

The Center of Innovation Program  
センター・オブ・イノベーションプログラム



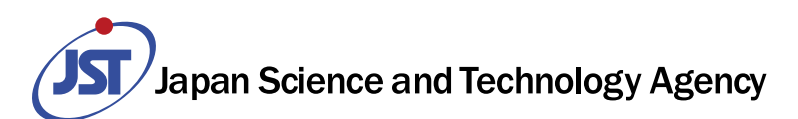
The Center of Innovation Program  
センター・オブ・イノベーションプログラム

**Japan Science and Technology Agency**  
Department of Innovation Platform, COI group

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K's Gobancho  
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# “We want to create a new future!”

How should we change society and people by the end of the next decade?

The COI Program promotes challenging and high-risk R&D to realize our visions for our ideal society.

## Key points of the COI Program

### Backcasting Approach

Employ the “backcasting approach”, visualizing an ideal society at the starting point and subsequently setting R&D plans towards realization of the society, rather than the “forecasting approach” which relies on existing researches or technologies aiming at their commercialization.

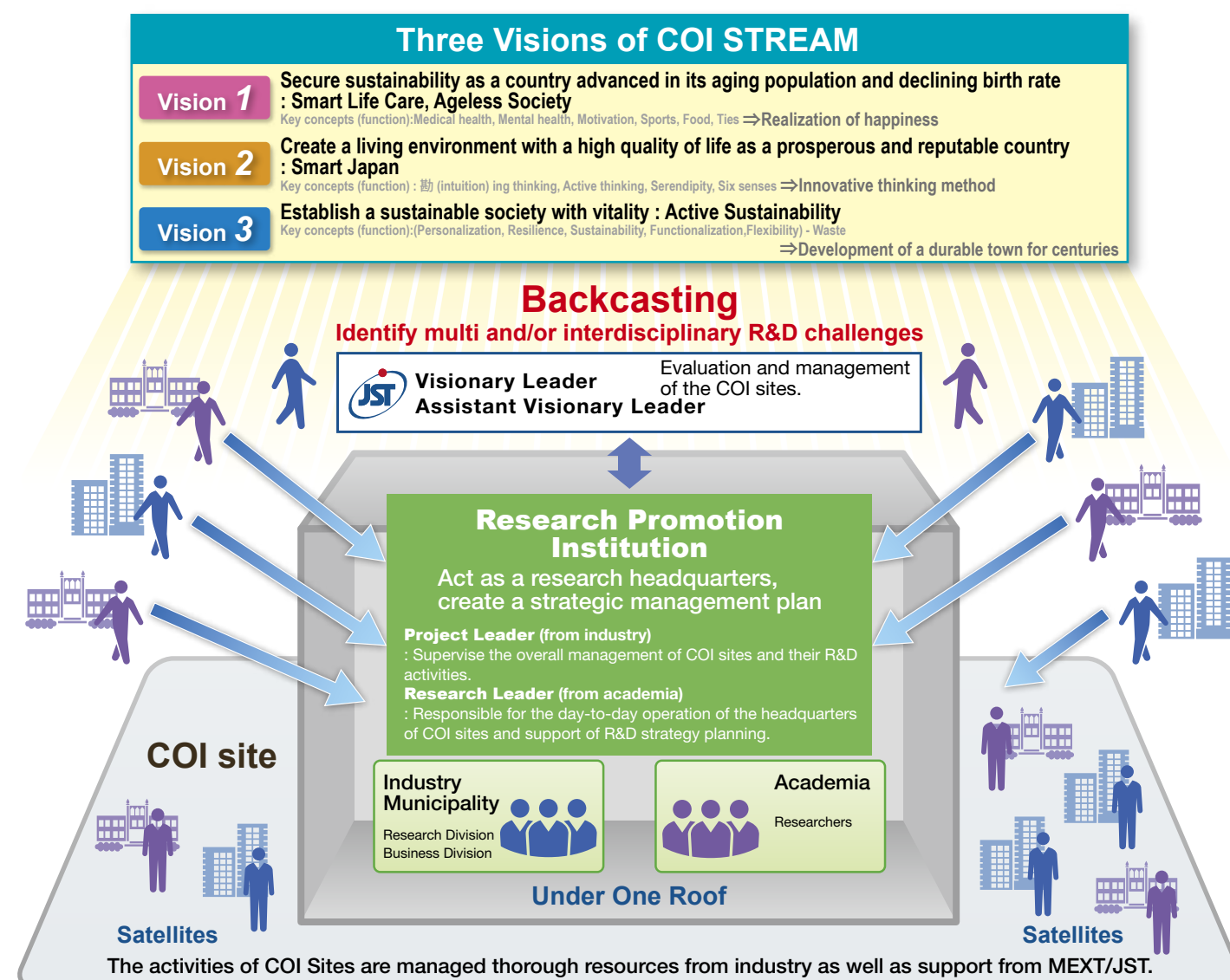
### Under One Roof

Establish an innovation platform (COI Site) where universities and companies can work on R&D together under one roof.

### Period & Budgets

Support each COI Site up to 9 fiscal year with expenses from 100 million to 1 billion yen per year, including overhead expenses.

## Management of a COI Site



## Management of the COI Program

### COI STREAM Governing Committee [Set the visions and design fundamental policies]

Chairman



**Hiroshi Komiya**  
Chairman of the Mitsubishi Research Institute, Inc.



**Joichi Ito**  
Director of the MIT Media Lab.



**Takashi Kawamura**  
Former Chairman, Hitachi, Ltd.



**Atsushi Horiba**  
Chairman, President & CEO, Horiba Ltd.



**Hiroshi Matsumoto**  
President, RIKEN



**Hiroshi Mikitani**  
Chairman and CEO, Rakuten, Inc.



**Katsuaki Watanabe**  
Corporate Advisor, Toyota Motor Corporation

### COI STREAM Structuring Team

The COI STREAM Structuring team examines the measures for cross-cutting issues of COI sites, and will support R&D of the site in cooperation with the visionary team. COI STREAM Structuring team will work under the direction of the Senior Visionary Leader.

#### Member

**Kazuhiro Ueta**, Professor, Graduate School of Economics, Kyoto University  
**Koichiro Eto**, Planning Manager, National Institute of Advanced Industrial Science and Technology  
**Yuya Kajikawa**, Associate Professor, Graduate School of Innovation Management, Tokyo Institute of Technology  
**Satoshi Koike**, CEO, vegetalia Inc.  
**Atsushi Sunami**, Professor, National Graduate Institute for Policy Studies  
**Kazuhiko Takeuchi**, Professor, Integrated Research System for Sustainability Science, The University of Tokyo  
**Miwako Doi**, Auditor, National Institute of Information and Communications Technology  
**Yoshiki makabe**, General Manager R&D Planning Dept. Corporate Research Planning Dept., TORAY  
**Yutaka Matsuo**, Associate Professor, School of Engineering, The University of Tokyo  
**Masaaki Mizuno**, Presidential adviser/ Professor, Graduate School of Medicine, Nagoya University  
**Sakiko Yoshikawa**, Director/ Professor, Kokoro Research Center, Kyoto University



**Senior Visionary Leader**  
Michinari Hamaguchi



Detect and specify cross-vision or cross-site issues and consider methods to promote activities of COI STREAM.

### Visionary Teams

[Promotion and evaluation of COI sites]

- The Visionary Teams are in charge of the progress management and activity assessment of COI sites.
- COI Sites implement R&D activities in accordance with advice and recommendations by the Visionary Teams.

#### Vision 1



**Visionary Leader**  
**Yuzuru Matsuda**  
Advisor, Kyowa Hakkō Kirin Co., Ltd.



**Visionary Team member**  
**Akio Onishi**  
Visiting Professor, Graduate School of Public Policy, The University of Tokyo



**Visionary Team member**  
**Masahiko Mori**  
President, DMG Mori Seiki Co., Ltd.

**Research adviser**  
Assist in the Visionary leader as a specialist in individual areas of research and technology field.

#### Vision 2



**Visionary Leader**  
**Akira Yokota**  
Former Executive Vice President, ITOCHU Corporation



**Visionary Team member**  
**Koichi Abe**  
Senior Vice President and Representative Member of the Board, Toray Industries, Inc.



**Visionary Team member**  
**Shinichiro Ohgaki**  
President, Japan Water Research Center

**Hideaki Koizumi**  
Fellow, Hitachi, Ltd.

**Koji Shimizu**  
Professor, Kyoto university

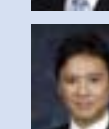
**Miwako Doi**  
Auditor, NICT

**Masaaki Mizuno**  
Presidential adviser, Professor, Nagoya University

#### Vision 3



**Visionary Leader**  
**Masaharu Sumikawa**  
Senior Adviser, Hitachi, Ltd.



**Visionary Team member**  
**Shinji Asakura**  
GE International Inc. General Manager, Global Research Japan



**Visionary Team member**  
**Tetsuhiko Ikegami**  
Former President, The University of Aizu

**Yuji Furui**  
Project Assistant Professor, The University of Tokyo





## Vision 1



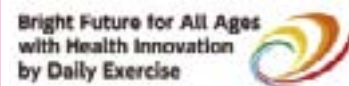
**Sustaining national health in an aging society**  
 Hirosaki University  
 PL : Kudo Toshihiko (Maruman Computer Service Corp.)  
 RL : Shigeyuki Nakaji (Hirosaki University)  
 Participating institution →p.9

## Vision 1



**The Last 5X innovation R&D Center for a Smart, Happy, and Resilient Society**  
 Kyoto University  
 PL : Tsuyoshi Nomura (Panasonic Corporation)  
 RL : Hidetoshi Kotera (Kyoto University)  
 Participating institution →p.19

## Vision 1



**Bright Future for All Ages with Health Innovation by Daily Exercise**  
 Ritsumeikan University  
 PL : Sonoko Ishimaru (Toyobo Co., Ltd.)  
 RL : Tadao Isaka (Ritsumeikan University)  
 Participating institution →p.17

## Vision 2



**COI Site to develop a "Super Nippon-jin" by activating human power**  
 Osaka University  
 PL : Takeshi Uenoyama (Panasonic Corporation)  
 RL : Kazuhiko Matsumoto (Osaka University)  
 Participating institution →p.25

## Vision 2



**Center of KANSEI Innovation Nurturing Mental Welfare**  
 Hiroshima University  
 PL : Takahide Nouzawa (Mazda Motor Corporation)  
 RL : Shigeto Yamawaki (Hiroshima University)  
 Participating institution →p.27

## Vision 3



**Center for Co-Evolutional Social Systems**  
 Kyushu University  
 PL : Yoichi Korehisa (Kyushu University)  
 RL : Masato Wakayama (Kyushu University)  
 Participating institution →p.41

## Vision 3



**Frontier Center for Organic System Innovations**  
 Yamagata University  
 PL : Toru Miyake (Dai Nippon Printing Co., Ltd.)  
 RL : Yoshihiro Ohba (Yamagata University)  
 Participating institution →p.29

## Vision 3



**Global Aqua Innovation Center for Improving Living Standards and Water-sustainability**  
 Shinshu University  
 PL : Shinjiro UEDA (Hitachi, Ltd.)  
 RL : Morinobu ENDO (Shinshu University)  
 Participating institution →p.37

## Vision 3



**Construction of next-generation infrastructure using innovative materials**  
 Kanazawa Institute of Technology  
 PL : Shouichi IKEBATA (Daiwa House Industry Co., Ltd.)  
 RL : Kiyoshi UZAWA (Kanazawa Institute of Technology)  
 Participating institution →p.35

## Vision 3



**Innovation Hub for a "Mobility Society"**  
 Nagoya University  
 PL : Shigeru Kuroyanagi (Toyota Motor Corporation)  
 RL : Takayuki Morikawa (Nagoya University)  
 Participating institution →p.39

## Vision 3



**Center of Kansei-oriented Digital Fabrication**  
 Keio University  
 PL : Kenji Matsubara (Longfellow Inc.)  
 RL : Jun Murai (Keio University)  
 Participating institution →p.33

## Vision 1



**Innovative Food & Healthcare MASTER**  
 Hokkaido University  
 PL : Masanori Yoshino (Hitachi, Ltd.)  
 RL : Akiko Tamakoshi (Hokkaido University)  
 Participating institution →p.7

## Vision 1



**Center of Innovation for creation of a health-conscious society to realize healthy and fulfilling life, and strengthen family ties through unobtrusive sensing and daily health screening**  
 Tohoku University  
 PL : Takuzo Takayama (Toshiba Co., Ltd.)  
 RL : Tomokazu Matsue (Tohoku University)  
 Participating institution →p.11

## Vision 1



**Self-Managing Healthy Society**  
 The University of Tokyo  
 PL : Tomihisa Ikeura (The University of Tokyo)  
 RL : Ung-il Chung / Yuichi Tei (The University of Tokyo)  
 Participating institution →p.13

## Vision 3



**Innovative Center for Coherent Photon Technology (ICCPT)**  
 The University of Tokyo  
 PL : Junji Yumoto (The University of Tokyo)  
 RL : Shinji Tsuneyuki (The University of Tokyo)  
 Participating institution →p.31

## Vision 2



**Creating Innovation for "Synesensory" through Inspirational Arts, and Science and Technology**  
 Tokyo University of Arts  
 PL : Seiichi Tamura (JVCKENWOOD Corporation)  
 RL : Masaaki Miyasako (Tokyo University of the Arts)  
 Participating institution →p.21

## Vision 2



**Happiness Co-Creation Society through "ISHIN-DENSHIN" Intelligent Communications**  
 Tokyo Institute of Technology  
 PL : Shigeyuki Akiba (Tokyo Institute of Technology)  
 RL : Shunri Oda (Tokyo Institute of Technology)  
 Participating institution →p.23

## Vision 1



**Center of Open Innovation Network for Smart Health (COINS)**  
 Kawasaki Institute of Industrial Promotion  
 PL : Hiromichi Kimura (Kawasaki Institute of Industrial Promotion)  
 RL : Kazunori Kataoka (Kawasaki Institute of Industrial Promotion)  
 Participating institution →p.15

Vision 1



**Secure sustainability as a country advanced in its aging population and declining birth rate : Smart Life Care, Ageless Society**

**Visionary Leader  
Yuzuru Matsuda**

<b>Innovative Food &amp; Healthcare MASTER</b>	7
Core institution : Hokkaido University PL : Masanori Yoshino (Hitachi, Ltd.)	RL : Akiko Tamakoshi (Hokkaido University)
<b>Sustaining national health in an aging society</b>	9
Core institution : Hirosaki University PL : Kudo Toshihiko (Maruman Computer Service Corp.)	RL : Shigeyuki Nakaji (Hirosaki University)
<b>Center of Innovation for creation of a health-conscious society to realize healthy and fulfilling life, and strengthen family ties through unobtrusive sensing and daily health screening</b>	11
Core institution : Tohoku University PL : Takuzo Takayama (Toshiba Co., Ltd.)	RL : Tomokazu Matsue (Tohoku University)
<b>Self-Managing Healthy Society</b>	13
Core institution : The University of Tokyo PL : Tomihisa Ikeura (The University of Tokyo)	RL : Ung-il Chung / Yuichi Tei (The University of Tokyo)
<b>Center of Open Innovation Network for Smart Health (COINS)</b>	15
Core institution : Kawasaki Institute of Industrial Promotion PL : Hiromichi Kimura (Kawasaki Institute of Industrial Promotion)	RL : Kazunori Kataoka (Kawasaki Institute of Industrial Promotion)
<b>Bright Future for All Ages with Health Innovation by Daily Exercise</b>	17
Core institution : Ritsumeikan University PL : Sonoko Ishimaru (Toyobo Co., Ltd.)	RL : Tadao Isaka (Ritsumeikan University)
<b>The Last 5X innovation R&amp;D Center for a Smart, Happy, and Resilient Society</b>	19
Core institution : Kyoto University PL : Tsuyoshi Nomura (Panasonic Corporation)	RL : Hidetoshi Kotera (Kyoto University)

Vision 2



**Create a living environment with a high quality of life as a prosperous and reputable country : Smart Japan**

**Visionary Leader  
Akira Yokota**

<b>Creating Innovation for "Synesensory" through Inspirational Arts, and Science and Technology</b>	21
Core institution : Tokyo University of Arts PL : Seiichi Tamura (JVCKENWOOD Corporation)	RL : Masaaki Miyasako (Tokyo University of the Arts)
<b>Happiness Co-Creation Society through "ISHIN-DENSHIN" Intelligent Communications</b>	23
Core institution : Tokyo Institute of Technology PL : Shigeyuki Akiba (Tokyo Institute of Technology)	RL : Shunri Oda (Tokyo Institute of Technology)
<b>COI Site to develop a "Super Nippon-jin" by activating human power</b>	25
Core institution : Osaka University PL : Takeshi Uenoyama (Panasonic Corporation)	RL : Kazuhiko Matsumoto (Osaka University)
<b>Center of KANSEI Innovation Nurturing Mental Welfare</b>	27
Core institution : Hiroshima University PL : Takahide Nouzawa (Mazda Motor Corporation)	RL : Shigeto Yamawaki (Hiroshima University)

Vision 3



**Establish a sustainable society with vitality : Active Sustainability**

**Visionary Leader  
Masaharu Sumikawa**

<b>Frontier Center for Organic System Innovations</b>	29
Core institution : Yamagata University PL : Toru Miyake (Dai Nippon Printing Co., Ltd.)	RL : Yoshihiro Ohba (Yamagata University)
<b>Innovative Center for Coherent Photon Technology (ICCPT)</b>	31
Core institution : The University of Tokyo PL : Junji Yumoto (The University of Tokyo)	RL : Shinji Tsuneyuki (The University of Tokyo)
<b>Center of Kansei-oriented Digital Fabrication</b>	33
Core institution : Keio Univesity PL : Kenji Matsubara (Longfellow Inc.)	RL : Jun Murai (Keio University)
<b>Construction of next-generation infrastructure using innovative materials</b>	35
Core institution : Kanazawa Institute of Technology PL : Shouichi Ikebata (Daiwa House Industry Co., Ltd.)	RL : Kiyoshi UZAWA (Kanazawa Institute of Technology)
<b>Global Aqua Innovation Center for Improving Living Standards and Water-sustainability</b>	37
Core institution : Shinshu University PL : Shinjiro UEDA (Hitachi, Ltd.)	RL : Morinobu ENDO (Shinshu University)
<b>Innovation Hub for a "Mobility Society"</b>	39
Core institution : Nagoya University PL : Shigeru Kuroyanagi (Toyota Motor Corporation)	RL : Takayuki Morikawa (Nagoya University)
<b>Center for Co-Evolutional Social Systems</b>	41
Core institution : Kyushu University PL : Yoichi Korehisa (Kyushu University)	RL : Masato Wakayama (Kyushu University)



Project Period : FY2013~FY2021 ※Executed as trial FY2013~FY2014

<https://www.fmi.hokudai.ac.jp/>

# Innovative Food & Healthcare MASTER

Happy healthy life filled with smiles through  
“delicious food and fun exercise” optimized for individuals of all ages  
from future mothers, families to the elderly



**Project Leader**  
**Masanori Yoshino**

Senior Project Manager at Hitachi, Ltd.  
Fundamental Research Center,  
General Manager at Hitachi Hokkaido  
University, Lab.  
Joined Hitachi, Ltd. in 1980  
Responsible for Business Strategy  
and Product Development

## The Future

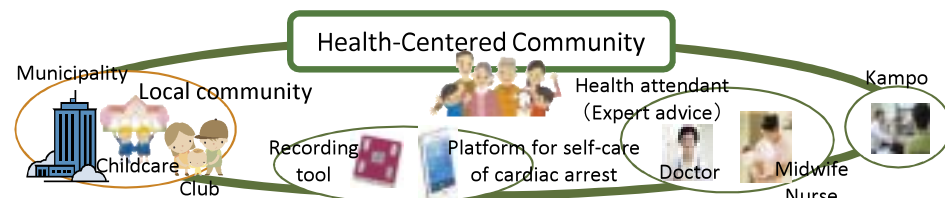


## Outline

We provide products and services based on the concept “delicious food and fun exercise” tailored to the individual health status. We utilize the new “health standard”, which enable to assess the degree of health, and platform for “self-healthcare”, which based on the ICT (Information and Communication Technology), by studying intestinal environment, food, “Kampo Medicine (Traditional Japanese Medicine)”, and exercise. Through these efforts, we aim to build a “health-centered community” that is sustainable and filled with smiles in order to eventually achieve the society friendly to pre-mother, child-raising mother, and the elderly, where each one of us becomes a specialist in food and healthcare.

## Application & Service

- Health community service  
(Platform for family healthcare)
- Delicious food and fun exercise



## Implementation Structure

**Project Leader : Masanori Yoshino (Hitachi, Ltd.)** **Research Leader : Akiko Tamakoshi (Hokkaido University)**  
**Research Adviser : Hiroyuki Tsutsui (Kyusyu/Hokkaido University)**

**[Core institution]** Hokkaido University  
**[Core enterprise]** Hitachi, Ltd.

**[Participating institution]** ADEKA Corp., Iwate Sargassum horneri Production Cooperative, H2O Institute of Research Inc., Oji Nepia Co., Ltd., Cosmo Corp., J-Mac System, Inc., The Kaiteki Institute, Inc., Tsuruha Holdings, Inc., Data Horizon Co., Ltd., Daiichi Kishimoto Kensa Center, K.K., Nitto Denko Corp., Biosensor, Ltd., Hamanatsu Information Co., Ltd., Hitachi Maxell, Ltd., Morinaga Milk Industry Co., Ltd., Life Science Institute Co., Ltd., Wako Pure Chemical Industries, Ltd., Hokkaido, Iwamizawa City, Hokkaido Research Organization, Northern Advancement Center for Science & Technology, Hokkaido Food Industry Promotion Organization

### Satellite institution

**University of Tsukuba Satellite**

**Satellite Leader : Hiroko Isoda (University of Tsukuba)**

**[Participating institution]** JA Ibaraki Kouseiren, Kyowa Hakko Bio Co., Ltd., Research Institute of Biomolecule Metrology Co., Ltd., Tanita Corp., Nippon Flour Mills Co., Ltd., Fujifilm Holdings Corp., Renaissance Inc.

### Kitasato University Satellite

**Satellite Leader : Hiroshi Odaguchi (Kitasato University)**

**[Participating institution]** Fujitsu, Ltd., Ominedo Pharmaceutical Industry Co., Ltd., Uchida Wakanyaku Ltd., National Institutes of Biomedical Innovation, Health and Nutrition, National Institute of Health Sciences, Tokyo Crude Drugs Association



Global Research Center for Food & Medical Innovation (FMI)

## Key R&D Themes

### 1. Self-healthcare platform

[Yokota (Hokkaido University), Hitachi, Ltd. and more]

Establishment a “Face-Viewable Service” in community based on a development of a mechanism to encourage in a fun way the continuous behavior change and autonomy by monitoring the individual health status in real time.  
Implement an application of AI(Artificial Intelligence), IoT(Internet of Things), and analysis by mathematical method.

### 2. New “Health standard”

[Food: Nakamura (Hokkaido University), Isoda (University of Tsukuba), Morinaga Milk Industry Co., Ltd. and more  
Exercise: Okura (University of Tsukuba), Tanita Corp. and more  
Kampo diagnostic: Odaguchi (Kitasato University), Fujitsu Ltd.

[Herbs Quality: Kobayashi (Kitasato University), Ominedo Pharmaceutical Industry Co., Ltd., Uchida Wakanyaku Ltd. and more]

Development and standardization of an innovative evaluation system (health standard) to examine the health indicated by intestinal environment, lipid, protein, muscle function of lower limb, balance power, etc., and providing them as a service.  
Progress on the formalization and objectification of knowledge about diagnosis, and implement a quality assurance system of Kampo medicine to the world as a familiar preventive against diseases.

