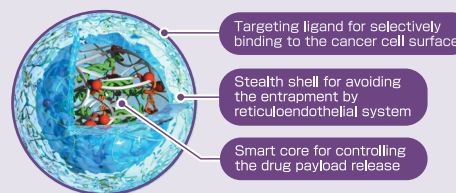
## 1 Theme Development of nanomachines that can target and eliminate intractable cancer



**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 nanomachines are already in a Phase II clinical trials. 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.

### Structure of Nanomachines



### Participating institutions

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

## 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 Hospitals”, 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)  
Shimadzu Corporation, Nitto Denko Corporation,  
Fujifilm Corporation, Medical Industry Innovation Institute (MI3)  
Tokyo Institute of Technology, The University of Tokyo

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

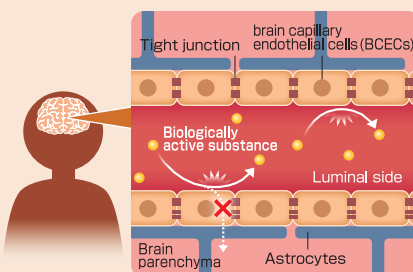


**Theme Leader**  
**Yasutaka ANRAKU**  
Project Associate Professor  
Department of Bioengineering,  
Graduate School of Engineering,  
The University of Tokyo

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, Braizon Therapeutics Inc.,  
The University of Tokyo

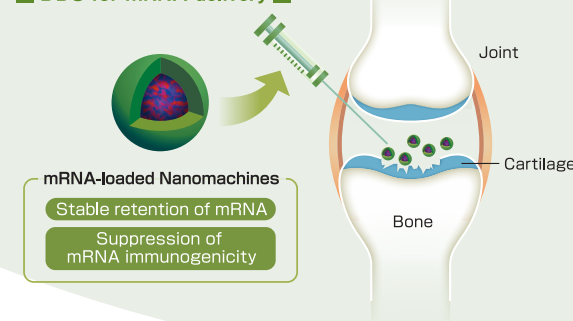
## 3 Theme Development of nanomachines that carry messenger RNA (mRNA) for tissue reconstruction and vaccination



**Theme Leader**  
**Keiji ITAKA**  
Professor,  
Institute of Biomaterials and Bioengineering,  
Tokyo Medical and Dental University

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. Development of vaccines against viruses including COVID-19 using this technology are also being carried out.

### DDS for mRNA delivery



### Participating institutions

Innovation Center of NanoMedicine (iCONM),  
NOF Corporation, Central Institute for Experimental Animals,  
NanoCarrier Co., Ltd., Tokyo Medical and Dental University,  
The University of Tokyo,

## 6 Approaches

Targeting  
specific cells

Transformation  
of society

Treatment  
without burden

Diagnosis  
of microenvironments  
inside the body

Overcoming  
barriers  
inside the body

Prevention  
of aging and  
damage

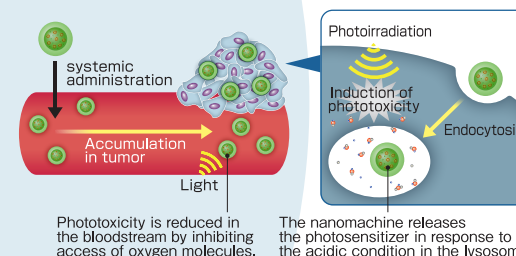
## 5 Theme Ultra-minimal invasive treatment through the development of a theranostic system that combines nanomachines and medical equipment



**Theme Leader**  
**Nobuhiro NISHIYAMA**  
Professor,  
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



### Participating institutions

Innovation Center of NanoMedicine (iCONM)  
SBI Pharmaceuticals Co., Ltd., Toray Industries, Inc.,  
National Institutes for Quantum and  
Radiological Science and Technology,  
Tokyo Institute of Technology, Tokyo Women's Medical University,  
Tokyo University of Science, The University of Tokyo

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



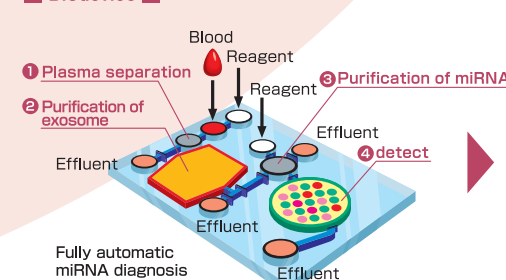
**Theme Leader**  
**Takanori ICHIKI**  
Professor,  
Department of Materials Engineering,  
Graduate School of Engineering,  
The University of Tokyo

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.

### Participating institutions

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

### Biodevice



# 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.



## KING SKYFRONT: Tonomachi's International Strategic Hub

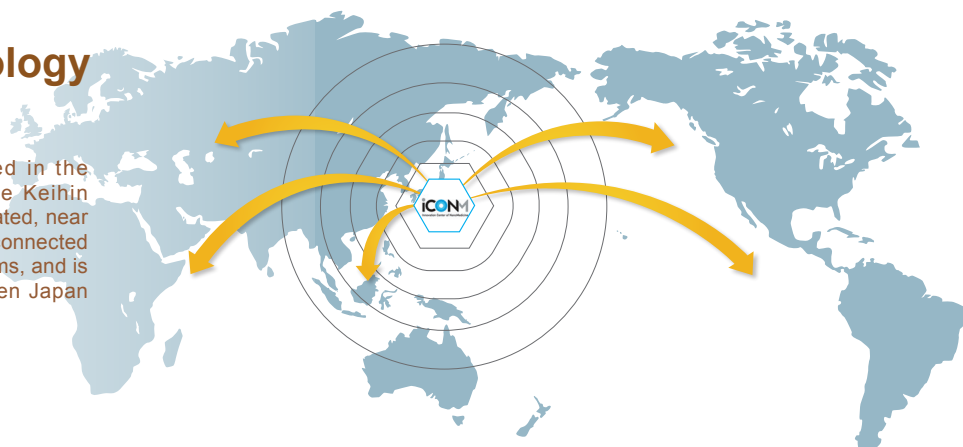


iCONM is situated at KING SKYFRONT, a designated national strategic special zone. The approximately 40-hectare site is located to the southwest of Haneda International Airport, on the opposite shore of the Tama River. The international strategic hub's formation is in full progress, and new industries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

The area was named "KING SKYFRONT" - 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.

## 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, and is accelerating collaboration between Japan with the rest of the world.



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