### 3. Delicious food and fun exercise

[Food: Miyashita (Hokkaido University), Takeda (Hokkaido University), Isoda (University of Tsukuba), Morinaga Milk Industry Co., Ltd. and more  
Exercise: Okura (University of Tsukuba), Renaissance Inc. and more]

Development of food materials and products as well as exercise programs in order to improve the health status indicated by the “new health standard”.

### 4. Health-centered community

[Ogasawara (Hokkaido University), Tamakoshi (Hokkaido University), Tsuruha Holdings, Inc., Iwamizawa City]

Societal implementation of studying outcomes through development the health-centered community, and creation of platform which sustains the freestanding regional comprehensive care and local creation by cooperation with health management.  
Development of the world’s first real-time cohort study which follows up the health status of mothers and children by analyzing feces, breast milk, blood, etc., over a long term (from pre-delivering to infant stage).

### 5. Business Planning and Coordination

[Yoshino (Hokkaido University)]

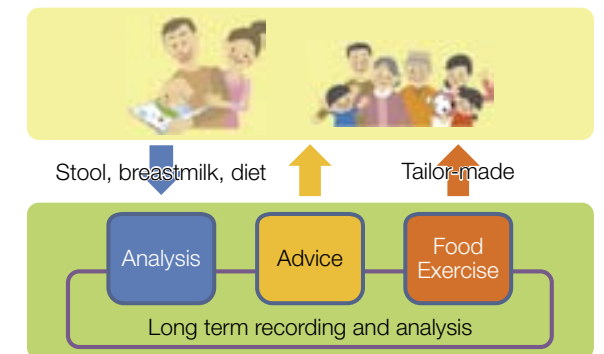
Planning vision, studying marketing and business model for societal implementation, and development of open-society and health management.

## Topics

① In cooperation with Iwamizawa City, we will develop a “health-centered community” that is friendly to women and families with children of Iwamizawa, and subsequently amplify the outcomes across the country. By creating a mechanism of communication and a physical place where citizens can gather and enjoy self-healthcare continuously, we will create a community in which even those who are disinterested in health will engage voluntarily in the self-healthcare.



② We will record the information about the life of mothers and children, and their health (intestinal environment, breast milk, diet, etc.) over a long term, in order to clarify the relationship between the subsequent growth of the children and their health. Moreover, we will analyze the recorded information and provide food and exercise programs as well as advice about health maintenance, which are customized to the individuals.



### Center for Food & Medical Innovation (FMI)

(1) Equal partnership

● The operation of the Steering Committee is “terrace-type”, whose members are composed of industry, academia, government (the majority is off-campus). All has a decision right.

(2) Mechanism to accelerate the social implementation

● Hokkaido University’s unique “industry-creating IP-Policy” and A2B2C (Academia to Business to Consumer)

### ~ Organization<sup>2</sup> Acceleration of joint research and promotion of commercialization (social implementation) of the companies and related institutions ~



## Inquiry

**Hokkaido University Center for Food & Medical Innovation (FMI)**

Tel : +81-11-706-9600 Fax : +81-11-706-9607

E-mail : coi-office@fmi.hokudai.ac.jp

Nishi 11, Kita 21, Kita-ku, Sapporo, 001-0021

[Access] Approx. 10 minutes by taxi from Sapporo Station



Project Period : FY2013~FY2021

<http://coi.hirosakiu.ac.jp/web/>

# Sustaining national health in an aging society

Center of Healthy Aging Innovation (CHAIN)

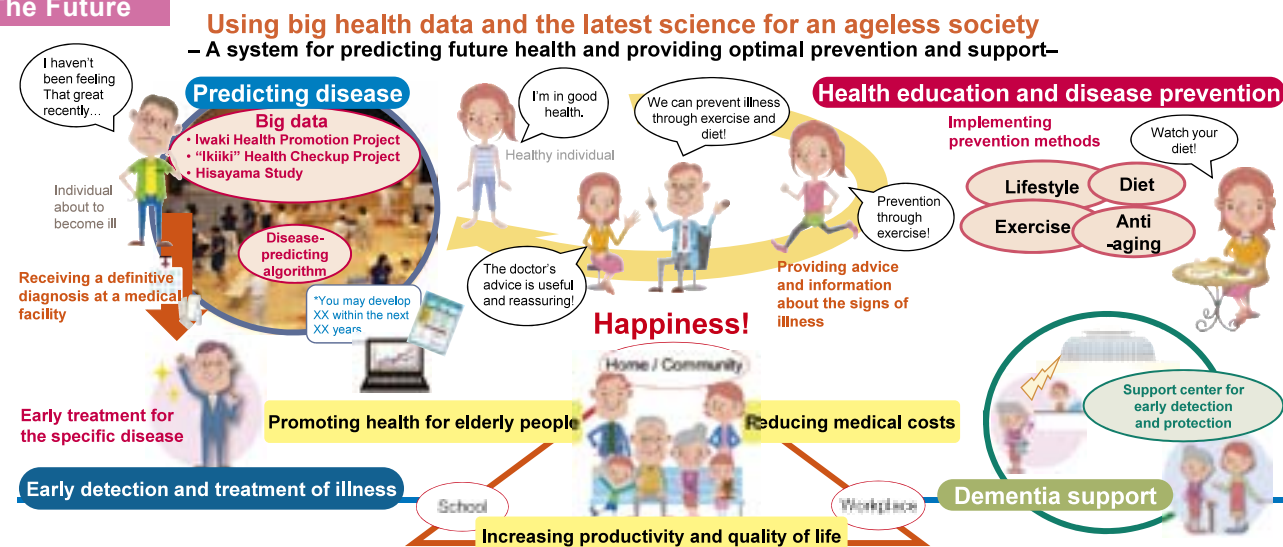
## A revolution in life expectancy × A future social system created together with people with dementia



Project Leader  
Toshihiko Kudo

Maruman Computer Service Corp.  
1979- Oki Electric Industry Co., Ltd.  
1982- Nihon System CO., Ltd.  
(Establishment officer)  
1991- Maruman Computer Service Corp.

### The Future



### Outline

Japan's population is aging at an unprecedented pace, bringing with it a range of social issues regarding the elderly such as the need to cut medical costs, promote health, increase quality of life, and extend longevity in terms of social participation. Unlike conventional medicine, which focuses on treating illnesses after onset, preventive medicine aims to prevent illnesses from developing in the first place. At CHAIN, we are working to develop an integrated approach to risk-based preventive medicine incorporating industrial, academic, government, and financial organizations along with healthcare professionals. By analyzing the vast amounts of health data generated from a cohort study of Aomori Prefecture residents, we aim to construct a framework for disease prediction and prevention. Furthermore, by developing a dementia support system, we intend to establish a social system that enables elderly people to enjoy their lives and feel secure in handling their finances.

### Application & Service

- **Disease-predicting algorithm**  
A system for analyzing an individual's level of risk based on predictive factors obtained from their health data and medical records.
- **Disease-predicting application**  
A health promotion solution called "Health Story" that contributes to preventive medicine by sending notifications regarding the results of predictive testing, information on countermeasures, and guidance.
- **Dementia support system**  
A social system that enables elderly people to enjoy their lives and feel secure in handling their finances.

### Implementation Structure

**Project Leader :** Kudo Toshihiko (Maruman Computer Service Corp.)  
**Research Leader :** Shigeyuki Nakaji (Hirosaki University Graduate School of Medicine)  
**Implementation Leader:** Takuji Yasukawa (Kao Corp.)

**[Core institution]** Hirosaki University / Maruman Computer Service Corp.  
**[Participating institution]** Kyushu University, GE Healthcare, TOHOKU CHEMICAL Co., Ltd., TechnoSuruga Laboratory Co., Ltd., Eiken Co., LTD., AEON RETAIL CO.,LTD., KAGOME CO., Ltd., KYOWA HAKKO BIO CO.,LTD., Nippon Telegraph and Telephone East Corporation, Eisai Co., Ltd., Kao Corporation, Lion Corporation, OMRON HEALTHCARE Co., Ltd., National Agriculture and Food Research Organization, Aomori Industrial Technology Center, Aomori Prefectural Government, Hirosaki City Government, Benesse Holdings, Inc., Life Science Institute, Inc., AXA Life Insurance Co., Ltd., Sysmex Corp., Human Metabolome Technologies, Inc., Hokkaido System Science Co., Ltd., Kyoto University, The University of Tokyo, Institute of Medical Science, the University of Tokyo, Nagoya University

- **Satellite Leader :** Taisaku Okumura Benesse Style Care Co., Ltd
- **Satellite institution :** Kyoto Prefectural University of Medicine

**[Participating institution]** Benesse Style Care Co., Ltd., Kyoto Prefectural University of Medicine, Chuo University, Keio University, Kyoto Prefectural University, SHIGAKUKAN University, Future University Hakodate, AITO SYSTEM LIMITED, RFnetworks Corporation, Bank of Kyoto, Ltd., Sansho Shoji Co., Ltd, Murata Manufacturing Co., Ltd., Cisco Systems, Inc., Sony Life Insurance Co., Ltd., IJ Global Solutions Inc., Sumitomo Mitsui Trust Bank, Limited, SECOM CO., LTD., Dai Nippon Printing Co., Ltd., APPLIED ENGINEERING Inc, Sumitomo Electric Industries, Ltd., SUMITOMO FORESTRY CO., LTD., Fubright Communications Co., Ltd., Mizuho Information & Research Institute, Inc., Doshisha Women's College of Liberal Arts



### Key R&D Themes

#### 1. Using big data to predict disease

[Shigeyuki Nakaji (Hirosaki University Graduate School of Medicine), Maruman Computer Service Corp., GE Healthcare, TOHOKU CHEMICAL Co., Ltd., Techno-Suruga-lab., Eisai Co., Ltd., Kao Corp., National Agriculture and Food Research Org., Lion Corp., OMRON HEALTHCARE Co., Ltd., Sysmex Corp.]

We are developing an algorithm that can predict mild cognitive impairment (MCI) and lifestyle diseases at a pre-symptomatic stage based on health, lifestyle, and genetic data obtained from the "Iwaki Health Promoting Project" and the "Hisayama Study". For the past 10 years, we have been working on the "Iwaki Health Promoting Project", which is a cohort study of health-promoting and research activities involving residents in Hirosaki City (formerly Iwaki district), and investigating chronological health information (a total of 11,000 people, Examination 600 items). The "Hisayama Study" has been carried out by Kyushu University, and the highly accurate, more-than 50-year epidemiological study of the residents of Hisayama Town in Fukuoka Prefecture (approximate population, 8,400 people) investigates lifestyle diseases such as stroke, malignant tumors, dementia, hypertension, and diabetes.

#### 2. Developing prevention methods based on predictive factors

[Ken Itoh: Hirosaki University Graduate School of Medicine, Maruman Computer Service Corp., Eiken, AEON RETAIL CO.,LTD., KAGOME CO., Ltd., Kao Corp., KYOWA HAKKO BIO CO.,LTD., Benesse Holdings, Inc., Nippon Telegraph and Telephone East Corp.]

We are constructing an alert system for individuals with disease risk factors and developing practical prevention methods using approaches such as improving lifestyle. As well as conducting preventive intervention studies using exercise therapy and oral care for individuals with MCI or lifestyle diseases, we are working to establish a revolutionary molecular-based anti-aging method.

#### 3. Developing a dementia support system

[Jin Narumoto: Kyoto Prefectural University of Medicine, Benesse Style Care Co., Ltd. and others.]

We are working on the following developments in order to create an elderly-friendly bank: educational methods for bank employees; in-bank systems; guidelines regarding financial product contracts; financial products for managing assets and supporting business activities such as new welfare trusts; senior life planning methods that provide support during the early stages of dementia; and applications and tools to support decision-making.

### Topics

#### ◆Establishing the Center for Promoting Healthy Aging

The Center for Promoting Healthy Aging was established on April 1, 2015. This center is part of the Aomori Medical Association and is run by the Hirosaki University School of Medicine Department of Social Medicine and the Hirosaki University COI organization.

As the core organization for health promotion in Aomori Prefecture, the Center conducts health promotion and intervention activities and trains 'Health and Happiness Leaders' and 'Health Member' to run these activities. By conducting support activities that enhance healthy longevity for Aomori residents with these Health and Happiness Leaders, the goal is to promote social and behavioral change and build a new foundation for society regarding aging, the Aomori Model, which can then be expanded to other regions.

#### ◆Collaborating with Kyushu University (Faculty of Medical Sciences) and Kyoto Prefectural University of Medicine

Collaboration between Hirosaki University and Kyoto Prefectural University of Medicine aims to establish a support system allowing elderly people to transition seamlessly and securely from health through to living with dementia.

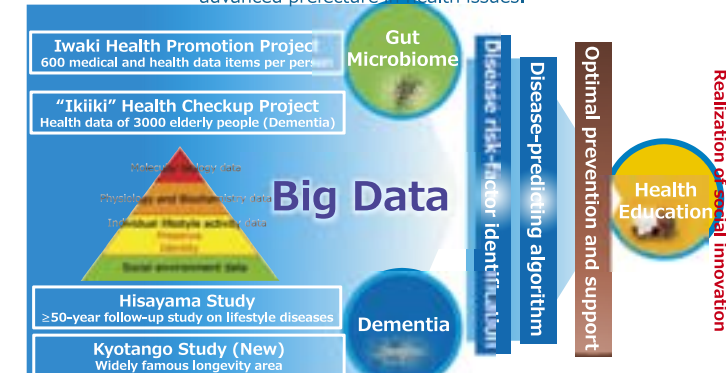
Meanwhile, a novel study design is being generated by combining the approaches of Kyushu University (Faculty of Medical Sciences)'s Hisayama Study, Kyoto Prefectural University of Medicine's Kyotango Study, and Hirosaki University's Iwaki Health Promotion Project. Expanding the scope of study enables faster validation of the disease-predicting algorithm and more accurate disease detection and prevention methods.

#### ◆Establishment of "big data analysis team"

In order to facilitate the big data analysis, we established a new team consisted of excellent researchers in bioinformatics and biostatistics field. The team is currently working on a development of a disease prediction algorithm in cooperation with Hirosaki University, Kyoto University, the University of Tokyo (faculty of medicine and institute of medical science), and Nagoya University.

### Using big data to predict and prevent disease

Our research field, "the shortest-life prefecture" Aomori is an advanced prefecture in health issues.



#### Creation of social innovation

Health maintenance, Extension of "healthy life expectancy", and Community development

### Developing a support system for dementia patients



### Establishing the Center for Promoting Healthy Aging (part of the Aomori Medical Association)



### Inquiry

**Hirosaki University**  
**COI Research Initiatives Organization**

Tel : +81-172-39-5538 Fax : +81-172-39-5205  
E-mail : [coi@hirosaki-u.ac.jp](mailto:coi@hirosaki-u.ac.jp)

5 Zaifu-cho Hirosaki city, Aomori Prefecture, JAPAN,  
036-8562

[Access] From the JR Hirosaki station, 35 minutes on foot or 10 minutes by taxi.



Project Period : FY2013~FY2021

<http://www.coi.tohoku.ac.jp>

## Center of Innovation for creation of a health-conscious society to realize healthy and fulfilling life, and strengthen family ties through unobtrusive sensing and daily health screening

## Daily management of family health in a proper and unobtrusive manner



**Project Leader**  
**Takuzo Takayama**  
1991: Joined Toshiba Corporation  
April 2014: Director, Visiting Professor  
TOHOKU UNIVERSITY COI STREAM  
Research Promotion Institution Promotion  
Office of Strategic Innovation  
April 2016: Senior Manager,  
Toshiba Corporation  
Life Science Business Dept., Life Science Div.

### The Future

### 202X – A typical Morning in the GENKI Family Household

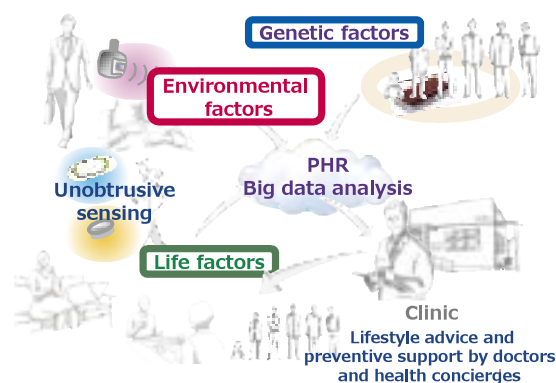


### Outline

Everyone wants to live a healthy, vibrant, and fulfilling life. However, concerns about illness, loneliness, or worries about family members living apart mean that this is not always the case in reality. As a solution, we are working to develop a daily health screening program that uses unobtrusive sensing technology to help users and their families identify and monitor their lifestyle and health anywhere, at any time and anywhere, and work to achieve their optimum physical condition. Daily Health Screening is performed by unobtrusive non-contact sensors, patch sensors, ingestible sensors, etc. These sensors collect data on health and related factors (life factors, environmental factors) and the information is centrally managed in the cloud as a big data PHR (personal health record) together with physical constitution data (genetic factors). This data is used for a range of purposes, such as providing encouragement and guidance to users as they work to realize optimum physical health, as well as checking on the condition of family members, and confirming safety or calling for help in the event of an emergency.

### Application & Service

- Lineup of innovative sensing devices to realize unobtrusive sensing of environmental factors and life factors
  - Intelligent mirror, patch sensor, ingestible sensor, photoacoustic sensor, health glasses, urine sensor, oral cavity bacteria sensor
- Genome array capable of evaluating physical constitution, disease risk, and drug responsiveness due to genetic factors quickly and at a low cost
- Innovative PHR platform to centrally manage data on life factors, environmental factors and genetic factors
- Service to provide predictive health information based on analysis of healthcare big data:
  - Lifestyle advice and preventive support by doctors and health concierges
- Accumulation of PHR through data banking services and secondary use of data by various manufacturers, retailers and distributors



### Implementation Structure

**Project Leader : Takuzo Takayama (Toshiba Co., Ltd.)**

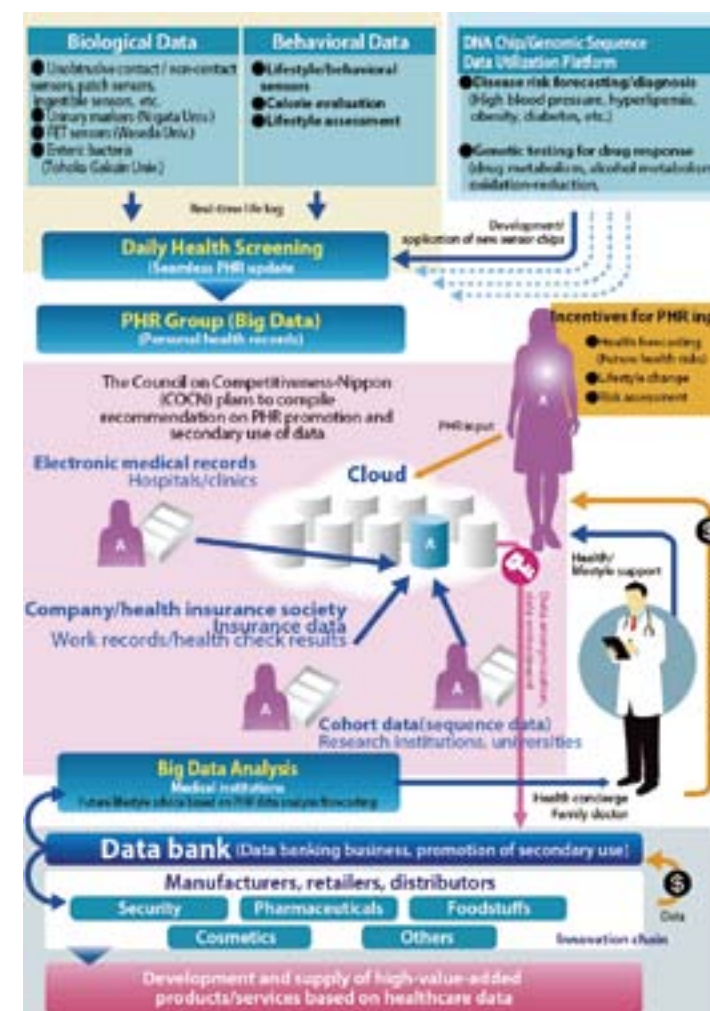
**Research Leader : Tomokazu Matsue (Tohoku University)**

**[Core institution]** Tohoku University, Toshiba Co., Ltd., Nihonkoden Co., Ltd., Omron Healthcare Co., Ltd.

**[Participating institution]** Riken Genesis Co., Ltd., Toppan Printing Co., Ltd., Right Mfg. Co., Ltd., ADVANTECH CORPORATION, Naigai TEC Corporation

**Satellite leader (institution) : Hitoshi Takahashi (Head of the Institute for social Innovation and Cooperation, Niigata University)**  
**Masatoshi Nakazawa (Dean of the Engineering, Tohoku Gakuin University)**  
**Kazuaki Utsumi (Guest Professor, Waseda University)**

### Core Project



### Topics

#### Prototyping of sensing devices

- **Intelligent mirror:** Remote and non-contact measurement of pulse wave and blood pressure fluctuations from images. Prototyping for commercialization purposes and installation in a mirror display were carried out. Going forward, we will continue to verify the measurement technology and establish an indicator, with the aim of social implementation as a health management display.
- **Health glasses:** A MEMS scanner, lens, and spectacle-type relay optical system are fixed onto an acrylic board to produce a wearable image projection detection device. It has been verified that a pattern reflecting the fundus image of a model eyeball can be obtained.
- **Photoacoustic sensor:** A prototype of an electret type resonating photoacoustic sensor has been designed and produced, and it has been verified that a satisfactory sensitivity can be obtained.



※Prototype of intelligent mirror

#### Expansion of verification trials for the Japonica Array

- The genome research results of more than 10,000 samples in research facilities nationwide are stored in the Japonica Array, a SNP array optimized for Japanese for which social implementation was carried out in 2014.
- The genetic structure and functional information will be sorted out in the next-generation SNP array and SNP effective for the detection of disease risks will be identified, with the aim of designing disease-specific arrays.

### Inquiry

**Center of Innovation, Tohoku University**

Promotion Office of Research Innovation, Tohoku University

University Research Administration Center, Office of Research Promotion Tohoku University

Tel : +81-22-752-2186 Fax : +81-22-752-2189

E-mail : [promo-innov@grp.tohoku.ac.jp](mailto:promo-innov@grp.tohoku.ac.jp)

### R&D and practical application of unobtrusive sensor technology and sensing system

- Development of ultra-compact, bio-compatible sensor devices
- Development of sensing technologies using optical techniques
- Development of MEMS sensors to obtain bio-data and environmental information and integration of such information
- Technologies of checking stress markers to maintain physical and mental balance

[Development project leaders for various types of sensors]

Matsuhiko Nishizawa / Makoto Yoshizawa / Takahito Ono /

Kazuhiro Hane / Tsutomu Nakamura

[Satellite research leaders] Tadashi Yamamoto (Niigata Univ.) /

Shin Yabukami (Tohoku Gakuin Univ.) / Tetsuya Osaka (Waseda Univ.)

● Ultra-compact power generation, supply and storage technologies

● Body surface and intra-body communication technologies

[Project leaders] Itaru Honma/Noriharu Suematsu

### Research and development of analytical and predictive technologies regarding indicators that can monitor and evaluate the health status of each individual

- Define evaluation indicators for health risks due to environmental factors and lifestyle factors
- Propose the sensing possibilities and specifications for selected risk factors and health indicators

[Project leader] Ryoichi Nagatomi

● Development of technologies for data acquisition, epigenome analysis, single cell analysis and so on

● Build foundation for the efficient identification of SNPs that may be possible disease causes

● Design of arrays mounted with new SNPs for disease-related multi-search purposes, and data analysis

● Feasibility study (FS) with the aim of social implementation of sensors

● Joint research on sensing data and genome data

[Project leader] Jun Yasuda

### Research and development of PHR platform, big data analysis system, data bank system

- Accumulate and integrate diverse and multi-layered data seamlessly together with genome information, conduct big data analysis of the information, and develop a platform that allows PHR services to be linked
- Develop various types of services to promote changes in behavior that can further raise the motivation of users, and create a framework that incentivizes each and every individual
- Develop a business model that includes Daily Health Screening and a PHR data bank, and conduct an economic assessment and research on measures to resolve social, ethical and legal issues

[Project leaders] Mitsuyuki Nakao / Kenji Fujimori / Hiroshi Yoshida

### Construction of simulated living space, verification test field

- An environment capable of accumulating and analyzing PHR big data for research purposes has been constructed, allowing other COI centers and new participating companies besides the COI Tohoku Center to carry out prototyping and verification tests.



### Social dissemination/innovation creation initiatives

- Proposals on the secondary use of PHR and data were made through COCN (Council on Competitiveness-Nippon)
- Promising members of the centers gathered in one place to conduct a dialogue-type workshop on innovation creation and discuss future visions of society.
- An experimental room of a simulated living space was opened to the general public.

468-1 Aoba, Aramaki, Aoba-ku, Sendai City, Miyagi  
Prefecture 980-0845, Japan



Project Period : FY2013~FY2021

<http://park.itc.u-tokyo.ac.jp/slcas-coi/>

# Self-Managing Healthy Society

“From hospitalization to outpatient care”,  
“From outpatient care to home care”, “Being healthy at home”  
Well-being For Life.



Project Leader

Tomihisa Ikeura

Director of Todai COI  
Former Adviser to Mitsubishi Chemical Holdings

## The Future

### Toward the era of Self-Managing Healthy Society ten years from now



## Outline

Japan, facing the world's most rapid-aging society with fewer children, is in urgent need for a structural shift to a "self-managing healthy society", where an individual takes care of one's own health, the elderly takes active part in supporting the society, and a new health/medical industry is created to increase the gross national income. It is imperative to create an innovative preventive, diagnostic and therapeutic system that drastically decreases hospitalization and outpatient visits, and a new health/medical guidance service based on scientific evidence to promote health at home. The TODAI COI has the following features: 1) the graduate schools of medicine, engineering, pharmaceutical sciences and sciences creating cutting-edge science-and-technology seeds and the hospital providing clinical needs are located on the same campus, 2) a tight network is established with regulatory and standardization authorities, 3) abundant investment funds are prepared to reduce developmental risk for participating companies. Taking advantage of these features, we will accelerate the formation of an open innovation platform where all the stakeholders in industry, government, academia and private sectors are involved as equals "under one roof" from the early phase of research and development, and thereby aim at a drastic reduction in time and cost from research and development to social implementation.

## Application & Service

- **Establishment of an All-Japan Health/Medical ICT network, and integration of life/health/medical data:**  
Contribution to the establishment of a platform for the next generation health/medical industry, through the integration of EHR systems and connection with health and life data.
- **Health promotion, prevention, ultra-fast diagnosis, and prognosis management at home:**  
Contribution to the innovation of scientific evidence-based health guidance, through the realization of personal measurement systems to check health and ME-BYO status at home, and small integrated diagnostic and treatment devices combined with personal monitor systems to enable remote follow-up and treatment by a medical specialist.
- **Day treatment and instant diagnosis during outpatient visits:**  
Contribution to the 50% reduction of hospitalization and outpatient visits, through the realization of minimally invasive integrated diagnostic and treatment systems that are less stressful and enable early social rehabilitation, and desk-top precision diagnostic devices that enable rapid precision measurement of disorders of the body and the mind.

## Implementation Structure

**Project Leader :** Tomihisa Ikeura (Director of Todai COI, Former Adviser to Mitsubishi Chemical Holdings)  
**Research Leader :** Ung-il Chung/Yuichi Tei, MD, Ph.D. (Vice-Director of Todai COI, Professor, The University of Tokyo)

[Core institution] The University of Tokyo

[Participating institution] Hitachi, Ltd., Hitachi High-Technologies Corporation, 3-D Matrix, Ltd., Kyowa Hakko Kirin Co., Ltd., CMIC HOLDINGS Co., Ltd., Toshiba Medical Systems Corporation, TOWA PHARMACEUTICAL CO., LTD., TOKYO CHEMICAL INDUSTRY CO., LTD., JGC Catalysts and Chemicals Ltd., Kurogane Kasei Co., Ltd., PeptiDream Inc., Nissan Chemical Industries, Ltd., COSMOS TECHNICAL CENTER CO., LTD., Thermostable Enzyme Laboratory Co., Ltd., TOKYO RIKAKIKAI CO., LTD., JEOL Ltd., PASCAL CO., LTD., TOKAI OPTICAL CO., LTD., FUJITSU LIMITED, NIPPON TELEGRAPH AND TELEPHONE CORPORATION, PST Corporation, Inc., Eisai Co., Ltd., Habitus Care Inc., IBM Japan, Ltd., MEDICAL & BIOLOGICAL LABORATORIES CO., LTD., The Japan Research Institute, Limited, Nippon Sogo Systems, Inc., CHUGAI PHARMACEUTICAL CO., LTD.



## Key R&D Themes

### 1. All-Japan Standardization of Health/Medical ICT (Platform)

- 1-1 Development of integrated database of personal genome and clinical information  
[Kazuhiko Ohe (Graduate School of Medicine, The University of Tokyo), Fujitsu]
- 1-2 Development of innovative clinical sequencer and genome analysis/interpretation system  
[Satoru Miyano (The Institute of Medical Science, The University of Tokyo), IBM Japan]
- 1-3 Development of prophylaxis, curative therapy and nursing-care service for dementia  
[Shoji Tsuji (Graduate School of Medicine, The University of Tokyo), Eisai]

### 2. Innovation in Prevention and ME-BYO(Pre-symptomatic State)

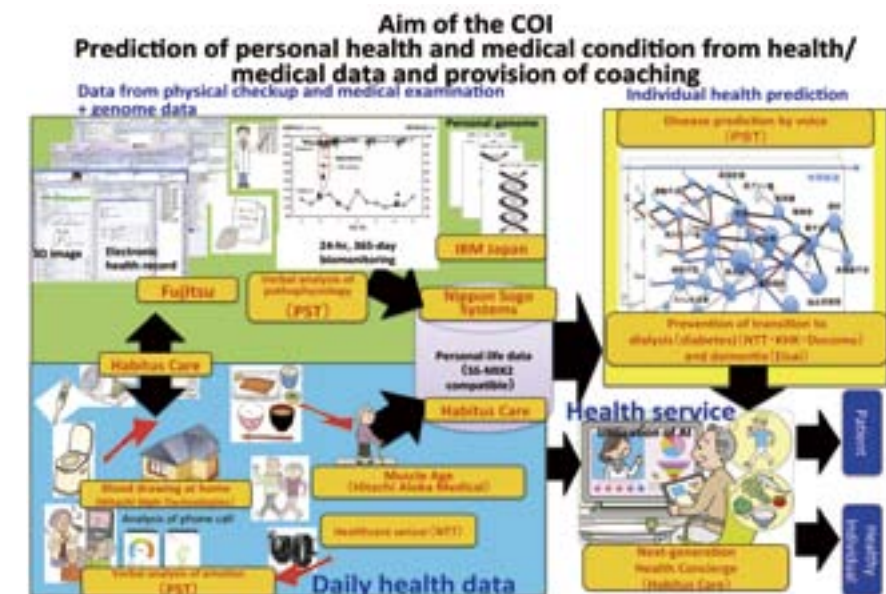
- 2-1 Health guidance and prevention based on scientific evidence  
[Hiroyuki Arai (Graduate School of Pharmaceutical Sciences, The University of Tokyo), Habitus Care]
- 2-2 Prevention and ultra-early diagnosis by verbal analysis of pathophysiology  
[Shinichi Tokuno (Graduate School of Medicine, The University of Tokyo), PST]
- 2-3 Development of a micro-measurement device for home use  
[Ryo Miyake, Takehiko Kitamori (Graduate School of Engineering, The University of Tokyo), Hitachi High Technologies]

### 3. Development of Ubiquitous Diagnostic/Therapeutic Systems

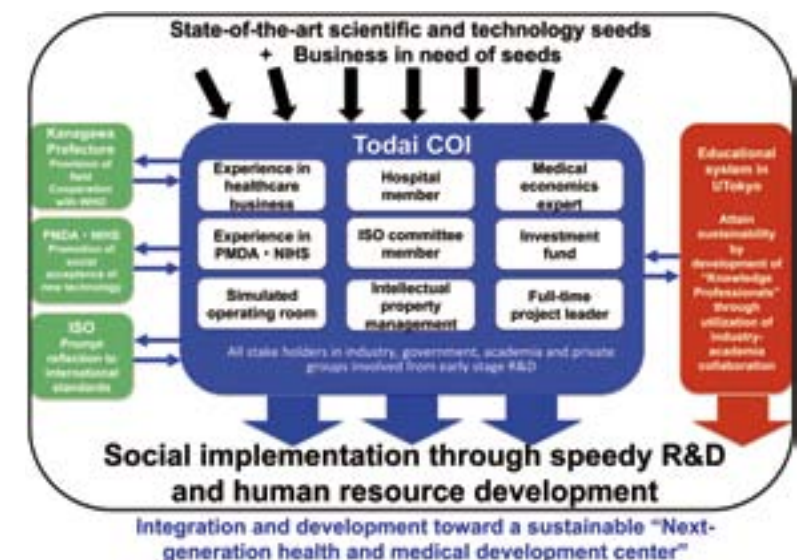
- 3-1 Development of day treatment by ultrasound technology  
[Ichiro Sakuma, Shu Takagi (Graduate School of Engineering, The University of Tokyo), Hitachi]
- 3-2 Pluripotent stem cell-based cancer treatment  
[Mineo Kurokawa (Graduate School of Medicine, The University of Tokyo), Kyowa Hakko Kirin]
- 3-3 Development of oral and maxillofacial bone regeneration device with high performance gel  
[Tsuyoshi Takato (Graduate School of Medicine, The University of Tokyo), 3-D Matrix]

### 4. Collaboration with Kanagawa Prefecture

Establishment of ME-BYO (pre-symptomatic state) evidence and prediction of personal health



1. To make the most of the research and clinical resources and the comprehensive strength of the University of Tokyo, we establish the **Social Implementation Promotion Group**, aiming at the social implementation of the achievements.
2. We establish a national level medical ICT foundation that will become the infrastructure for the next generation health and medical industry. On this platform, we will implement our innovation concept: "From hospitalization to outpatient care, From outpatient care to home care, Being healthy at home."
3. To create a "Self-Managing Healthy Society", we develop risk prediction applications that advance behavior change of individuals and aim at reforming the social system through collaboration with government. In parallel, we organize the "Healthy Long Life Loop Society" to serve as a field for inter-program and inter-business collaboration. We also partner with municipal governments and companies to realize a society that helps take health maintenance as a serious personal matter (JIBUNGOTO).
4. We utilize the **Medical Technology Assessment Lab** to develop globally competitive innovative medical technology.



## Inquiry

The University of Tokyo

COI: Self-Managing Healthy Society

Tel : +81-3-5841-1656 Fax : +81-3-5841-7798

E-mail : coi-jimu@bioeng.t.u-tokyo.ac.jp

7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-8656, Japan

COI Administration Office

Room 209, Building 2, Graduate School of Engineering,

The University of Tokyo

[Access] 10 min walk from Tokyo Metro Hongo-Sanchome Station



Project Period : FY2013~FY2021

<http://coins.kawasaki-net.ne.jp/en/>

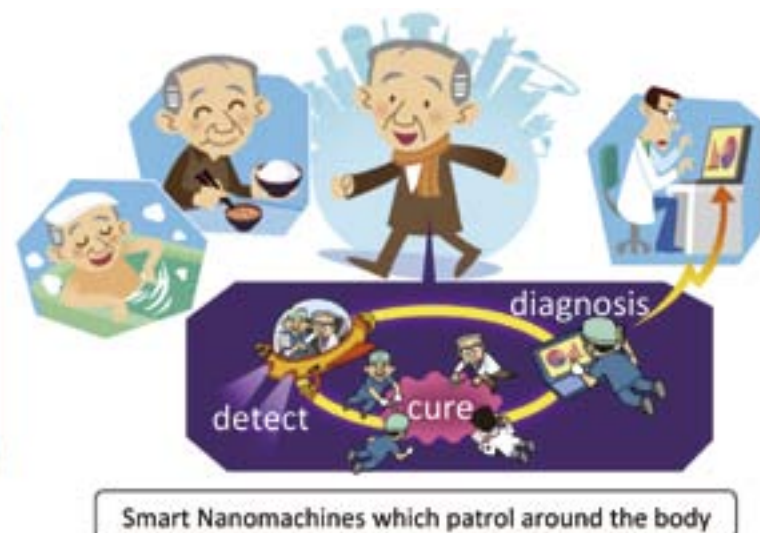
# Center of Open Innovation Network for Smart Health (COINS)

Smart Nanomachines, which serve as a “In-Body Hospital”, changes the society



Project Leader  
**Hiromichi Kimura**  
Kawasaki Institute of Industrial Promotion

## The Future



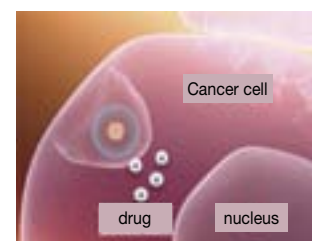
## Outline

Our goal is to achieve a “smart health society” where people will be free from the threat of diseases without any regards to cost and access to the solution, gaining better health in their daily life. We think it is the development of dream-like smart nanomachines that patrol around the body 24 hours a day, detect any sign of disease, treat the disease and immediately report the information to the doctors. Innovation Center of NanoMedicine (iCONM), which started its operation in April, 2015, is a core center for integrated research, where world “monodzukuri” knowledge and intelligence, are assembled. The COINS vigorously promotes integrated research with universities, industries and governmental organizations to implement cutting edge medical care at the iCONM as a core research center.

## Application & Service

Major application service that stimulate social implementation

- Nanomachines which can target and eliminate intractable cancer
  - Deliver drug without hurting normal cells→No side effects
- The system for in-home cancer diagnosis, which requires no blood sampling
  - Medical checkup becomes possible at home by a card-type diagnostic device



A Card-type diagnostic device

## Implementation Structure

**Integrated Research System**

Project Leader : Hiromichi Kimura

(Kawasaki Institute of Industrial Promotion)

Research Leader : Kazunori Kataoka

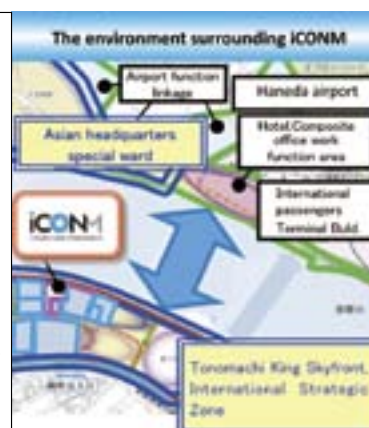
(Kawasaki Institute of Industrial Promotion)

【Core institution】Kawasaki Institute of Industrial Promotion  
Innovation Center of NanoMedicine (iCONM)

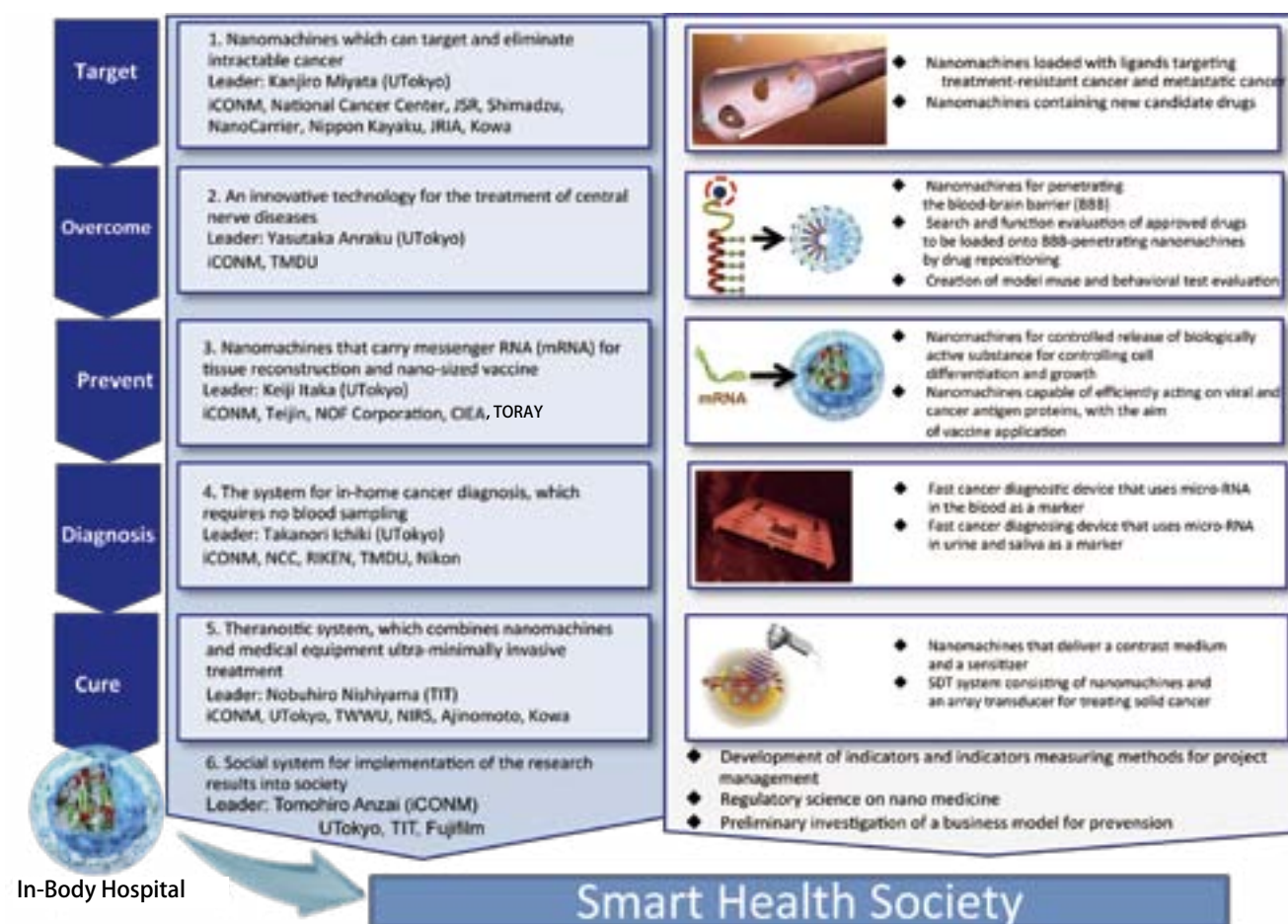
【Participating institution】The University of Tokyo, Tokyo Institute of Technology, Tokyo Women's Medical University, Tokyo Medical and Dental University, National Cancer Center, National Institute of Radiological Sciences, RIKEN, Medical Industry Innovation Institute, Central Institute for Experimental Animals, Japan Radioisotope Association, Ajinomoto Co., Ltd., Shimadzu Corporation, JSR Life Sciences Corporation, Teijin Limited, NanoCarrier Co., Ltd., Nikon Corporation, NOF Corporation, Nippon Kayaku Co., Ltd., Fujifilm Corporation, Kowa Company, Ltd., TORAY INDUSTRIES, INC., Kanagawa prefecture, Kawasaki city

- ◇In operation◇
- Innovation Center of NanoMedicine (iCONM)
  - Life Science & Environment Research Center
  - Central Institute for Experimental Animals
  - Johnson & Johnson Tokyo Science Center
  - Cyberdyne Inc.
  - Kanagawa Life Innovation Center

- ◇Moving to the site◇
- Daiwa House Industry Co., Ltd.
  - Create Medic Co., Ltd.
  - National Institute of Health Science
  - Fujifilm RI Pharma Co., Ltd.
  - Japan Radioisotope Association
  - PeptiDream Inc.



## Key R&D Themes



## Topics

<Research outcome in 2015>

◆ Stamping out cancer stem cells

→ In a mesothelioma model survival assay, the new type of nanomachines completely cured intractable cancer !

◆ Development of innovative treatment technology for cranial nerve disease (Alzheimer's disease)

→ Nanomachine achieved the highly effective drug delivery to the brain, suppressed the expression of Alzheimer's-related protein.

◆ Nanomachine gene therapy

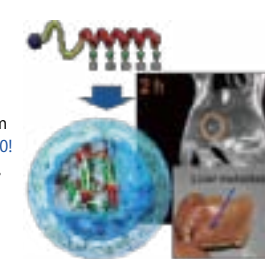
→ Freely manipulating mRNA to recover motor function, for the first time ever!

◆ Fast cancer diagnostics using miRNA

→ The prototype of cancer diagnosis system achieved successful size reduction to 1/10!

◆ Nanomachine diagnostics to detect tumor malignancy

→ Achieved visualization of tumor hypoxia and highly sensitive detection of small metastasis!



Nat. Nanotech. (2016)

**Eradicating intractable cancer**

Cancer is the cause of death for one in three Japanese people. 1.3 million people in Japan suffer from cancer, a third of which are unemployed  
**Nanomachines track down and destroy the metastatic cancer**

**Thorough treatment of Alzheimer's disease**  
The prevalence among people 65 years or older with neurodegenerative diseases is very high, ranging from 3.0 to 8.8%  
→ This puts a critical burden on society  
BBB-penetrating nanomachines provide opportunity for treatment

**Extending healthy life expectancy**  
Regenerating sensory and motor functions to prevent patients from being bedridden

**[Smart Nanomachines change the society]**

Nanomachines loaded with sensing function autonomously patrol the microenvironments in the body and automatically detect virus and anomalous cells and treat.



**-The world's most innovative research center which creates new medical technology realizing human dream-**

**iCONM's vision**

- 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.

● The iCONM started its operation in April, 2015. Having an excellent location on the opposite shore to Haneda Airport, it is expected to be the open innovation platform as the hub for promoting integrated research in and out of Japan.

● Host International Symposium to present the activities of COINS inviting research institutions outside Japan. The iCONM welcomes visitors of overseas delegates for international research collaboration.

● The iCONM respects and promotes young researchers' independence. We employ young researchers in their 30s as theme leaders.

## Inquiry

Kawasaki Institute of Industry Promotion  
COINS Research Promotion Support Office

Tel : +81-44-589-5785 Fax : +81-44-589-5789

E-mail : jimukyoku-coins@kawasaki-net.ne.jp

iCONM Rm#2104,  
3-25-14, Tonomachi, Kawasaki-ku,  
Kawasaki 210-0821 JAPAN

[Access] 15-minutes walk from KEIKYU “Kojimashinden” Station



Project Period : FY2013~FY2021 ※Executed as trial FY2013~FY2014

<http://www.activeforall.jp>

# Bright Future for All Ages with Health Innovation by Daily Exercise

## “Active for All”



**Project Leader  
Sonoko Ishimaru**

Ms. Ishimaru joined Toyobo Co., Ltd. in April 1987. She is engaged in the development of extremely comfortable products that utilize sense measurement technologies, including wide-ranging developments in the areas of bedding, car sheets, and cosmetics. She is also engaged in the development of psychological and physiological measurement technologies and clothing pressure simulation technologies.

### The Future



### Outline

We will be working with new, space value-altering health technologies (smartwear technologies, space-sharing technologies, exercise guidance and continuation technologies), as well as implementing a “Locomotive Syndrome Visualization and Prevention Method Development” program aiming to eliminate bedriddenness. This will maintain and improve health through the dual aspects of medicine and exercise through sports, and will help to guide all people toward an active state. In sharing the time and space of individuals, this will realize a society of relationships for which Japan should feel pride.

### Application & Service

#### ● Exercise Guidance and Continuation System:

This is an environmental system that promotes exercise guidance and continuation. The system combines smartwear collecting biological information with a directional speaker to provide users with feedback that combines individual and group physical condition information. Through this, it will induce changes to lifestyles at the same time it manages physical health.

#### ● Regional Coordination Assistance System (Home Self-Management Assistance System):

This is a testing and communication linkage model assistance system that will be used at homes and living facilities for the aged, and will utilize user bio-samples and physical capability information to make visible persons that are risk for locomotive syndrome and those who have experienced the onset of the disease. The system will then provide those individuals with recommendations for appropriate locomotive syndrome countermeasures (in concrete terms exercise as well as devices and supplements based on the condition). The system repeatedly visualizes the individual's implementation, allowing that individual to carry out locomotive syndrome countermeasures.

### Implementation Structure

**Project Leader : Sonoko Ishimaru (TOYOBO CO.,LTD.) Research Leader : Tadao Isaka (Ritsumeikan University)**

【Core institution】 Ritsumeikan University

【Participating institution】 TOYOBO CO.,LTD., Shiga University of Medical Science, Kinki University, OMRON HEALTHCARE Co., Ltd., Panasonic Corporation, Daiwa House Industry Co.,Ltd, HIGASHI OSAKA STADIUM., Ltd., Hitachi, Ltd., Nippi. Inc., Dai Nippon Printing Co., Ltd., Kao Corporation, TOKYU LAND CORPORATION

■ **Satellite institution : Juntendo University**

### Key R&D Themes

#### 1. The Practical Application of Smartwear

Naruhiro Shiozawa  
(College of Sport and Health Science,  
Ritsumeikan University)  
TOYOBO CO.,LTD.  
OMRON HEALTHCARE Co., Ltd.

Utilizing flexible bionic sensors, we will develop smartwear items that can measure a variety of biological signals just by wearing them. We will develop applications that provide measurement result feedback to the user and promote exercise.



#### 2. The Practical Application of Space-Sharing Technologies

Takanobu Nishiura  
(College of Information Science and Engineering, Ritsumeikan University)  
Panasonic Corporation,  
Daiwa House Industry Co.,Ltd

This technology uses highly-directive, highly-rectilinear ultrasonic speakers to partition a single space through sound. We have succeeded in constructing an extremely limited-area audio spot in which it is possible to listen at a single point in that space. This shows the possibilities for audio holograms.



#### 3. The Practical Application of Exercise Guidance and Continuation Systems

Tetsuo Yoshimoto  
(College of Management,  
Ritsumeikan University)  
HIGASHI OSAKA STADIUM., Ltd.

Combining the characteristics of smartwear and directional speakers, we provide an exercise program individualized on the basis of bio-information. We will construct an environment in which mental and physical health can be promoted and maintained for users of all generations through the inducement of inter-generational exchanges through exercise.



#### 4. The Practical Application of Locomotive Syndrome Onset Prevention

Hisashi Naito (Graduate School of Sport and Health Science, Juntendo University)  
Hitachi, Ltd., Nippi. Inc.,  
TOKYU LAND CORPORATION, Kao Corporation

This is first time anywhere in the world that locomotive syndrome sensing technologies have been used to make individuals at risk of locomotive syndrome visible. We will develop appropriate exercise programs and exercise assistance devices for those individuals. We will also specify bio-markers based on urine samples taken from those same subjects and develop simple, everyday visualization methods for at-risk individuals.



#### 5. The Practical Application of Locomotive Syndrome Progression Prevention

Eri Hirasawa (Graduate School of Medical Science, Juntendo University)  
Nippi. Inc. Hitachi, Ltd., Dai Nippon Printing Co., Ltd.,  
TOKYU LAND CORPORATION

We have succeeded in detecting locomotive syndrome condition in individuals through the biomarker candidate urine. The use of urine allows for the locomotive syndrome condition to be understood in a non-invasive and everyday manner. We will develop a body management communication system run by female home doctors in order to protect against the progression of locomotive syndrome. We will also develop anti-locomotive syndrome supplements. Working in the successes of the project on locomotive syndrome onset prevention, we will construct a system that allows individuals to self-manage the onset and progression of locomotive syndrome.



### Topics

1. We have succeeded in developing printed bio-measurement sensors and wiring, as well as wearable smartwear. In order to publicize these successes, we have participated in exhibitions both inside and outside of Japan. With a greater number of items capable of being measured than by traditional means, we have come closer to achieving practical application through the use of additional electrically conductive paste in the wiring.
2. Using highly-directive, highly-rectilinear ultrasonic speakers, we have developed an extremely limited-area audio spot technology in which sounds can only be heard in a single location. Used in combination with visual holograms it becomes possible to have the sound transmit from the virtual image.
3. The activities to identify persons at risk of locomotive syndrome began with persons working at urban department stores in the cities of Shiroy, Inzai, and Narita in Chiba Prefecture. As participants were aware of their level of locomotive syndrome, it raised their awareness of the condition overall and of the effectiveness of exercise in its prevention.



### Inquiry

**Division of Research, Research Office at BKC  
Toshinobu Hashimoto**

Tel : +81-77-561-2802 Fax : +81-77-561-2811  
E-mail : t-hash@st.ritsumei.ac.jp

Nojihigashi, Kusatsu, Shiga 525-8577

[Access] 15 minutes by Bus from JR Minami Kusatsu Station



Project Period : FY2013~FY2021

<http://www.coi.kyoto-u.ac.jp/>

# The Last 5X innovation R&D Center for a Smart, Happy, and Resilient Society

## Smart, flexible and accommodating society



**Project Leader**  
**Tsuyoshi Nomura**

Visiting member  
Panasonic Corporation  
2009-2015 Managing Director,  
Director of Manufacturing  
Innovation Division 2004-2009  
Director of Mount Engineering Lab.

### The Future



### Outline

Our goal is to develop a smart, flexible, and accommodating society, in which citizens remain active and pursue new challenges throughout their entire lives.

We will approach this through the supports to women and children, healthcare, relief from disease, and release anxiety, which based on the key technology of cordless, power transmission and advanced ICT. Universities and corporations will collaborate in R&D across fields of study both vertically and horizontally and implement it in society.

### Application & Service

- Wireless electric power supply to mobility scooter for elderly persons, a medical robot and sensors  
Contributes to the creation of secure and comfortable aging populations by developing a cordless charging system
- Support system for drug creation  
Contributes to improvement in the efficiency of drug creation research, with a robotic system that can culture iPS cells and others on a large scale



Wireless Electric Power Transmission

Support System for drug creation

### Organization

**Project Leader : Tsuyoshi Nomura (Panasonic Corporation)**

**Research Leader : Hidetoshi Kotera (Kyoto University)**

**[Core institution]** Kyoto University

**[Participating institution]** Panasonic Corporation, HORIBA, Ltd., SUNCALL Corporation, ARKRAY, Inc., Hitachi, Ltd., Konica Minolta, Inc. Kyoto Institute of Technology, Kyoto Prefecture, City of Kyoto, Town of Seika, Aquafairy Corporation, Ajinomoto Co., Inc., ADEKA CORPORATION, RT.WORKS co., Ltd., SRL, Inc., OIKE & Co., Ltd., Kawakami Sangyo, Kawamura Gishi Co., Ltd., Canon Inc., SHIMADZU CORPORATION, SHO Engineering Corporation, Sumitomo Electric Industries, Ltd., Sekisui House, Ltd., DAIKIN INDUSTRIES, LTD., Dai Nippon Printing Co., Ltd., Takeda Pharmaceutical Company Limited., TANAKA KIKINZOKU KOGYO K.K., Tsubakimoto Chain Co., Techno Smart Corp., Toyo Kohan Co., Ltd., TOYOBOKU CO., LTD., Nitto Denko Corporation, NIPRO CORPORATION, Panasonic Healthcare Co., Ltd., Panasonic Medical Solutions Co., Ltd., Fujiwara Corporation, FUNAI ELECTRIC, Plascoat Co., Ltd., Mitsubishi Heavy Industries, Ltd., MedVision Corporation, Unicharm Corporation, UPD Co., Ltd.



International Science Innovation Building

### Core Project

#### 1. Parenting Support

Leader : Takashi Hakii (Konica Minolta, Inc.) , Nobuya Inagaki (Kyoto Univ.)

Through developing healthcare system for women and expectant mother, and support to growing care on children, we realize a society that women can raise children without fearing.

#### 2. Healthcare

Leader : Ken Shimono (Panasonic Corporation), Toru Sato, Fumitoshi Matsuno (Kyoto Univ.)

Through developing sensors to monitor their health, surround, and action of elder people and people in need of nursing care, we realize a reliable society watching for all anytime and anywhere.

#### 3. Early Detection of Illness

Leader : Kinji Kuriyama (Hitachi, Ltd.), Tsuyoshi Shiina (Kyoto Univ.)

Through developing ultrasonic diagnostic equipment for home use and imaging probes detecting lesions, we realize a reliable proactive medicine in society.

#### 4. Support in Case of Illness

Leader : Atsushi Murakami (ARKRAY, Inc.), Tetsuya Matsuda (Kyoto Univ.)

Through developing technologies on regenerative medicine using iPS cells and advanced support system for semi-automatic surgical operation, we realize a secured society that enable us to take a translational medicine in life.

#### 5. Support After Illness

Leader : Hiroya Kobayakawa (SUNCALL CORPORATION), Tadao Tsuboyama (Kyoto Univ.)

Through development of easier walking assist device which enable to use in hospital, nursing-care facility, home, and outdoors, we realize a comfortable society that enable us to return to society earlier.

#### 6. Support in time of disaster / Cordless Power Supply and ICT

Group Leader : Masaaki Hayami (HORIBA, Ltd.), Naoki Shinohara (Kyoto Univ.)

Through developing wireless electric power transmission, solid-hydrogen sourced fuel cells, and film-type solar cells, and cooperate with various disciplines, we realize a secured society that enable us to use the electric power anytime and anywhere even it's in time of disaster.

### Topics

Some topics introduced to the press are indicated.

1. We have developed genetic analysis kit that can analyze side effects of thyroid medication conveniently.  
It will contribute to the individualized medical care that can judge a side effect of the medicine in advance.
2. We succeeded in long cultivation of a human iPS cell by automatic culture equipment and are subsequently developing automation equipment of induction of differentiation.
3. We succeeded in development of wireless electric power supply technology and are subsequently promoting demonstration experiments on a charge for mobility and electric power supply to sensors utilizing national strategy zone.



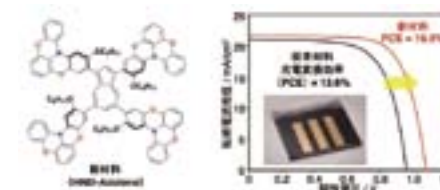
4. We have developed a non-contact heart rate measurement system with millimeter wave radar and are subsequently developing a technology that reduce the distinction distance on measurement multiple heart rates.



5. We succeeded in development of modular-unit wearable walking support equipment for a walking rehabilitation and are subsequently promoting clinical testing for validity confirmation.



6. In the development of Film-type Solar Cells, we realized the high efficiency of the Perovskite Solar Cells by use new Material HND-Azulene and are subsequently promoting large experimental production as well as aiming at further high efficiency.



### Inquiry

**Research Promotion Institution for COI Site, Kyoto University**

Tel : +81-75-753-5641/5642 Fax : +81-75-753-5643

E-mail : [info@coi.kyoto-u.ac.jp](mailto:info@coi.kyoto-u.ac.jp)

36-1 Yoshida-Honmachi, Sakyo-ku, Kyoto 606-8501, Japan

[Access] A 15-minute walk to the east from Demachiyanagi Station of Keihan Railway





Project Period : FY2013~FY2021 ※Executed as trial FY2013~FY2014

<http://innovation.geidai.ac.jp/en/>

# Creating Innovation for “Synesensory” through Inspirational Arts, and Science and Technology

## Establishment of Japan as a Cultural Nation and the Realization of a Symbiotic International Society

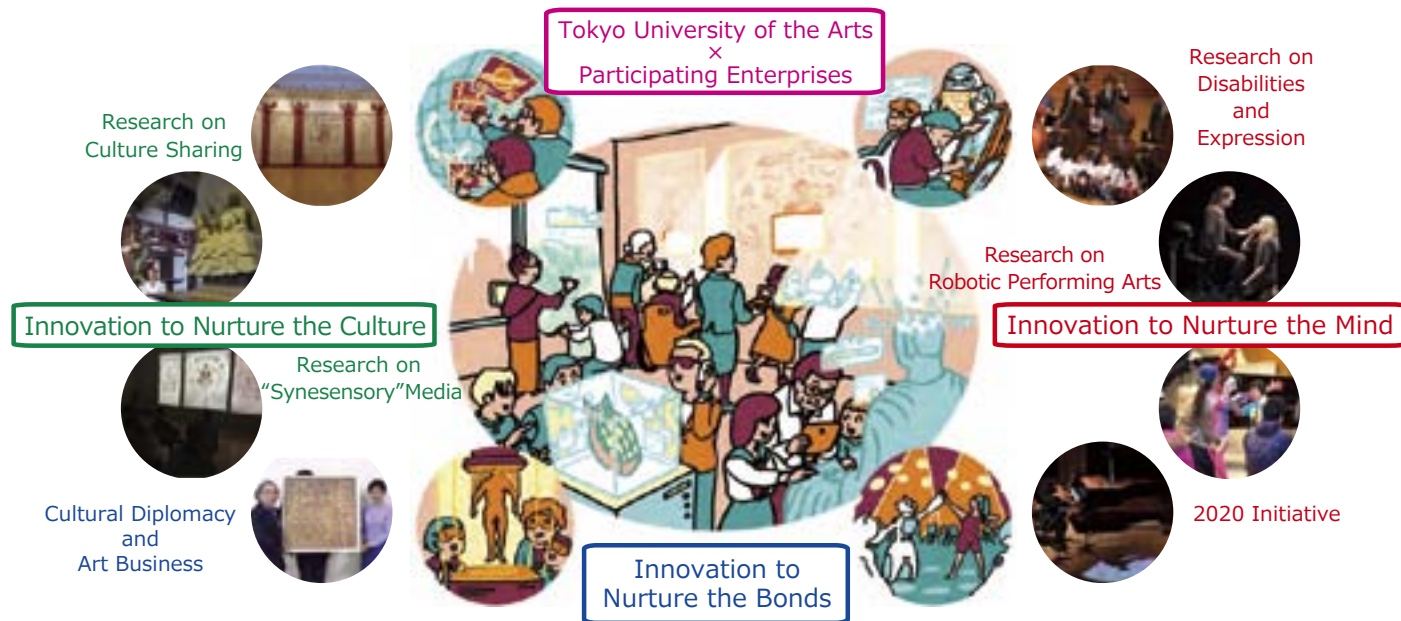


Project Leader

**Seiichi Tamura**

Director of the Board,  
Chief Strategy Officer  
Tamura joined JVCKENWOOD in 2013.  
Since then, he has conducted the  
business portfolio transformation and  
new businesses creation.

### The Future



### Outline

By fusing the arts together with science and technology, the Group seeks to develop rich cultural contents capable of serving as next-generation infrastructure, as well as ensure the social implementation of cultural and educational contents through the education industry, in addition to providing cultural diplomacy items that contribute to the establishment of international relations. The Group, which is based on collaboration between academia and companies with expertise in the education industry and/or the information industry, is led by the Tokyo University of the Arts, which has long nurtured and promoted artistic expressions involving the five senses; namely fine arts, music, visual expressions, and bodily expressions. Efforts will be made, in collaboration with companies known for their expertise in the education and information industries, to ensure the broad implementation of the contents and applications developed by the Group in both domestic and overseas societies. Contributions will be made in areas ranging widely from compulsory education, higher education and social education to welfare, medical care and international understanding through the social implementation of these contents and applications in order to establish the presence of Japan as a cultural nation and to achieve a symbiotic international society by leveraging the power of art (inspiration).

### Application & Service

- Synesthetic contents, such as highly accurate replicas of cultural assets and mobile museums, which contribute to next-generation global education infrastructure
- Communication services using robots, which contribute to welfare, medical care and tourism
- Synesthetic contents based on disabilities and expressions, which contribute to the cultural programs of the 2020 Tokyo Olympics and Paralympics

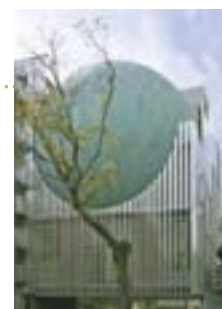
### Implementation Structure

**Project Leader : Seiichi Tamura (JVCKENWOOD Corporation)**  
**Research Leader : Masaaki Miyasako (Tokyo University of the Arts)**

【Core institution】 Tokyo University of the Arts

【Lead Company】 JVCKENWOOD Corporation

【Participating institution】 Osaka University, Nagoya University, National Institute of Information and Communications Technology (NICT), Benesse Holdings, Inc., YAMAHA CORPORATION, SoftBank Robotics Corp., Makers' Co., Ltd., NHK Engineering System, Inc., NHK Enterprises, Inc., NHK Promotions, Inc. Tokyu Agency Inc., Takeo Co., Ltd., The Asahi Shimbun Company.



Arts &amp; Science LAB

### Key R&D Themes

#### 1. Research on cultural sharing

Masaaki Miyasako (RL/Director, Tokyo University of the Arts Public Collaboration Center/Professor, Tokyo University of the Arts Graduate School of Fine Arts)  
 Benesse Holdings, Inc., NHK Promotions Inc., Takeo, The Asahi Shimbun

By combining the achievements of the arts, history and technology, the sub-group will create synesthetic contents, such as clone cultural assets which restore the DNA of arts, mobile museums, and implement them in mobile and wearable terminals in preparation for their use as materials for elementary education, as well as their incorporation into personal learning systems.



Creating clone cultural assets

#### 2. Research on synesthetic media

Takashi Kiriya (Professor, Tokyo University of the Arts Graduate School of Film and New Media)  
 NICT, YAMAHA, NHK Engineering System

The sub-group will combine texture-oriented printing technologies and 3D printing technologies with art to develop interfaces that link together visuals, audio and vibrations in order to build various interactive education systems that concurrently stimulate multiple senses, including sight, hearing and touch.

#### 3. Cultural Diplomacy and Art Business

Junji Ito (Project Professor, Tokyo University of the Arts Public Collaboration Center), Akira Senju (Project Professor, Tokyo University of the Arts Public Collaboration Center)  
 JVCKENWOOD, Makers', NHK Enterprises, The Asahi Shimbun

The sub-group will establish a system to practice the achievement of COI site, and conduct the social implementation of cultural diplomacy assets in international collaboration as well as regional revitalization.



Android Theater: "Sayonara (Fare Thee Well)"

#### 4. Research on robotic performance arts

Oriza Hirata (Project Professor, Tokyo University of the Arts Public Collaboration Center)  
 Osaka University, Benesse Holdings, SoftBank Robotics

The sub-group will develop educational contents by producing and presenting the most-advanced works of "robotic performance art," as well as contribute to the development of new robot-based tourist sites by giving entire towns a new look and atmosphere through the (strategic) placement of robots, in addition to contributing to the fields of welfare for the disabled and medical care.

#### 5. Research on disabilities and expressions

Oko Arai (Project Professor, Tokyo University of the Arts Public Collaboration Center)  
 Nagoya University, Benesse Holdings, YAMAHA, Tokyu Agency

The sub-group seeks to achieve a symbiotic society that offers a world full of dreams to all by learning from people with disabilities about the emotional thrill of coming into contact with the arts, while studying the relationship between emotional thrill and brain functions.



Disabilities and the Arts 2014

#### 6. The 2020 Initiative

Isao Matsushita (Vice President, Tokyo University of the Arts/Professor, Performing Arts Center)  
 Nagoya University, YAMAHA, NHK Enterprises, Tokyu Agency

The sub-group will devise a plan for the formulation of contents and programs for the Tokyo Olympics and Paralympics in 2020, which are to generate new "emotional thrills" through sports and the arts, as well as implement effective methods of utilizing and disseminating information on Japan's diverse and innovative cultural resources.

### Topics

(1) 25 high-resolution reproductions of three different murals from the Bagan archaeological site were produced at the request of the Myanmar government and hand-delivered to the country's Deputy Minister for Culture. The reproductions of the murals were presented to the heads of state participating in the ASEAN Summit as a commemorative gift from the Republic of the Union of Myanmar, thus making Japan's art and technology known to the world.



(2) The ceiling mural of Bamiyan Eastern Buddha in Afghanistan, which was once destroyed by terrorism, has been brought to back to life as "Clone Cultural Asset" in full size and exhibited at Tokyo University of the Arts Museum Annex. Furthermore, the restored mural was presented in the Ise Shima summit. It was a meaningful opportunity to show that even a vanished culture could be shared worldwide with Clone Cultural Asset technology.



### Inquiry

**Tokyo University of the Arts**  
**COI Research Promotion Office**

Tel : +81-50-5525-2031 Fax : +81-3-5685-7761

E-mail : [kenkyo@ml.geidai.ac.jp](mailto:kenkyo@ml.geidai.ac.jp)

12-8 Ueno Park, Taito-ku, Tokyo 110-8714  
 [Access] 10-minute walk from Ueno Station



Project Period : FY2013~FY2021 ※Executed as trial FY2013~FY2014

<http://www.coi.titech.ac.jp/>

# Happiness Co-Creation Society through “ISHIN-DENSHIN” Intelligent Communications

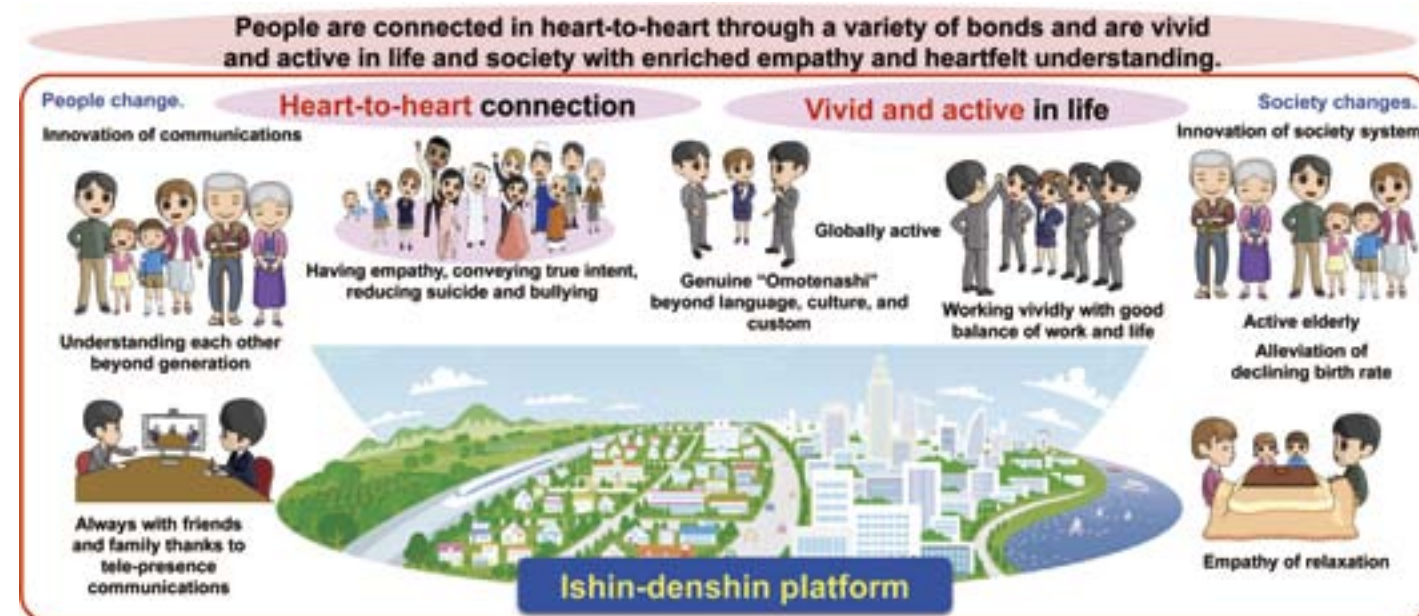
## Revolution in Communication



Project Leader  
**Shigeyuki Akiba**

Adviser, KDDI R&D Labs., Inc.  
He joined KDD Corp. in 1976. He was engaged in R&D works for large capacity optical fiber submarine cable systems. From 2006 to 11 he was VP of KDDI Corp. and President and CEO of KDDI R & D Lab., Inc.

### The Future



### Outline

We aim for the Happiness Co-Creation Society, where everyone's mind is tied in a variety of bonds with increased empathy and compassion and people are active and live vividly. In order to realize such society we will develop revolutionary heart-to-heart communication which can interpret and convey people's minds as well as the on-site atmosphere and can read the meaning between the lines. We call such communication “Ishin-denshin” communication and will create pioneering new services for implementation into society. To create new services we realize innovative core technologies consisting of AI technology for experience database and fuzzy search, device technology for wearable charge-free zero-power happiness sensors and actuators, and all band intelligent communication platform technology with advanced network security.

### Application & Service

- Future communication service recognizing context and recalling key information: Memories and necessary key information are recalled right away by processing the vital data, time, place, and situation at the site of communication together with the analysis of the experience database.
- Multilingual intent translation service: True meaning and intent taking account of cultures and customs are provided and explained in language translation.
- New tele-presence communication service: People in the distant places can feel the presence of each other as if they were side by side and can make heart-to-heart communication.
- Space and service linking people for new co-creation: New works will evolve through a novel scheme which connects people by identifying common intention for a new work and how to work and promotes empathy in shared work places.

### Implementation Structure

Project Leader : Shigeyuki Akiba (Tokyo Institute of Technology)  
Research Leader : Shunri Oda (Tokyo Institute of Technology)

[Core institution] Tokyo Institute of Technology  
[Participating institution] KDDI Research Inc., Fuji Xerox Co.,Ltd., NTT, Sony Corporation, Ricoh Company, Ltd., Lapis Semiconductor Co.,Ltd., Information Services International-Dentsu, Ltd., Gurunavi,Inc., TOKYU CORPORATION, Nissan Koseikai Tamagawa Hospital, Kanto Central Hospital, Tokyo Ota Ward, Ota Industrial Development Association, Suwa Industry Integrated Research Center

- Satellite institution : Japan Advanced Institute of Science and Technology
- Satellite Leader : Hiroshi Mizuta



Okayama Campus Ishikawadai  
Bldg.1

### Key R&D Themes

#### 1. “Future communication service recognizing context and recalling key information” and “Multilingual inferred intent translation service”

[Hitoshi Wakabayashi, Manabu Okumura, Safumi Suzuki(Tokyo Institute of Technology), KDDI Research, GURUNAVI, etc.]

##### ■ Overview

We aim to realize novel future communication services. Those services will bring us revolutionary heart-to-heart communications in which communication difficulties are predicted and requisite information is timely proposed and then we can share the on-site atmosphere, real-meaning and empathy.

##### ■ Research & development items

- Experience database and fuzzy search technology for recognizing context and recalling key information
- Multilingual inferred intent translation system
- Vital data analysis such as predicting unhappiness from sensing data and visualization system of empathy
- High-security technique both in terms of information and network including Body Area Network (BAN)



#### 2. “New tele-presence communication service” and “Space and service linking people for new co-creation”

[Shoichi Hasegawa, Yoshihiro Miyake, Takako Yoshida (Tokyo Institute of Technology), Fuji Xerox, KDDI Research, NTT, Sony, Ricoh, etc.]

##### ■ Overview

New tele-presence service gives the feeling as if you are in the same air even when you are far away. The space and service provides the community in which people easily take part in a new work-group and live vividly keeping work-life balance and new work-style.

##### ■ Research & development items

- Avatar-agent robot giving the feeling like people and its control technique using vital movement such as eye-tracking
- Visualization technique of empathy in communications and method to vitalize people in communities



#### 3. Zero-Power Happiness Sensors and Actuators as core technologies

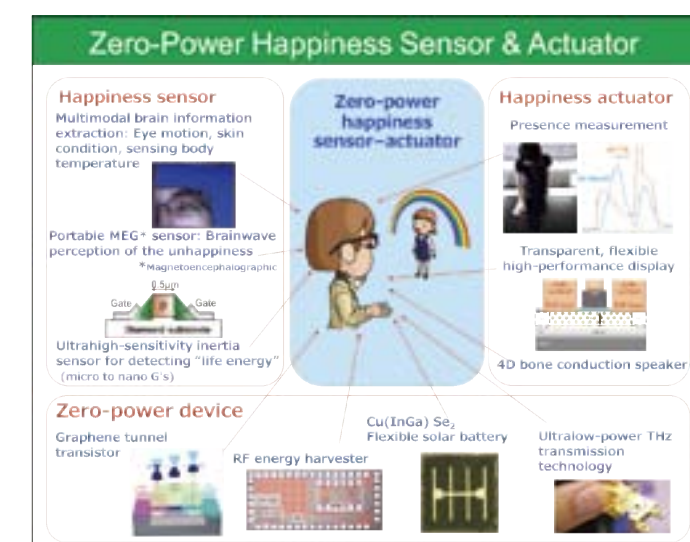
[Hitoshi Wakabayashi (Tokyo Institute of Technology), Lapis Semiconductor, Fuji Xerox, etc.]

##### ■ Overview

We realize wearable charge-free zero-power happiness sensors and actuators by the technology, such as energy harvester, ultra low power consumption sensors and actuators, and signal processing circuits. We make comprehensive processing not only for five senses but also for unconscious information such as magneto-encephalography(MEG) and spiritual motion, “ki” in Japanese. Innovative actuator utilizing emotional resonance between people is also developed.

##### ■ Research & development items

- Happiness sensor technology, such as 3D self-taking video capture and analysis technology, MEG sensor, ultra sensitive inertia sensor, etc.
- Happiness actuator technology, such as feeling-motion feedback, transparent, flexible, high resolution, high frame rate video processing display technology.
- Charge-free terminals with zero-power technology, such as energy harvester, ultra low power consumption device, ultra low power terahertz communication device, etc.



### Inquiry

Tokyo Institute of Technology  
Happiness Co-Creation Society through  
“ISHIN-DENSHIN” Intelligent Communications  
Tel : +81-3-5734-3891 Fax : +81-3-5734-7694  
E-mail : [coi.info@coi.titech.ac.jp](mailto:coi.info@coi.titech.ac.jp)

2-12-1, Ookayama, Meguro-ku, Tokyo, 152-8550, Japan  
[Access] 5-minute walk from Ookayama Station on the Tokyu Lines



Project Period: FY2013~FY2021

<http://www.coistream.osaka-u.ac.jp/>

# COI Site to develop a "Super Nippon-jin" by activating human power

## -to Realize a Self-empowerment Society Where People Can Fulfill Their Latent Strengths Through Brain Management-



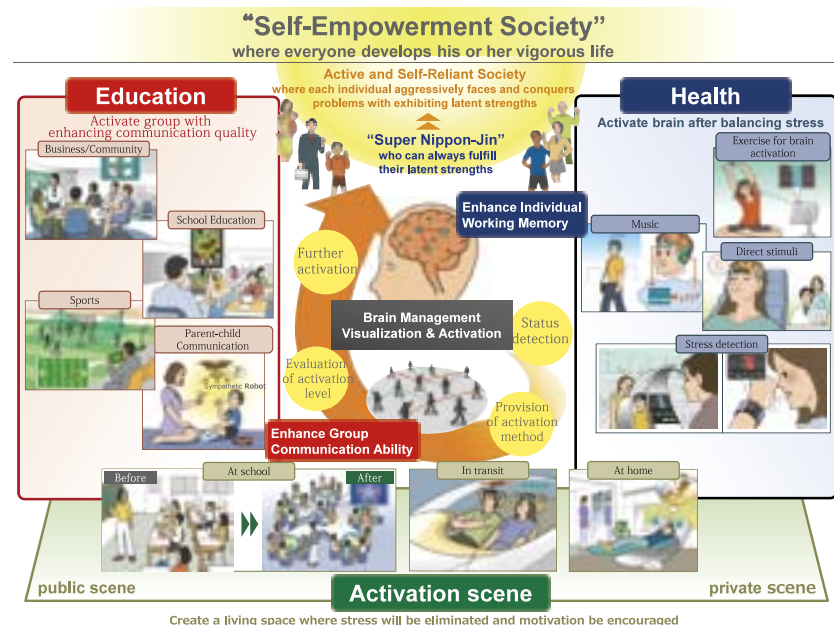
Project Leader

**Takeshi Uenoyama**

Fellow, Panasonic Corporation

1981 Joined Panasonic  
2008 Executive Officer  
2013 Fellow (current position)

### The Future



### Outline

For the vision 10 years later "establishment of prosperous living environment", expected is a "SUPER NIPPON-JIN" who is always ambitious to display his or her potential talents from his or her childhood to the age of old to realize a "self-empowerment society", i.e. an "active and self-reliant society" where each individual aggressively faces and conquers problems." Our COI site will explore human power determinants based on medicine-brain-science-engineering collaboration so as to "realize a stress-free comfortable lifestyle" (provide a comfortable space where the brain is activated with excluding stress) and will analyze community networks on the analogy of brain networks so as to "provide prosperous communities such as an educational environment with increasing the quality of communication between two persons or a person and an object. Through these actions, we will establish prosperous living environments, focusing on "health" and "education".

### Application & Service

#### ● Biosensors and activation methods

Realize simple & mobile devices and contribute to health care. Patch-type wearable sensor, sleep diagnosis by body movement measurements, etc.



#### ● Consulting services for activation

Quantify communications and contribute to sports & education. Activation of classes, strengthening strategy of team sports, etc.



### Implementation Structure

**Project Leader : Takeshi Uenoyama (Panasonic Corporation)****Research Leader : Kazuhiko Matsumoto (Osaka University)**

【Core institution】Osaka University and Panasonic Corporation

【Participating institution】The University of Tokyo, National Institute of Information and Communications Technology, Center for Information and Neural Networks (NICT-CiNet), National Cerebral and Cardiovascular Center, Tokyo City University, The University of Electro-Communications, Kinki University, Hamamatsu University School of Medicine, Chubu University, Kansai Medical University, Hokkaido University, Hokkaido University of Science, Doshisha University, imec international, MEDINET Co., Ltd., Hitachi, Ltd., DAIKIN INDUSTRIES, LTD., Yamaha Corporation, SHOWA DENKO K.K., Konica Minolta, Inc., CEMEDINE Co., Ltd., KANEKA Corporation, NIPPON MEKTRON, LTD., PI-CRYSTAL INC., MSI.TOKYO, Inc., Quantum Biosystems Inc., Evidence Finder's Club, BrainShare Inc., Brains Corporation, CRIMSON TECHNOLOGY, Inc., FIRST SYSTEM Co., Ltd., TANAKA SHOJI INC., LTD., SCREEN Holdings Co., Ltd., NISSIN KASEI CO., LTD., TOHO KASEI CO., LTD., SHINKO Manufacturing Co., Ltd., ORGANO CORPORATION., FINE JAPAN CO., LTD

■ **Satellite institution : Kanazawa University**■ **Satellite Leader : Yoshio Minabe (Kanazawa University)**

【Participating institution】Osaka University, The University of Tokyo, Hamamatsu University School of Medicine, Kanazawa Institute of Technology, University of Fukui, National Center of Neurology and Psychiatry, PFU Limited



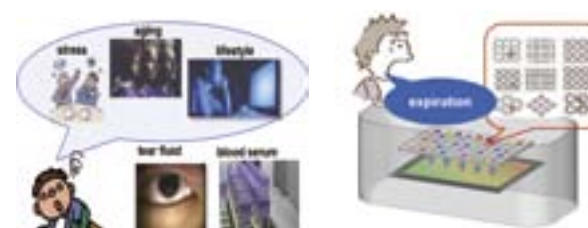
The Institute of Scientific and Industrial Research, Osaka Univ. (Incubation Research Building)

### Key R&D Themes

#### 1. Stress biomarker search and stress substance detection technologies

Leader: Koji Nishida (Graduate School of Medicine, Osaka Univ.) (MEDINET, Panasonic, etc.)

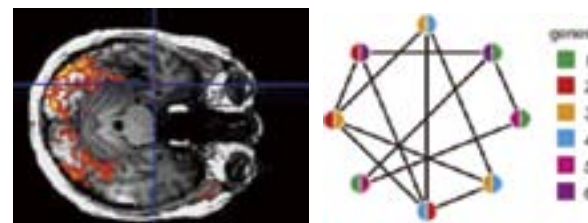
The stress is one of the big factors to inhibit the human activation. We search for the most suitable stress biomarker that is detectable even from a small amount of tear and blood. Simple detection methods to quickly measure stress substances and an activation method by intestinal flora improvement are also studied.



#### 2. Brain function imaging and neural network modeling

Leader: Takahisa Taguchi (NICT-CiNet) (Panasonic, Hitachi, etc.)

Installing state-of-the-art 7T-fMRI, we clarify intricate brain functions, visualize the stress and relate it to other sensing methods. A new model is also proposed as a basic principle of neural network in the brain as well as in the community by the analogy.



#### 3. Imperceptible wearable sensors and personal DNA sequencer

Leader: Kazuhiko Matsumoto (The Institute of Scientific and Industrial Research, Osaka Univ.) (imec, Quantum Biosystems, etc.)

For appropriate treatment after evaluating the stress, it is required to easily monitor brain wave, etc. We perform medical inspection for state-of-the-art wearable sensors and develop imperceptible wearable devices and a personal DNA sequencer at low cost.



#### 4. Quantification of communication and activation by communication

Leader: Takeshi Yagi (Graduate School of Frontier Bioscience, Osaka Univ.) (Hitachi, etc.)

In home, school, sports, business and local societies, a person-to-person communication has significant effects on the human activation. We try to activate a group as a whole by intervention or optimization, evaluating the relation between communication quality and activation degree, or stress level, in associated with the brain status.



#### 5. Deep sleep and music for activation

Leader: Masako Taniike (Graduate School of Medicine, Osaka Univ.) (DAIKIN, Yamaha, Brains, etc.)

Since the sleep has significant effects on the human activity, we estimate sleep quality and quantity and provide pleasant sleep by optimizing the environment such as sound, temperature, etc. We also study on an activation by auditory stimulation, i.e., automatic composition of the most suitable music contents appropriate to the brain status.



#### 6. Healthy mental development of children with respecting diversity

Leader: Yoshio Minabe (Research Center for Child Mental Development, Kanazawa Univ.)

Respecting the individuality and diversity of children, the brain function is studied by a child-sized MEG, one of three in the world. Studies on transcranial direct current stimulation (tDCS), superconducting sensors for advanced MEG and human-robot interaction are now in progress.



### Topics

#### ① Search for stress biomarkers

A stress substance was detected from tear and blood, correlated with chronic fatigue syndrome, etc., which indicates endogenous substances could be useful biomarkers.

Verification of relevance to brain inflammation and the library construction are in progress.



#### ② Imperceptible wearable sensors

A high-performance wireless patch-type wearable sensor was developed. Flexible electrode made of biocompatible permeable gel sheet and highly-conductive ink enables bioinstrumentation including brain wave. Advanced multichannel high accuracy measurement is in progress.



### Feature of our site

Taking advantage of all-round university, under one roof of medicine-brain-science-engineering-industry collaboration, R&D from basic research to social implementation is undergoing.

### Inquiry

**COI Program Administrative Office****Department of Research and Industry Collaboration, Osaka University**

Tel : +81-6-6879-4986 Fax : +81-6-6879-8463

E-mail : [coi-info@coistream.osaka-u.ac.jp](mailto:coi-info@coistream.osaka-u.ac.jp)

8-1, Mihogaoka, Ibaraki, Osaka 567-0047, Japan

[Access] 15 minute-walk from Kita-Senri, or from Handai-Byoin-Mae.



Project Period: FY2013~FY2021

<http://coikansei.hiroshima-u.ac.jp/>

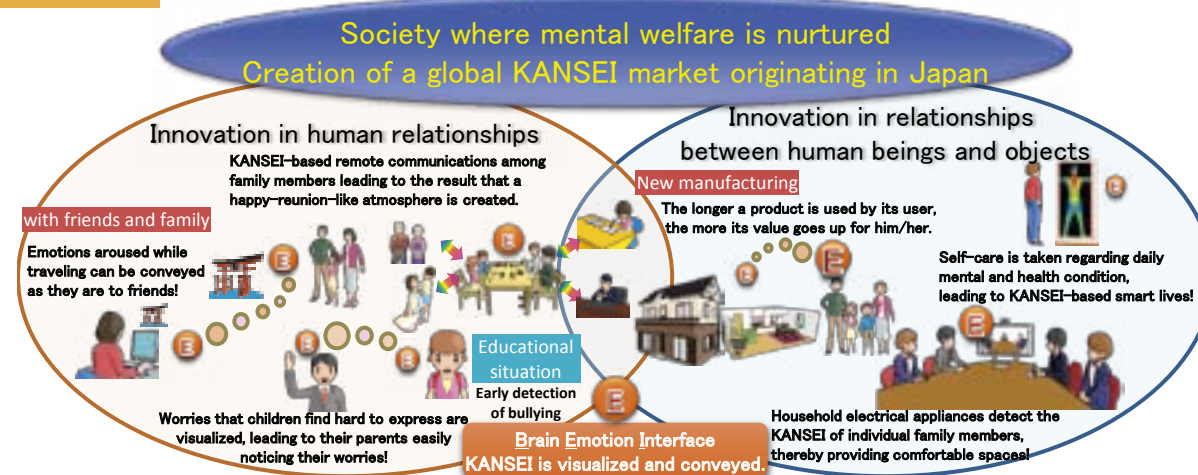
# Center of KANSEI Innovation Nurturing Mental Welfare

A society with happiness where “objects” and “minds” are in harmony and mental welfare is nurtured



**Project Leader  
Takahide Nouzawa**  
Chief Engineer, Technical Research  
Institute, Mazda Motor Corporation  
1980: Entered Mazda Motor  
Corporation.  
2010 – 2015: Head of the  
Technical Research Institute of the  
said corporation.

## The Future



## Outline

In the Center of KANSEI Innovation, we develop BEIs (Brain Emotion Interfaces) whereby inter-human and object-human connections are established by means of KANSEI by making full use of state-of-the-art brain science, optical technology, and information communication technology. By utilizing BEIs, we develop products and services such that the longer they are used by users, the further the user's mental welfare is nurtured, in various fields such as clothing, food, housing, movable objects, household electrical appliances, education, and medical care. These developments lead to innovation in inter-human and object-human relationships. Thereby, we are aiming at creating a society with happiness where “objects” are in harmony with “minds”.

## Application & Service

### ● Wearable and real-time KANSEI meters based on brain science

- Life and society with “spiritual” richness is realized by means of meters whereby KANSEI can be readily determined anytime on a daily basis.

### ● Products and services whereby KANSEI information is fed back in real time in keeping with users' features

- Products and services such that the longer they are used, the further their value goes up for users, and that users can be as strongly attached to them as if to life partners.
- KANSEI communication services whereby what users felt can be conveyed to acquaintances and family members in distant locations.

<b>Waku Waku*</b>	<b>85</b>
Axis 1 Comfort	70
Axis 2 Activity	82
Axis 3 XXX	63

\*a state of mind of being happily excited

## Implementation Structure

**Project Leader : Takahide Nouzawa (Mazda Motor Corporation)**

**Research Leader : Shigeto Yamawaki (Hiroshima University)**

【Central organization】Hiroshima University

【Participating organizations】Hiroshima City University, National Institute of Advanced Industrial Science and Technology, Mazda Motor Corporation, Mitsubishi Rayon Co., Ltd., Andersen Group, Kobelco Construction Machinery Co., Ltd., HIROSHIMA GAS Co., Ltd., TOTO Ltd., Sapporo Holdings Limited, and TOPPAN PRINTING Co., Ltd.

■ **Satellite institution : National Institute for Physiological Sciences**

**Satellite Project Leader: Ippei Hagiwara**

(NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, INC.)

**Satellite Research Leader: Keiji Imoto**

(National Institute for Physiological Sciences)

【Participating institution】NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc., National Institute for Physiological Sciences, and Yokohama National University

■ **Satellite institution : Innovative Photonics Evolution Research Center**

**Satellite Project Leader: Tsutomu Hara**

(Hamamatsu Photonics K. K.)

**Satellite Research Leader: Shoji Kawahito**

(Shizuoka University)

【Participating institution】Hamamatsu Photonics K. K., Shizuoka University, Hamamatsu University School of Medicine, The graduate School for the Creation of New Photonics Industries, Honda Electronics Co., Ltd., Yamaha Motor Co., Ltd., Pulstec Industrial Co., Ltd., and Brookman Technology, Inc.

## Key R&D Themes

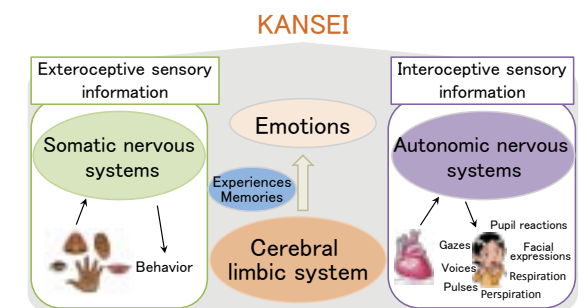
### Definition of KANSEI

The center of KANSEI Innovation has defined KANSEI as follows:

KANSEI is a high-order function whereby exteroceptive sensory information and interoceptive sensory information are integrated together, and whereby the emotional responses generated by comparing the integrated information against past experiences and memories are overviewed at a higher level.

### Elemental technologies for BEIs (Brain Emotion Interfaces)

In order to develop BEIs, it is necessary that the following items be organically fused together: KANSEI visualization technology, sensory perception visualization technology, substitute property measurement technology, KANSEI models, KANSEI control systems, user models, and communication systems. The Center of KANSEI Innovation aims to develop BEIs via these technologies, together with the Hiroshima University group, which is the core center, as well as the National Institute for Physiological Sciences group and the Innovative Photonics Evolution Research Center, which are satellites.



### 1. Development of KANSEI visualization technology

Shigeto Yamawaki (Hiroshima University), Mazda Motor Corporation

KANSEI visualization technology will be developed by using MRI (Magnetic Resonance Imaging) and EEGs (Electroencephalograms) to clarify the cerebral mechanisms for KANSEI. Meanwhile, for the purpose of subjecting BEIs to social deployment, the development of KANSEI visualization technology will be promoted by making various physiological measurements in implementation situations. Furthermore, sights are set on developing KANSEI visualization technology that is based on brain science and is capable of being subjected to social deployment, in such a way that brain information and physiological information are measured simultaneously.

### Joint research between Mazda Motor Corporation and Hiroshima University



Brain activities during performing the task of driving an automobile are analyzed using fMRI and EEG.

### 2. Development of sensory perception visualization technology

Keiji Imoto (National Institute for Physiological Sciences), Mazda Motor Corporation

The relationship between KANSEI and sensory perception including the five senses will be clarified on the basis of the definition of KANSEI given above.

### 3. Technology for real-time sensing of KANSEI information

Shoji Kawahito (Shizuoka University), Brookman Technology, Inc.

Facial expressions related to KANSEI should be precisely measured even in an environment where luminosity changes from daylight brightness to nighttime darkness within the vehicle. Our CMOS image sensor technology achieved an ultra wide dynamic range camera with over 120dB as a visual sensing device. By this contribution, many social products submit BEIs for a future happy life.

## Topics

Various products and services utilizing BEIs developed by this center are intended to be subjected to social deployment in diverse fields in cooperation with the following consortia:

#### 1. KANSEI Consortium (centering on Hiroshima University)

Enterprises in the Chugoku region participate in this consortium. Feasibility studies for social deployment of BEIs are made under one roof together with researchers at Hiroshima University. Concepts aimed at the development of specific products and services are established and carried out.

#### 2. Consortium for Applied Neuroscience (National Institute for Physiological Sciences Satellite)

This is an open innovation model consortium operated by NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, INC., where members of private enterprises in different industries and researchers in different fields meet together in one place, and where research and development, people-to-people exchange, and awareness development are addressed on the basis of the latest research information in neuroscience and in domains related thereto. This consortium aims to promote the industrialization of applied neuroscience.

#### 3. PhotonRing Consortium (The graduate School for the Creation of New Photonics Industries in Hamamatsu City)

In commercialization related to opto-electronics technology and providing support for the creation of new commodities having value added, especially when an enterprising, startup company needs a solution to a problem in commercializing, a new product with an additional value. PhotonRing proposes—seeds (academia) and needs (industry) matching, - establishment of value chains, - the commercialization of pertinent items, and the process to new industrial fields.

## Inquiry

**KANSEI Innovation Research Promotion Organization,  
Hiroshima University**

Tel : +81-82-257-1737 Fax : +81-82-257-1723

E-mail : [info@coikansei.hiroshima-u.ac.jp](mailto:info@coikansei.hiroshima-u.ac.jp)

1-2-3, Kasumi, Minami-ku, Hiroshima City, Hiroshima  
Prefecture 734-8551, JAPAN

[Access] 20 minutes by bus from Hiroshima Station



Project Period : FY2013~FY2021 ※Executed as trial FY2013~FY2014

<http://yucoi.yz.yamagata-u.ac.jp/en/>

# Frontier Center for Organic System Innovations

Creating healthy and enriching lifestyles and a sustainable society through organic-based innovative technology



Project Leader  
**Toru Miyake**

General Manager of Research & Development Center and Corporate R&D Division,  
Dai Nippon Printing Co., Ltd.

## The Future



## Outline

Creating new value for people, business and society - we will innovatively integrate fundamental organic technologies, which are friendly to the environment and humans, with our engineering designs and information and communication technologies to enable a lively societal system that is sustainable and diverse and to cater to individual needs. The "frontier organic system" is a foundational technology for creating an ambient-intelligence society by organically connecting humans to humans and humans to products. The system will deliver solutions for a self-sustaining health care system and communication services in order to build a future society that is humane and comfortable, and supports healthy lifestyles.

## Application & Service

- "Communication wall system" – Wall papers that can enrich communications and living environments
- "Smart organic system device chip" – A fusion between organic human sensors and organic RFIDs
- "Smart device printer" – Device formation technology with diverse printing, fabrication and integration method
- "Diagnostic sensors for metastatic cancers" – Simple diagnostic sensors to detect metastatic cancer cells in the blood
- "Organic ICT system" – Combined and networked technology with an organic system for improved QOL and society

## Implementation Structure

**Project Leader : Toru Miyake (Dai Nippon Printing Co., Ltd.)**

**Research Leader : Yoshihiro Ohba (Yamagata University)**

【Core institution】 Yamagata University

【Participating institution】 Dai Nippon Printing Co., Ltd., Sekisui House, Ltd., NEC Lighting, Ltd., Panasonic Corporation, KONICA MINOLTA, INC., ZEON CORPORATION, KANEKA CORPORATION, Mitsubishi Heavy Industries, Ltd., Lumittec Inc., ITO ELECTRONIC CO., LTD., KEN OKUYAMA DESIGN, Toray Engineering Co., Ltd., JSR Corporation, Yokogawa Electric Corporation, SATO HOLDINGS CORPORATION, DIC Corporation, Sony Corporation, Otsuka Chemical Co., Ltd., Piolax Medical Devices, Inc., Sumitomo Rubber Industries Ltd., NEC Corporation, PARAMOUNT BED CO.,LTD, Tohoku University of Art and Design (TUAD), Sendai National College of Technology

■ **Satellite institution : National Institute of Advanced Industrial Science and Technology (AIST)**



## Key R&D Themes

### 1. Creating a Pleasant Ambient-Intelligence Space

[Prof. Junji Kido (Yamagata Univ.), TUAD, Dai Nippon Printing, Sekisui House, NEC Lighting, Panasonic, KONICA MINOLTA, ZEON, KANEKA, Mitsubishi Heavy Industries, Lumittec, ITO ELECTRONIC, KEN OKUYAMA DESIGN]

Based on the technology of printable and flexible organic light-emitting diodes (OLEDs), we will create a human-friendly lighting system and "communication wall system" which can help facilitate and an enriched lifestyle – a lighting, display and communication system integrated into the ceilings and walls of homes through advanced design engineering and sensitivity.

### 2. Self-Sustaining Health Care for Healthy Longevity

[Prof. Shizuo Tokito (Yamagata Univ.), AIST, SATO x, DIC, Yokogawa Electric]

We will create a multi-functional "smart organic system device chip" – the integration of bio and ICT technologies based on a fusion of organic human sensors and organic RFIDs.

### 3. Soft Biomaterials

[Prof. Masaru Tanaka (Yamagata Univ. / Kyushu Univ.), Otsuka Chemical, Sumitomo Rubber Industries, Piolax Medical Devices]

The challenge is the development of new therapeutic and diagnostic devices based on our original "intermediate water concept." We will create 1) simple diagnostic sensors for metastatic cancers, and 2) a long-term use stent for cholangiocarcinoma therapy.

### 4. Future Additive Manufacturing

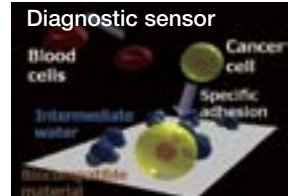
[Prof. Hiroshi Ito (Yamagata Univ.), Toray Engineering, JSR, Yokogawa Electric, DIC, Sony]

We will develop "smart device printers" and "nano processing technology" – complex device formation technologies using diverse device fabrication methods such as printing, micro and nano surface structure molding, and functional material processing.

### 5. Organic ICT Design and System

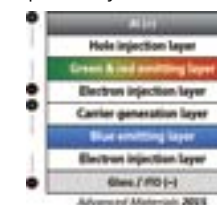
[Prof. Chiho Konno (Yamagata Univ.), Sendai National College of Technology, NEC, PARAMOUNT BED]

We will research and develop fundamental technologies for a novel "organic ICT system" – advancing research on ICT system infrastructures for organic communication systems in order to enable a vibrant and happy society.



## Topics

Multi-layer OLEDs, through subsequent solution-processing steps, achieve record-high power efficiencies for solution-processed blue, green and white OLEDs, respectively.



Solution-processed multi-layer OLEDs

The world's thinnest printed electronic circuit on a one-micron plastic film – applicable to wearable sensors and printed RFID tags.



Printed electronic circuit

A flexible OLED display driven by organic transistors – Tandem OLEDs and an organic thin-film transistor circuit are successfully integrated into a thin and light plastic film.



Flexible OLED display

Smart MIRAI House (smart-future house) – We have built a smart-future house for the experimental study of developed organic devices and systems for the improvement of QOL and for implementation in society.



Yamagata University's smart-future house concept, supported by MEXT.

Printable technologies at Yamagata University – Printable metal nanoparticle and organic semiconductor inks, ink-jet and roll-to-roll printing, organic electronics device integration and related technologies are extensively studied and developed under one roof. We have also started a university venture corporation relating to this technology.



## Inquiry

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4-3-16 Jonan, Yonezawa, Yamagata, 992-8510 Japan

[Access] 10 minutes by taxi from JR Yonezawa Station



Project Period : FY2013~FY2021

<http://www.ipst.s.u-tokyo.ac.jp/iccpt/>

# Innovative Center for Coherent Photon Technology (ICCPT)

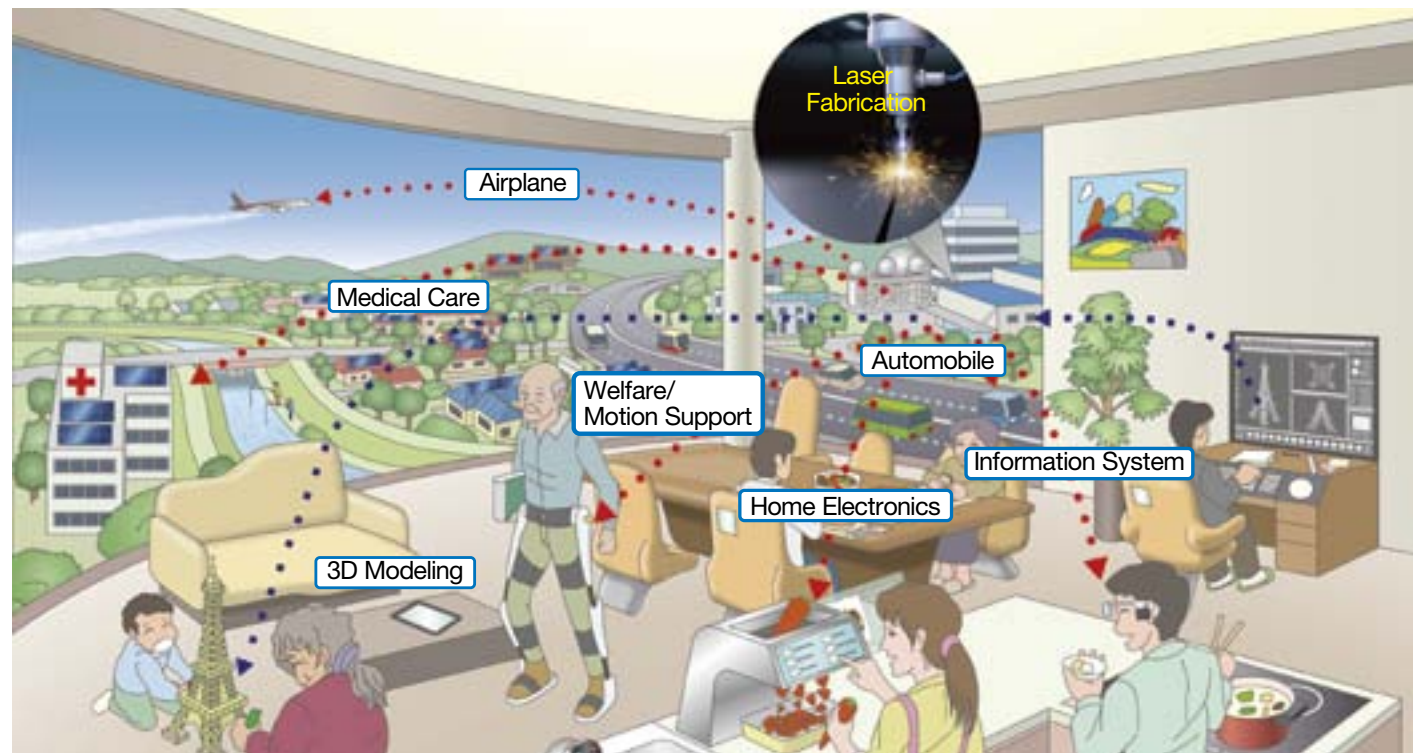
Comfortable, individuality-rich lifestyles realized by coherent photon technology



Project Leader  
**Junji Yumoto**

Univ. of Tokyo  
Graduate School of Science,  
Professor  
Former President & CEO of  
NEL America

## The Future



## Outline

Our goal is to build a “personalized and sustainable society” by actively employing ideas arising from individuals and by optimizing the use of resources. With the “photon” as the pivot of our alliance and on the solid scientific foundation that ensures the reliability of new technologies, we strive toward a paradigm-shift in “manufacturing” using coherent photon technologies. We work to create new technologies that are needed to support the future vision of our society and the industry; this will create a world wherein individual ideas and technologies are actively exchanged among industries, academia, government, and also the consumers surrounding them.

## Application & Service

### ● High-precision laser fabrication techniques

Non-thermal processing with short-wavelength, ultrashort-pulse, and high-intensity lasers will be applied to high-precision freeform fabrication of carbon-fiber reinforced plastics (CFRP). Regarded as a next-generation material, CFRP is a high-strength, light-weight and highly reliable material, having applications in aircraft and automobile fields.

### ● Regulated liquid level type 3D printer

Our model realizes the formation of previously-unformed structures and, consequently, contributes to high-value-added product fields, such as aerospace and medical industries.

### ● Internal organ observation system

A unique microscope will be released to observe lesions, such as tumors, inside organs visualized using organ transparent techniques (see the figure on the right) we developed. Using this microscope technique, the cost and time required for pathology diagnostic techniques are reduced time will be reduced.



Rat body treated using our transparent techniques

## Implementation Structure

Project Leader : Junji Yumoto (Univ. of Tokyo) Research Leader : Shinji Tsuneyuki (Univ. of Tokyo)

[Core institution] The University of Tokyo

[Participating institution] RIKEN, Mitsubishi Electric Corporation, Gigaphoton, Inc., Toray Industries, Inc.

## Key R&D Themes

### 1. Development of laser fabrication techniques for hard-to-process materials

[Junji Yumoto (Univ. of Tokyo), RIKEN, Mitsubishi Electric Co., Toray Industries, Inc.]

Non-thermal laser processing for materials such as carbon-fiber reinforced plastics (CFRP) and tempered glass, which have proven difficult to process by laser, will be established.

### 2. Advanced laser molding and modifying techniques

[Norikatsu Mio (Univ. of Tokyo), Toray Industries, Inc.]

Commercially available 3D printers, using improved stereolithographic techniques, and its application (modeled products), will be developed. Photo-modifying techniques for repairing microscopic defects on functional materials will also be developed.

### 3. Short-wavelength light source and application technologies

[Katsumi Midorikawa (RIKEN), Univ. of Tokyo, Gigaphoton, Inc.]

High-intensity laser sources as a core of “coherent photon technology,” such as short-pulse sources in UV-THz regions, and a coherent light source for testing EUV optics will be developed.

### 4. Exploration of individual needs

[Hiroshi Onodera (Univ. of Tokyo)]

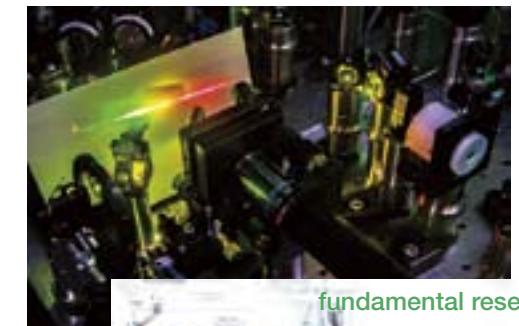
Wearable systems for walking support will be developed, applying the above-mentioned laser fabrication techniques and the 3D printer techniques.

Also, internal organ observation systems that do not overlook inside lesions will be developed.

### 5. Development of new non-equilibrium photo process

[Shinji Tsuneyuki (Univ. of Tokyo)]

This project will accomplish the following things: (1) develop a simulation method for prediction of atom dynamics in pseudo thermal-equilibrium electric excited state, (2) integrate atoms into a calculation code for electron dynamics simulation in high-intensity laser pulses, based on a time-dependent multi-configuration theory, and (3) develop an angular-resolved photon-electron spectroscopy with high energy resolution and high efficiency.

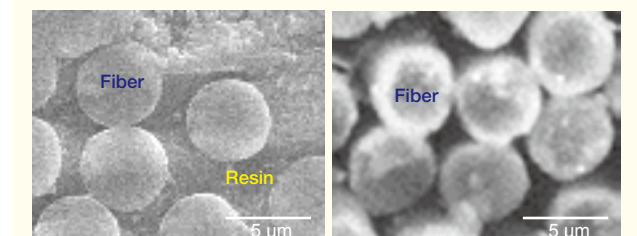


fundamental research bases

## Topics

### ● High-precision CFRP laser processing

Because CFRP is a composite material comprising high-heat-resistant carbon fiber and resin, the excess heat energy radiated during laser processing strongly affects the resin. Consequently, a heat-affected zone (HAZ) is generated in which the resin outside the processing area is thermally decomposed. The HAZ results in degradation of the mechanical properties of CFRPs. We have achieved the laser processing of CFRPs that suppresses the HAZ to approximately 20 nm by optimizing the process conditions, such as wavelength and pulse width. In the near future, we will attempt to accomplish laser processing of CFRPs with a dimensional accuracy of 5 nm or less via further process optimization.



CFRP cutting surface processed under optimized laser conditions

CFRP cutting surface processed under conventional laser conditions

SEM images of laser-processed CFRP surfaces

### ● Prototype production of a 1D liquid-level-control 3D printer

We have been investigating stereolithographic 3D printer elements with the aim of satisfying both the resolution- and enlargement-related requirements of printed products. Consequently, 1D liquid-level-control techniques that enable the fabrication of structures, such as a multibranched fine-pipe structures applicable to microfluidic devices, were developed. In addition, we developed a compact prototype machine “RECILS” to satisfy customer requests for trial usage. Its high modeling resolution of 100 microns or less allows complicated and fine structures to be formed.



RECILS overview

## Inquiry

The University of Tokyo,  
Institute for Photon Science and Technology

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7-3-1, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan  
[Access] 8 min walk from Tokyo Metro Hongo-Sanchome Station



Project Period : FY2013~FY2021 ※Executed as trial FY2013~FY2014

<http://coi.sfc.keio.ac.jp>

# Center of Kansei-oriented Digital Fabrication

The future of human aesthetics and creativity, supported by networks and digital fabrication.



Project Leader

**Kenji Matsubara**

President and CEO of Longfellow Inc.  
2007-2010 President and CEO  
of Koei Tecmo Holdings  
Took up current position in 2013  
Engaged in the Mitou program of IPA.

## The Future

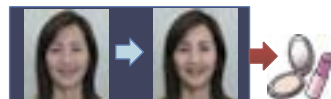


## Outline

The research project's aim is to realize the Global Fab Society, in which digital fabrication will connect people's sensibilities with digital manufacturing and broaden consumers' creativity. The Global Fab Society is one that prizes the diversity of individuals and enables all interested people to visualize, design, and create the things they want or need based on their unique sensibilities. By distributing and sharing the necessary ingenuity and know-how to fabricate things over the Internet, this sustainable society will provide lifestyles rich in self-fulfillment, self-growth, achievement, and solidarity. To realize the Global Fab Society, our research is looking at: (1) technologies connecting sensibilities and digital fabrication; (2) advanced material technologies; (3) manufacturing, logistics, and administration structures; (4) co-creation society expansion, popularization, and promotion; and (5) design of social implementation systems.

## Application & Service

1. Design and create facial accessories (cosmetics, cosmetics cases, glasses, costumes) that suit individual sensibilities and preferences
2. Create food products with pleasing designs or shapes for different purposes (Jelly food, care food, sport food)
3. Create your own satisfying assistive devices (casts, crutches, slings) with pleasing designs or shapes

Case 1.  
CosmeticsCase 2.  
Food CreationCase 3.  
Assistive devices

## Implementation Structure

**Organization leader**  
**Project Leader, overall supervision :**  
**Kenji Matsubara** (Longfellow Inc.)

**Deputy organization leader**  
**Research Leader, research supervision :**  
**Jun Murai** (Dean of the Faculty of Environment and Information Studies, Keio University)

**Assistant organization leader :**  
**Fumio Kishino** (Visiting Professor, Research Center for Kansei Value Creation, Kwansei Gakuin University)

**Assistant deputy organization leader :**  
**Hiroya Tanaka** (Professor, Faculty of Environment and Information Studies, Keio University)

**Deputy organization leader**  
**Collaborative co-creation supervisor :**  
**Kaoru Arakawa** (Professor, School of Interdisciplinary Mathematical Sciences, Meiji University)

**Assistant deputy organization leader :**  
**Homei Miyashita** (Professor, School of Interdisciplinary Mathematical Sciences, Meiji University)

**[Core institution]** Keio University  
**[Keio University center leader]** Hiroya Tanaka (Faculty of Environment and Information Studies)  
Institute of Advanced Media Arts and Sciences, Kanagawa Prefecture, Mozilla Japan, Roland DG Corporation, Okamura Corporation, JSR Corporation, TOPPAN PRINTING CO., LTD., Fuji Xerox Co., Ltd.  
**[Meiji University satellite leader]** Kaoru Arakawa (School of Interdisciplinary Mathematical Sciences)  
National Institute of Advanced Industrial Science and Technology, teamLab Inc., KOSÉ Corporation, Interlocus Inc.  
**[Kwansei Gakuin University satellite leader]** Noriko Nagata (School of Science and Technology)  
Kanazawa College of Art, Chukyo University, Digital Fashion Ltd., Honda R&D Co., Ltd., Tottori University, NIKON CORPORATION, Naris Cosmetics Co., LTD., NIPPON STEEL & SUMITOMO METAL CORPORATION, Mitsubishi Electric Corporation, RICOH COMPANY, LTD  
**[Yamagata University satellite leader]** Hidemitsu Furukawa (Graduate School of Science and Engineering)  
Mitsubishi Rayon Co., Ltd., Sunarrow Co., Ltd., Studio Midas



Yokohama Center,  
Social Fabrication Laboratory  
(NU Kannai Building 2F)

## Key R&D Themes

### 1. Human design

[Leaders : Noriko Nagata (Kwansei Gakuin University), Kaoru Arakawa (Meiji University), Kwansei Gakuin University, Meiji University, Kanazawa College of Art, Chukyo University, teamLab Inc., KOSÉ Corporation, Digital Fashion Ltd., Honda R&D Co., Ltd., Tottori University, NIKON CORPORATION, Naris Cosmetics Co., LTD., NIPPON STEEL & SUMITOMO METAL CORPORATION, Mitsubishi Electric Corporation, RICOH COMPANY, LTD, Interlocus Inc.]

We are sequentially building models and indexes of diverse human sensibilities represented by the five senses and of the creativity that gives rise to value. We will complete a matrix usable as an industry function and social device and, thereby, realize systems that enable people to design the things they truly want and need.

### 2. Digital material & system

[Leaders : Hidemitsu Furukawa (Yamagata University), Yamagata University, Meiji University, Kwansei Gakuin University, Keio University, Mitsubishi Rayon Co., Ltd., Sunarrow Co., Ltd., Studio Midas]

We are proceeding with the development of technologies that digitalize materials and the construction of related databases to advance the field of materials and process informatics. Materials and process informatics will make it possible to predict, through simulations, the functionality and textural feel of fabricated products from the compositions of mixed materials and the data of 3D modeling.

### 3. Process technologies

[Leaders : Hiroya Tanaka (Keio University), Keio University, Meiji University, Kanagawa Prefecture, Mozilla Japan, Roland DG Corporation, Okamura Corporation, JSR Corporation, TOPPAN PRINTING CO., LTD., Fuji Xerox Co., Ltd.]

We are proceeding with the development of The Fabricator, an IoT manufacturing device that immediately produces things from data. We are also working on creating standards and open sources for various data formats associated with fabrication.

### 4. Co-creation innovation

[Leaders : Hiroya Tanaka (Keio University), Keio University, National Institute of Advanced Industrial Science and Technology]

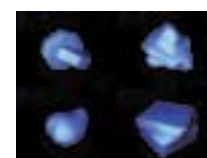
We are studying cases of co-creation innovation that can serve as models to push forward innovation by suppliers and users working together on products, technologies, and services. We are also identifying co-creation innovation methodologies from observation studies and hands-on operations at venues where co-creation mechanisms are functioning.

### 5. Policies

[Leaders : Shigeru Kobayashi (Institute of Advanced Media Arts and Sciences), Institute of Advanced Media Arts and Sciences, Keio University, Meiji University]

We are demonstrating concrete ideas and visions to creative consumers at social services facilities and in small businesses, providing the necessary rules and tools to encourage the activities of these creative consumers, and formulating policy recommendations to implement the Global Fab Society and to clear hurdles to its implementation

## Topics



We developed an index of sensibilities by modeling sensibility indicators for routinely used products, ranging from daily-use goods to consumer electronics, that can be applied to ordinary consumers.



We created design tools for cosmetic cases and Japanese confectionery and printed out the designs. We printed out at a 3D printer shop located in a shopping district near Nakano Station, Tokyo.



We were awarded the Good Design Award 2014.

## Inquiry

**Office of Research Development and Sponsored Project, Shonan Fujisawa Campus, Keio University**  
Tel : +81-466-49-3436 Fax : +81-466-49-3594  
E-mail : [coi@sfc.keio.ac.jp](mailto:coi@sfc.keio.ac.jp)

Yokohama Center, Social Fabrication Laboratory, Keio Research Institute at SFC  
NU Kannai Building 2F, 223-1 Yamashitacho, Naka Ward, Yokohama,  
Kanagawa 231-0023  
[Access] six minutes on foot from the JR Kannai Station or seven minutes from the Nihon-odori Station on the Minatomirai Line



Expansion of sensibility / value models and representations of individuals' sensibilities



Development of advanced designable materials



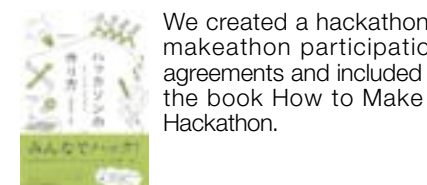
Development of the IoT Fabricator (standard framework)



We developed a CAD system for designing "softness" as well as soft medical elastomers for 3D printer (FDM) use.



We held a session on living materials at the 5th NicoNico Gakkai Beta Symposium.



We created a hackathon / makeathon participation agreements and included in the book How to Make a Hackathon.



Project Period : FY2013~FY2021

<http://www.icc-kit.jp/coi/>

# Construction of next-generation infrastructure using innovative materials

~Realization of a safe and secure society that can coexist with the Earth for centuries~

## Development of "innovative materials" as well as "innovative manufacturing processes and manufacturing equipment"

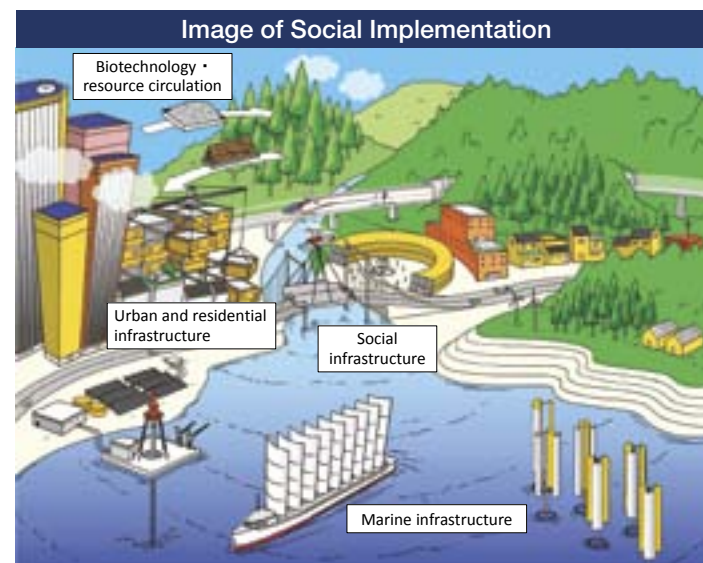


Project Leader

**Shouichi Ikebata**

Manager, Daiwa House Frontier Technology Laboratory, Daiwa House Industry Co., Ltd.  
 April 1976 - Joined Daiwa House Industry and started working at their manufacturing plant April 2003 - Promoted to Group Leader at Parts Production Design Group August 2012 - Promoted to Assistant Director, Daiwa House Central Research Laboratory November 2015 Promoted to Manager, Frontier Technology Laboratory (current post)

### The Future



### What is an "innovative manufacturing process"?

Development of mass production manufacturing process, manufacturing equipment, and processing equipment for composite materials using thermoplastic resins

- Development of long and large structural members manufactured by continuous forming  
 ⇒ Integral moulding of large structures  
 ⇒ Achievement of productivity improvement by 100-fold and cost reduction to one-tenth
- Development of processing technology with matrix of thermoplastic resins  
 ⇒ Easier secondary processing such as bending or bonding  
 ⇒ Realization to new onsite construction technologies

### What is an "innovative material"?

Utilization of biotechnology and nanotechnology

- Highly functional materials ⇒ Heat resistance, durability, and self-repairing functions
- Biomass-derived materials ⇒ Reduction in environmental burden and cost
- Highly functional wood-based materials ⇒ New wood-based materials suitable for living environment, high workability, and fireproofing.

### Outline

The ideas of "new innovative materials" and "innovative manufacturing processes" are fused to develop "new innovative structural materials" that are lightweight, high strength, long lasting, and mass producible at low costs, to replace conventional iron and concrete. These are incorporated into next-generation infrastructural systems with an aim of reducing social costs and creating new values as a means to realize a society that spans over centuries, which is safe, secure, and maintains its values over long periods. Furthermore, technologies for utilizing biomass will be employed to reduce environmental burden and reduce raw material costs.

### Application & Service

- Social infrastructure**  
 Social costs will be significantly reduced by offering long life, weight reduction, and enhanced structural strength, as well as new construction methods along with operation and maintenance technologies
- Urban & residential infrastructure**  
 Raw materials and highly functional materials with superior environmental performance for residential and urban infrastructures to build new residential environments, and restore and build cities.
- Marine infrastructure**  
 Ultra-long continuous structure, which is impossible to achieve with conventional materials such as iron, will be materialized (creation of new values).

### Implementation Structure

**Project Leader : Shouichi IKEBATA, Daiwa House Industry Co., Ltd.**

**Research Leader : Kiyoshi UZAWA, Kanazawa Institute of Technology**

**Research Promotion Group Leader : Kenji TAKAHASHI, Kanazawa University**

**Research Promotion Group Assistant Leader : Toshihide SEKIDO, Kanazawa Institute of Technology**

**[Core institution]** Kanazawa Institute of Technology

**[Participating institution]** Kanazawa University, Japan Advanced Institute of Science and Technology, Gifu University, Okayama University, National Institute for Material Science, Kyoto University, Public Works Research Institute, Industrial Research Institute of Ishikawa, Industrial Research Institute of Gifu Prefecture, Daiwa House Industry Co., Ltd., Toray Industries, Inc., Komatsu Industries Corp., Nissan Chemical Industries, Ltd. (~March, 2016), MODEC, Inc., Ichimura Sangyo Co., Ltd., Suncorona Oda Co., Ltd., Tsudakoma Corp., Shibuya Corporation, Komatsu Seiren Co., Ltd., Daido Kogyo Co., Ltd., Ashida Mfg. Co., Ltd., Sandvik K.K., Meiwa Kogyo Co., Ltd., NAC KS Co., Ltd., GH Craft Ltd., Nihon FRP Corporation (August, 2016~), MORIN Chemical Industries Co., Ltd. (August, 2016~), Nippon Paper Industries Co., Ltd. (August, 2016~)



Platform:  
 Innovative Composite materials research and development Centre (ICC), Kanazawa Institute of Technology

### Key R&D

#### 1. Molding/forming technologies of CFRTP structural members (continuous molding/forming, large-sized molding)

Leader : Toshihide SEKIDO, Kanazawa Institute of Technology

[Participating organizations and corporations : Kanazawa Institute of Technology, Kanazawa University, Gifu University, Industrial Research Institute of Ishikawa, Industrial Research Institute of Gifu Prefecture, Toray Industries, Inc., Komatsu Industries Corp., Ichimura Sangyo Co., Ltd., Suncorona Oda Co., Ltd., Tsudakoma Corp., Shibuya Corporation, Komatsu Seiren Co., Ltd., Daido Kogyo Co., Ltd., Sandvik K.K., NAC KS Co., Ltd., Nihon FRP Corporation]

By the development of innovative high-speed, large, continuous molding technology for a large plate and long structural element, common members of infrastructure, we will achieve high productivity at low cost.

#### 2. Basic technology (Bio/Nano technology, evaluation technology)

Leader : Kenji TAKAHASHI, Kanazawa University

[Participating organizations and corporations : Kanazawa Institute of Technology, Kanazawa University, Japan Advanced Institute of Science and Technology, Okayama University, National Institute for Material Science, Public Works Research Institute, Meiwa Kogyo Co., Ltd., MORIN Chemical Industries Co., Ltd., Nippon Paper Industries Co., Ltd.]

By innovative bio/nano technology and evaluation technology, we will support the development of raw materials having high functionality and environmental performance and assist its practical use.

#### 3. Application (Task Team)

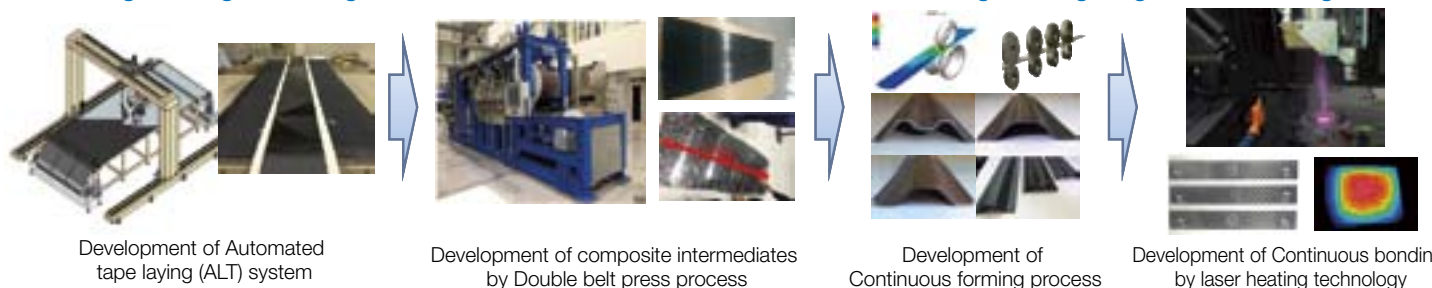
Leader: Shinichi MIYAZATO, Kanazawa Institute of Technology

[Participating organizations and corporations : Kanazawa Institute of Technology, Kyoto University, National Institute for Material Science, Public Works Research Institute, Daiwa House Industry Co., Ltd., Toray Industries, Inc., Komatsu Seiren Co., Ltd.]

Regarding embodied applications, we will launch a collaboration team to work on an early realization of the social implementation.

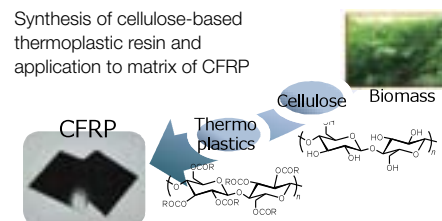
### Topics

#### ◆Molding/forming technologies of CFRTP structural members (continuous molding/forming, large-sized molding)



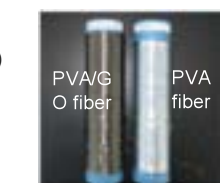
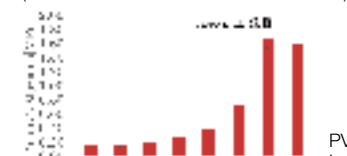
#### ◆Basic technology (Bio/Nano technology, evaluation technology)

Synthesis of cellulose-based thermoplastic resin and application to matrix of CFRP



Carbon fiber reinforced plastic (CFRP) using biomass-derived thermoplastics as matrix

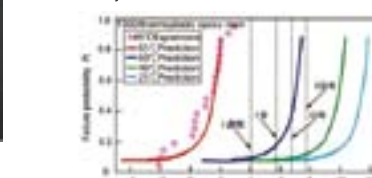
Established the good dispersion technique of graphene oxide into PVA (Elastic modulus was 9 times enhanced.)



PVA fiber:  
 Low density (1.30g/cm<sup>3</sup>)  
 High mechanical properties (5.1GPa)

Development of high-functional materials

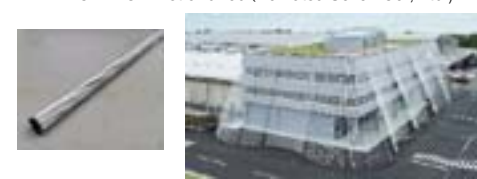
Creep life prediction of CFRTP from temperature dependent static strength of CFRTP and viscoelasticity of matrix resin



Technique for creep life time prediction

#### ◆Application (Task Team)

<Application of tension rods into aseismic reinforcement, etc.>  
 •CABKOMA strand rod (Komatsu Seiren Co., Ltd.)



T-b Tension Rod (Aseismic reinforcement)

<Development of blade modules of Vertical axis wind turbine>



T-d Large panel (Blades of wind turbine)

<SI (Skeleton Infill) housing>



T-a Housing materials (Panel)

### Efforts towards the Social Implementation

- Tokai-Hokuriku Composite Highway Consortium, established in November 2014, will accelerate industrialization in the field of composite materials.
- Personnel exchanges, international joint development and global business expansion will be promoted in cooperation with the European industrial cluster.



Partnership with  
 CFK-Valley, Germany



BtoB meeting in  
 Nantes, France

### Inquiry

**COI Research Promotion Organization, Kanazawa Institute of Technology**

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2-2 Yatsukaho, Hakusan City, Ishikawa Prefecture  
 924-0838

[Access] 15 to 20 minutes by taxi from Matto Station



Project Period : FY2013~FY2021

<http://www.shinshu-u.ac.jp/coi/english/>

# Global Aqua Innovation Center for Improving Living Standards and Water-sustainability

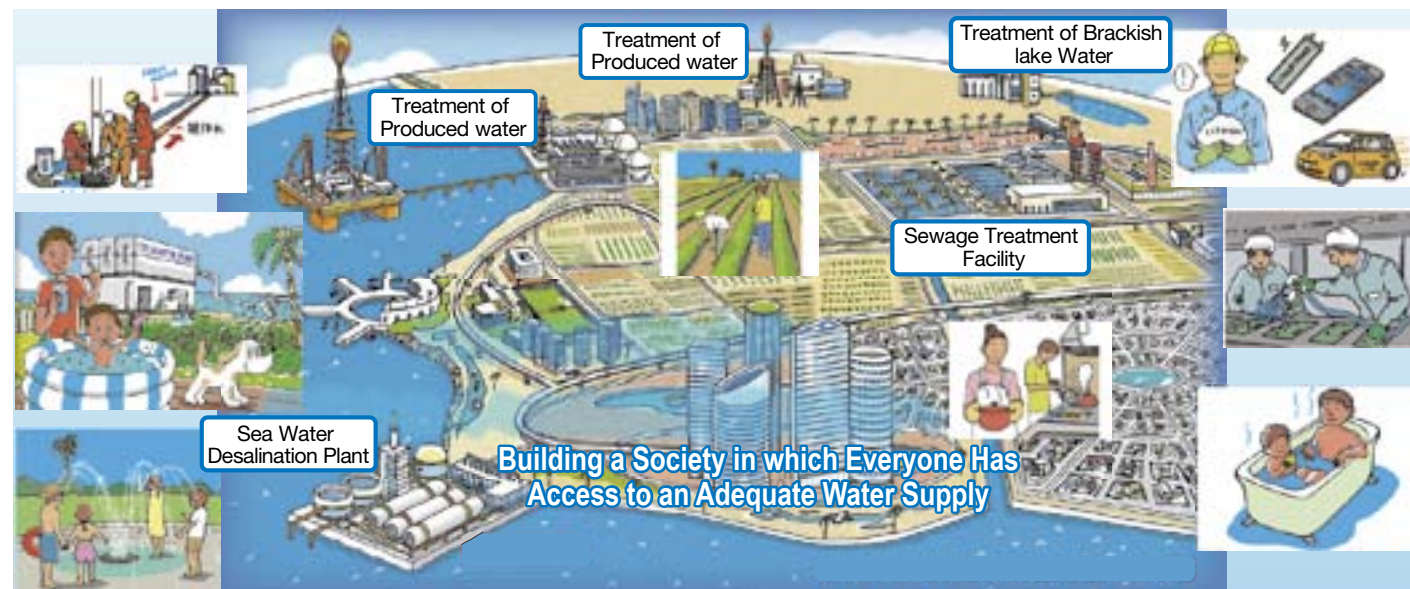
## Innovative Water Desalination and Reclamation Systems



Project Leader  
**Shinjiro UEDA**

Executive Technology Adviser  
Industry and water Business Administration  
Division, Hitachi, Ltd.  
1997 Deputy Director of Mechanical  
Engineering Research Laboratory, Hitachi, Ltd.  
2010 Vice President of Hitachi Plant  
Technologies Ltd.

### The Future



### Outline

Securing safe water supplies is becoming a worldwide challenge. Looking ahead to the future when the world population reaches 8 to 9 billion, our Center brings together people from academia, industry, and government organizations across Japan to develop and deploy innovative desalination and water reclamation systems based on robust reverse osmosis (RO) membranes composed of nanocarbons. These innovative systems will contribute to provide clean water supply around the world.

### Application & Service

- Sea water desalination are expected to be widely implemented in developing countries to secure adequate water supply for drinking, agriculture and industrial uses.
- Produced water from oil and gas extraction processes will be cleaned and recycled, contributing to reduce sea water contamination caused by discharge of untreated produced water.
- Desalination of brackish lake and pond water, and the separation of lithium at low cost will enable us to contribute to solution for water shortage and valuable resource recovery.

### Implementation Structure

**Project Leader : Shinjiro UEDA** (Executive Technology Adviser, Industry and water Business Administration Division, Hitachi, Ltd.)  
**Research Leader : Morinobu ENDO** (Distinguished Professor Shinshu University)

[Core institution] Shinshu University

[Core companies] Hitachi, Ltd., Toray Industries, Inc., Showa Denko K.K.

[Participating institutions] National Institute for Materials Science(NIMS), RIKEN, Research Organization for Information Science and Technology(RIST), Kitagawa Industries co., Ltd., Toclas Corporation, Nagano Prefectural Government

■ **Satellite institution(COI-S)**  
**Project Leader Mario TOKORO**  
(Founder & Executive Advisor, Sony CSL)

[Participating institutions] Japan Agency for Marine-Earth Science and Technology (JAMSTEC), The University of Tokyo, Chuo University



International Center for Science and Innovation

### Key R&D Themes

#### 1. Research & Development of RO Membranes Composed of Nanocarbons

[Morinobu ENDO (Shinshu University), Izumi ICHINOSE (NIMS) : Toray Industries, Inc., Showa Denko K.K., Kitagawa Industries co., Ltd.]

Many of problems that current polymer membranes and water treatment plants face involve large consumption of energy for high-pressure pumps and damages due to high-temperature of sea water. Our team aims to develop a high-performance and robust carbon separation membrane and adapt it to any condition of water source and purpose.

#### 2. Research & Development of Nanocarbon RO Membrane Modules

[Toray Industries, Inc.]

Toray aims to develop module production technology which can be used in desalination plant and treatment of produced water. The module has to be adapted to various water sources and consist of a heat-and-chemical resistant nanocarbon membrane and support layer.

#### 3. Systematizing Water Treatment by Using Nanocarbon RO Membranes

[Hitachi, Ltd.]

In cooperation with other R&D teams, Hitachi plans to make practical applications of robust nanocarbon membranes and to apply many efficient processes for various water sources. Hitachi is also studying how to achieve energy-saving targets and to get a solution for social implementation.

#### 4. Peripheral and Related Technologies

[Katsuya TESHIMA, Mutsumi KIMURA (Shinshu Univ.) : Toclas Corporation]

This group aims to develop the process of lithium recovery from brine through the use of an ion exchange material, and to develop a water treatment membrane using nanostructure-controlled polymers derived from renewable biomass sources.

#### 5. Water-related Science and Technology

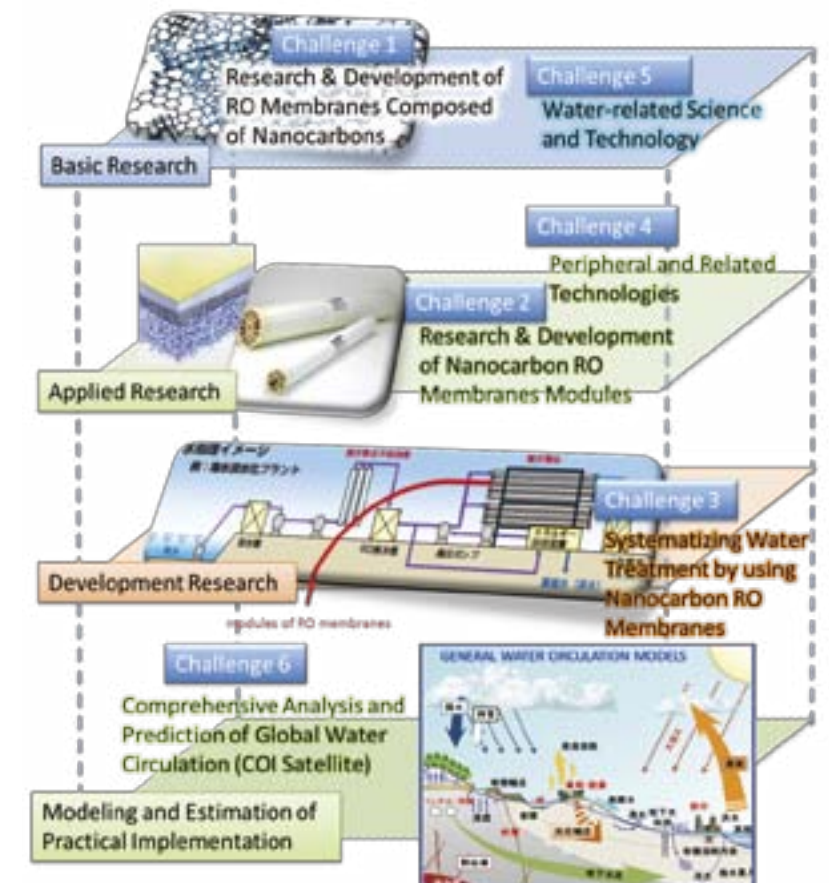
[Takuya HAYASHI (Shinshu University) : RIKEN, RIST]

This team aims to develop molecular dynamics models to clarify the interaction between membrane and atoms or molecules and to help R&D team produce nanocarbon RO membranes, clarifying the underlying phenomena of water molecules passing through the membrane.

#### 6. Comprehensive Analysis and Prediction of Global Water Circulation (COI Satellite)

[Keiko TAKAHASHI (JAMSTEC) : Sony CSL, The University of Tokyo, Chuo Univ.]

COI Satellite aims to develop global water circulation models (ocean, atmosphere and land including underground), computational simulation and predictions to forecast the impact of our innovative water desalination and reclamation systems to global environment.



Concurrent approach on each layer aims to create social system innovations.

### Topics

#### ● High-performance, Multi-functional RO Membranes obtained by CNT-PA Nanocomposite

We have developed High-performance multi-functional RO membranes obtained by carbon nanotube(CNT) and polyamide(PA) nanocomposite. Our phase I (FY2013-FY2015) goal was achieved by this membrane in both salt rejection rates and permeate flux. We also found that these studied parameters were not affected by the chlorine exposure. The present results clearly establish a solid foundation towards basic science and practical application.

#### ● Development of a Primary Treatment Method for Produced Water Using Exfoliated Graphite (EG)

By conducting EG treatment experiments, 100 ppm of oil concentration can be reduced to 0.1 ppm. Our aim is to put the results into practical use as a primary treatment process of produced water, and to reduce oil-containing water, which will therefore enable advanced treatment using various kinds of membrane.

#### ● Characterization of Membrane Structure by TEM and Computer Simulations of Molecular Dynamics

We clarified the structure of the CNT-PA RO membrane by using high resolution TEM (transmission electron microscope), Raman and X-ray photoelectron spectroscopy. At Shinshu university, we also constructed molecular dynamics models to simulate by supercomputer system and clarified how water molecule passes through CNT-PA RO membrane.

### Inquiry

**Global Aqua Innovation Center**

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E-mail : [coi\\_info@shinshu-u.ac.jp](mailto:coi_info@shinshu-u.ac.jp)

International Center for Science and Innovation, Nagano  
(Engineering) Campus, Shinshu University, 4-17-1 Wakasato  
Nagano 380-8553, Japan

[Access] 20 minutes walk from Nagano station(5 minutes by bus)



Project Period : FY2013~FY2021

<http://www.coi.nagoya-u.ac.jp/>

# Innovation Hub for a "Mobility Society"

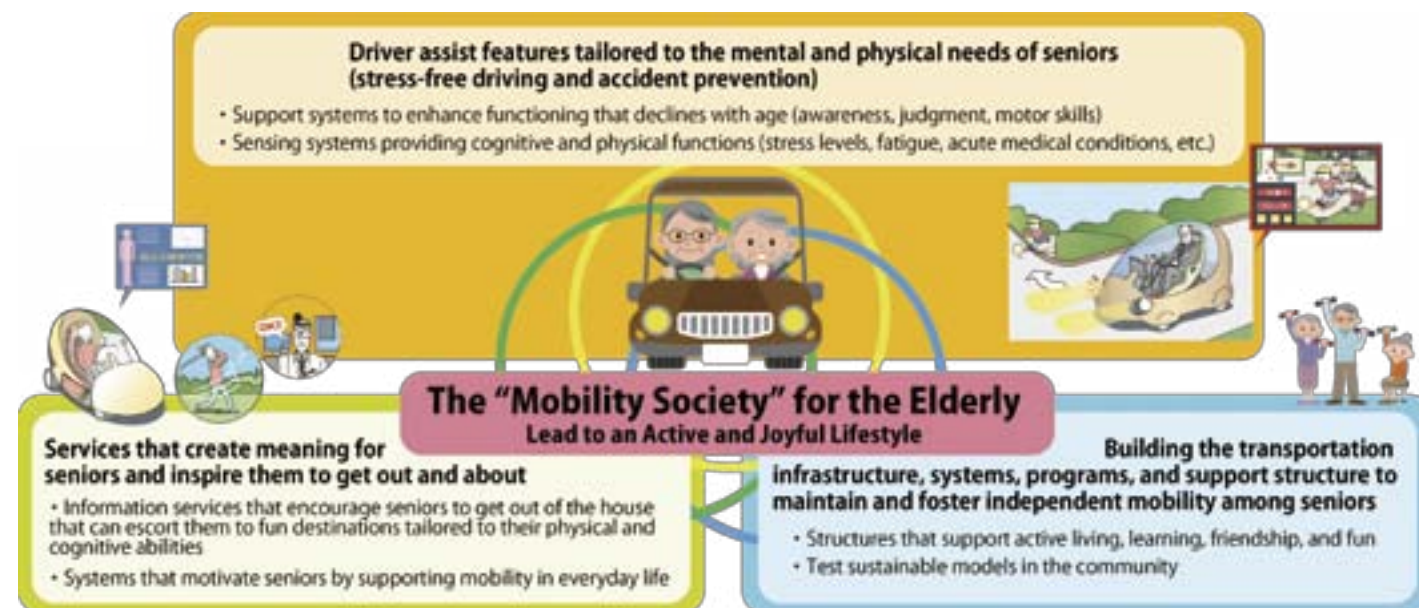
## - Leads to an Active and Joyful Life for Elderly -



**Project Leader**  
**Shigeru Kuroyanagi**

Project General Manager  
Frontier Research Planning Dept.,  
Frontier Research Center  
Toyota Motor Corporation

### The Future



### Outline

In order to realize a sustainable society for the elderly, it is essential for the elderly to have a mobility to interact in a joyful lifestyle without the age, regional and individual differences. One of the implementation approaches is to create active mobility which the elderly can move on their own will. The active mobility promotes their activities and social participation.

Under our program, we aim to realize "The Mobility Society for the Elderly which leads to an Active and Joyful Lifestyle".

Our goal is to implement:

- Vehicle which the elderly feel safe and comfortable to drive.
- Information service to promote the elderly to drive and take part in the events.
- Social structure to encourage the elderly to participate in activities and events.

### Application & Service

**Vehicles that empower seniors facing mental and physical decline by allowing them to drive when they choose, safely and without stress**

Develop artificial driver-assist intelligence that allows seniors to anticipate driving hazards with the skill and accuracy of a driving school instructor

**Programs and devices to support independent living, activities outside the home, and driving skills**

Develop personal concierge services that encourage seniors to be proactive and excited about staying mobile

### Implementation Structure

**Project Leader : Shigeru Kuroyanagi (Toyota Motor Corporation)**

**Research Leader : Takayuki Morikawa (Nagoya University)**

**[Core institution]** Nagoya University

**[Participating institution]** National Graduate Institute for Policy Studies, University of Tokyo, Tokyo Institute of Technology, Tokyo University of Agriculture and Technology, Aichi Prefectural University, Aichi Prefecture, Toyota City, National Institute of Advanced Industrial Science and Technology, Asahi Glass Co., Ltd., Denso Corporation, Toyota Motor Corporation, Toyota Central R&D Labs., Inc., Panasonic Corporation, Fujitsu Limited

**Satellite institution**

Tokyo University of Agriculture and Technology, University of Tokyo

### Key R&D Themes

#### Mobility Division

Conducts research into intelligent mobility, the characteristics of human beings and the aging process, and traffic information systems to (1) establish safe hazard-anticipation driving technologies tailored to personal characteristics and skills, (2) develop driver-assist technologies and software (to prevent cognitive impairment and improve driving skills) optimally tailored to individual drivers and backed by the correlation between visual/cognitive ability and driving characteristics, and (3) develop the basic technologies to set up a cloud-based, real-time dynamic transportation mapping database and use it to control speed and following distance throughout road networks.

#### Information Infrastructure Division

Develops the building blocks for sophisticated monitoring technologies that use signaling data collected from the daily activity patterns of individuals and their surroundings, as well as for utilizing activity signaling data throughout society while protecting privacy. These basic information technologies support the creation of added value by addressing mobility not only in terms of movement through space, but also in terms of the movement of information.

#### Sustainable Infrastructure Division

Puts together databases that use casual sensing technologies (sensors placed in chairs and other areas of seniors' daily living environments) to gain physiological insights including lifestyle information and physical conditions. This department also develops intelligent agents that integrate people and systems. Combining these we aim to create attentive support systems that produce living spaces that help people to feel positive, giving individuals their daily health status and other information to support awareness and discovery in a way that is tailored to their personal values.

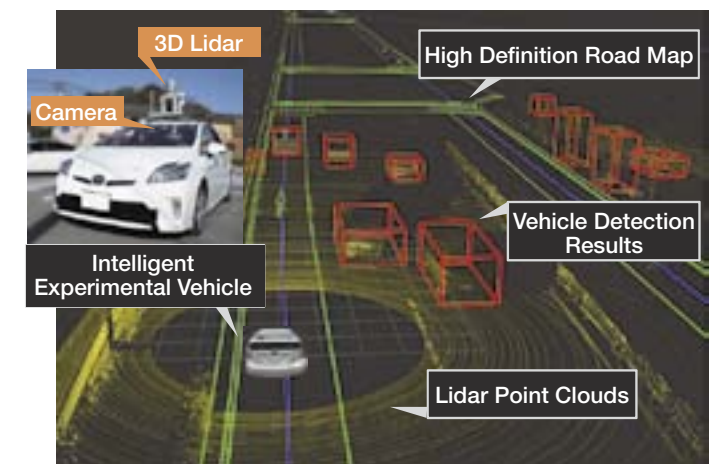
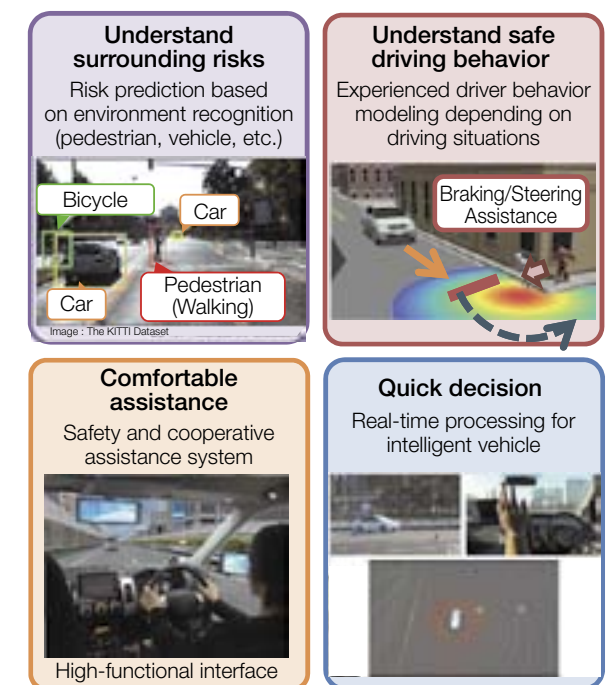
#### Daily Healthcare Infrastructure Division

Creates "Intellectual Glass" : a fully automatic technology that continually monitors health information in a noninvasive way using trace amounts of blood, urine, sweat, tears, saliva, or breath. The system produces dynamic, real-time information on individual health that can be used to support driving.

### Topics

We have succeeded in developing precision maps and positioning technology accurate to 10 centimeters, as well as the information processing speed needed to anticipate hazards while driving (predictive processing of faster-than-real-time data based on driving paths). We have also confirmed that our prototype vehicles can successfully position and process information while driving. These technologies can be combined with moving object detection technologies (developed separately) to ensure a safer, more stress-free driving environment for seniors.

We have developed a sensing device prototype that makes use of casual measurements in living spaces or in vehicles, in addition to providing assistance with daily activities (such as walking and standing) in seniors' homes. This technology is designed to help seniors live more active lives mentally, physically, and emotionally by collecting physical and psychological information and then presenting stimuli and promoting interaction optimized for each individual. The goal is to encourage seniors to get out of the house and keep playing an active role in their communities.



Smart Agent Nagoya Univ. and Panasonic

### Inquiry

**Institute of Innovation for Future Society, Nagoya University**

Tel : +81-52-7476390 Fax : +81-52-7886004

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Furo-cho, Chikusa, Nagoya 464-8601, Japan



Project Period : FY2013~FY2021

<http://coi.kyushu-u.ac.jp/>

# Center for Co-Evolutional Social Systems

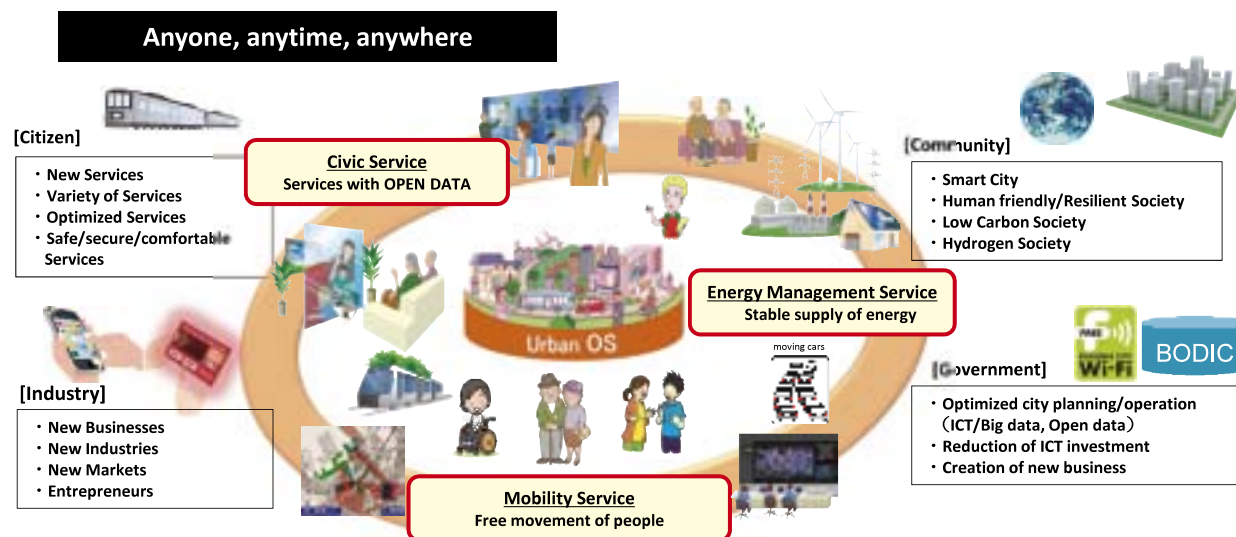
## Urban OS for Smart Community



Project Leader  
**Yoichi Korehisa**

1994 Director, Kyushu Matsushita Electric Research Lab, USA  
2001 CEO, Kyushu Matsushita Electric UK Ltd.  
2005 Director, Panasonic Communications Co., Ltd.  
2007 Managing Director, Panasonic Communications Co., Ltd.  
2013 Project Leader, Kyushu University

### The Future



### Outline

The Center for Co-Evolutional Social Systems (CESS) is aiming to resolve issues related to environmental change, globalization and global population explosion, in order to create social systems that are sustainable and co-evolutional. To put this into practice, the Urban Operating System (OS) is created; this models big data and open data with mathematical methods and performs simulations and optimizations. The Urban OS enables new traffic/energy systems and will be an inspiration for future innovations with the open environments.

### Application & Service

- Next generation transportation system, new energy system  
The Urban OS solves the transportation and energy issues with the optimization features and new devices such as fuel cell and organic EL.
- Platform to create smart community services  
Various kinds of open data/sensor data and analysis technologies of the Urban OS are disclosed to the public so that citizens, governments and enterprises can create new businesses.

### Implementation Structure

**Project Leader : Yoichi Korehisa (Kyushu University)**  
**Research Leader : Masato Wakayama (Kyushu University)**

**[Core institution]** Kyushu University

**[Participating institutions]** Japan Automobile Research Institute, Hitachi Ltd., Institute of Systems, Information Technologies and Nanotechnologies (ISIT), JX Nippon Oil & Energy Corporation, Nissan Motor Co., Ltd., Tokyo GAS Co., Ltd., Hodogaya Chemical Co., Ltd., Konica Minolta Inc., Harima Chemicals Group, Inc., Funai Electric Co., Ltd., Waseda University, Mizuho Information & Research Institute, Nippon Telegraph and Telephone Corporation, Toshiba Machine Co., Ltd., Denso Corporation, Komura-Tech Co., Ltd., Japan Display Inc., Toyobo Co., Ltd., Fukuoka Industry, Science and Technology Foundation (IST), OLM Digital, Inc., Organization for Promotion Academic City by Kyushu University (OPACK), Natural Resources, Energy and Environment Division/ Kyushu Bureau of Economy, Trade and Industry, Hamamatsu Photonics K.K., Seiko Electric Co., Ltd.

**■ Satellite institution**  
**Yokohama National University**  
**Leader : Fumihiko Nakamura**

**[Participating institutions]** The Institute of Behavioral Sciences, Nishi-Nippon Railroad Co., Ltd., Nissan Motor Co., Ltd., Microsoft Japan Co., Ltd., Hino Motors, Ltd., Fujitsu Traffic & Road Data Service Limited, Fuji Xerox Co., Ltd., Esri Japan Corporation, Relations Inc., NAVITIME JAPAN Co., Ltd.

**The University of Tokyo**  
**Leader : Ryuji Matsuhashi**

**[Participating institutions]** Shin-Etsu Chemical Co., Ltd., Shizuoka GAS Company, Ltd., EDION Corporation



### Key R&D Themes

#### 1. Science Technology Innovation Policy Unit : Akiya Nagata (Kyushu University)

Conducts a qualitative and quantitative impact analysis of how developed technologies effect the society, from the standpoint of Science Technology Innovation Policy. Also conducts an analysis and a proposal on social systems and policy design, upon implementation of new technologies in the society.

#### 2. The University of Tokyo (EMS) : Ryuji Matsuhashi (The University of Tokyo)

**[Participating Institutions]** Shin-Etsu Chemical Co., Ltd., Shizuoka Gas Company, Ltd., EDION Corporation

Research on social systems to realize significant energy efficiency improvements, such as the development of energy and economy models which takes the bounded rationality of consumers into consideration, and design and social implementation of the Pay-As-You-Save (PAYS) payment scheme.

#### 3. Yokohama National University(TMS) : Fumihiko Nakamura (Yokohama National University)

**[Participating Institutions]** The Institute of Behavioral Sciences, Nishi-Nippon Railroad Co., Ltd., Nissan Motor Co., Ltd. Mobility Services Laboratory Research Division 2, Microsoft Japan Co., Ltd., Hino Motors, Ltd., Fujitsu Traffic & Road Data Service Limited, Fuji Xerox Co., Ltd., Esri Japan Corporation, Relations Inc., NAVITIME JAPAN Co., Ltd.]

Research and development of Smart and Multi Modal Mobility systems, through utilizing urban redesign schemes based on the Urban OS; with taking people, knowledge and culture into consideration.

#### 4. Platform Unit : Rin-ichiro Taniguchi (Kyushu University)

**[Participating Institutions]** Japan Automobile Research Institute, Hitachi Ltd., Institute of Systems, Information Technologies and Nanotechnologies (ISIT) ]

Research Institute, Hitachi Ltd., Institute of Systems, Information Technologies and Nanotechnologies (ISIT)

Research and development of an Urban OS platform, comprising the cyber physical system, a collection of large quantities of data, and an integration/analysis of big data /open data.

#### 5. Mathematics for Industry Unit : Yasuhide Fukumoto (Kyushu University)

**[Participating Institutions]** Nippon Telegraph and Telephone Corporation, OLM Digital, Inc.]

Research on graph search for the Urban OS, construction of a large-scale graph processing system utilizing a mathematical optimization library, and a research on visualization/next generation cypher technologies which incorporates methods of mathematics for industry.

#### 6. Energy Unit : Kazunari Sasaki (Kyushu University)

**[Participating Institutions]** JX Nippon Oil & Energy Corporation, Nissan Motor Co., Ltd. EV System Laboratory Research Division 2, Tokyo GAS Co., Ltd.]

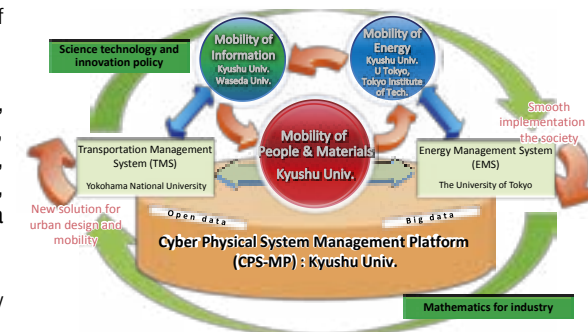
Establish a technology platform of materials, devices and systems for fuel cells to achieve higher durability, higher efficiency and higher power.

Development and systematization of innovative core technologies, and evaluation schemes that may be implemented to societies in various forms. Research of social models for mobility of energy.

#### 7. Information Device Unit : Chihaya Adachi (Kyushu University)

**[Participating Institutions]** Konica Minolta Inc., Komura-Tech Co., Ltd., Japan Display Inc., Denso Corporation, Toshiba Machine Co., Ltd., Toyobo Co., Ltd., Harima Chemicals Group, Inc., Funai Electric Co., Ltd., Hodogaya Chemical Co., Ltd., Mizuho Information & Research Institute, Fukuoka Industry, Science and Technology Foundation (IST), Waseda University, Institute of Systems, Information Technologies and Nanotechnologies (ISIT), Hamamatsu Photonics K.K.]

Research and development of next generation information devices and new applications, such as the flexible organic EL panel.



### Topics

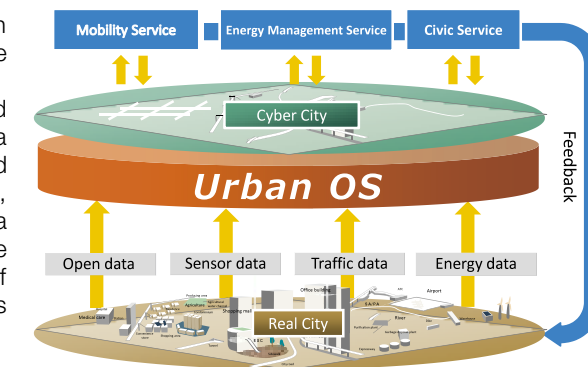
The center develops the Urban OS to resolve issues related to the urban regions and its societies. Urban issues are analyzed and countermeasures are evaluated.

The Urban OS is an ICT platform that performs analysis and simulation, based on mathematical approaches which incorporates a variety of real world data such as that of transportation and energy, in order to efficiently solve real world issues. The center has been collecting a variety of data for the Urban OS, constructing BODIC (Big Data Open Data in the Cloud) and developing a prototype for the demonstration tests. For example, demonstration tests have already started using sensor networks and fuel cells at the Ito campus of Kyushu University. Feasibility studies for the implementation and arrangements including legal systems will also be conducted.

### Cooperation with local communities

The center has been closely working with local governments and communities, such as those of Fukuoka City and Yokohama City. For example social implementation and tests have been planned, utilizing "The Green Asia International Strategic Comprehensive Special Zone" which has been specified, as well as the Fukuoka prefecture and Kitakyushu city.

Also the research results will be utilized for the next generation transportation systems promoted by the Fukuoka Directive Council. The center is also working in cooperation with the "Fukuoka City Smart Community Creation Council" for research studies and testings to build a smart city. U-Tokyo satellite(EMS) has been conducting demonstration testings for the Japanese version of the green deal in Simokawa town, Hokkaido.



### Inquiry

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