COI STREAM

COI 2021
Center of Innovation
2021年は今、つくられる。

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

MEXT MINISTRY OF EDUCATION, CULTURE, SPORTS, SCIENCE AND TECHNOLOGY-JAPAN

JST Japan Science and Technology Agency

“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

The COI Program aims to establish an innovation platform through industry-academia collaboration, and to realize radical innovation that is difficult for industry and academia to accomplish on their own.

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

Three Visions of COI STREAM

Vision 1 Secure sustainability as a country advanced in its aging population and declining birth rate : Smart Life Care, Ageless Society
Key concepts (function):Medical health, Mental health, Motivation, Sports, Food, Ties ⇒Realization of happiness

Vision 2 Create a living environment with a high quality of life as a prosperous and reputable country : Smart Japan
Key concepts (function) : 勘 (intuition) ing thinking, Active thinking, Serendipity, Six senses ⇒Innovative thinking method

Vision 3 Establish a sustainable society with vitality : Active Sustainability
Key concepts (function):(Personalization, Resilience, Sustainability, Functionalization,Flexibility) - Waste
⇒Development of a durable town for centuries

Backcasting

Identify multi and/or interdisciplinary R&D challenges

JST — **Visionary Leader** / **Assistant Visionary Leader**: Evaluation and management of the COI sites.

Research Promotion Institution

Act as a research headquarters, create a strategic management plan

Project Leader (from industry)
: Supervise the overall management of COI sites and their R&D activities.
Research Leader (from academia)
: Responsible for the day-to-day operation of the headquarters of COI sites and support of R&D strategy planning.

COI site

Industry Municipality — Research Division, Business Division

Academia — Researchers

Under One Roof

Satellites

Satellites

The activities of COI Sites are managed thorough resources from industry as well as support from MEXT/JST.

Management of the COI Program

COI STREAM Governing Committee

【Set the visions and design fundamental policies】

Chairman

Hiroshi Komiyama
Chairman of the Mitsubishi Research Institute, Inc.

Joichi Ito
Director of the MIT Media Lab.

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.

■ **Main Themes**
- Promotion of collaboration between COI sites on the use of health and medical data [COI Health and Medical Data Collaboration Organization]
- Promotion of success of next generation human resources
- Response to regulations that may pose obstacles to R&D and social implementation
- Structuring review of collaboration between COI sites and of social issues
- Sharing of sensing technology and promotion of collaboration, etc.

■ **Member**
Koichiro Eto, Senior Research Scientist, National Institute of Advanced Industrial Science and Technology
Yuya Kajikawa, Professor, School of Environment and Society, Tokyo Institute of Technology
Atsushi Sunami, Vice President, Professor, National Graduate Institute for Policy Studies
Kazuhiko Takeuchi, Director and Project 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, Project associate professor, Graduate School of Engineering, The University of Tokyo
Sakiko Yoshikawa, Director/ Professor, Kokoro Research Center, Kyoto University

Senior Visionary Leader
Ryozo Nagai
Jichi Medical University President

Deputy Senior Visionary Leader
Masaaki Mizuno
Nagoya University Assistant president

COI STREAM Structuring Team

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 Hakko Kirin Co., Ltd.

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

Visionary Team member
Masafumi Nogimori
Former Chairman of Astellas Pharma, Inc

Vision 2

Visionary Leader
Satoshi Koike
CEO, Vegitalia, Inc.

Visionary Team member
Hideaki Koizumi
Honorary Fellow, Hitachi, Ltd.

Visionary Team member
Atsushi Hasegawa
President, Concent, Inc.

Vision 3

Visionary Leader
Junichi Sato
President of the Japan Federation of Engineering Societies

Visionary Team member
Shinji Asakura
Former General Manager, GE International Inc.

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

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

Koji Shimizu Professor, Kyoto university
Miwako Doi Auditor, NICT
Yuji Furui Project Assistant Professor, The University of Tokyo

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Vision 1

CHAIN
Revolution in life expectancy

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 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 1

COI Kyoto Univ.

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

Bright Future for All Ages with Health Innovation by Daily Exercise
Ritsumeikan University
PL : Takahide Tanaka(OMRON HEALTHCARE Co., Ltd.)
RL : Tadao Isaka(Ritsumeikan University)
Participating institution →p.17

Vision 2

OSAKA UNIVERSITY COI SITE

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

CESS
Center for Co-Evolutional Social Systems

Center for Co-Evolutional Social Systems
Kyushu University
PL : Shinya Ishihara (NTT WEST CORPORATION)
RL : Masato Wakayama (Kyushu University)
Participating institution →p.41

Vision 3

Mobility Innovation Center
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 Univesity
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

COI TOHOKU

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 : Iwao Waga (NEC Solution Innovators, Ltd.)
RL : Tomokazu Matsue (Tohoku University)
Participating institution →p.11

Vision 1

東京大学COI 自分で守る健康社会

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

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 : Koshi Yamamoto (JVCKENWOOD Corporation)
RL : Masaaki Miyasako (Tokyo University of the Arts)
Participating institution →p.21

Vision 2

HAPIC

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

COINS

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

Vision 2

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

Visionary Leader
Satoshi Koike

Vision 3

Establish a sustainable society with vitality : Active Sustainability

Visionary Leader
Junichi Sato

Project Period : FY2013～FY2021 ※Executed as trial FY2013～FY2014 https://www.fmi.hokudai.ac.jp/coi/

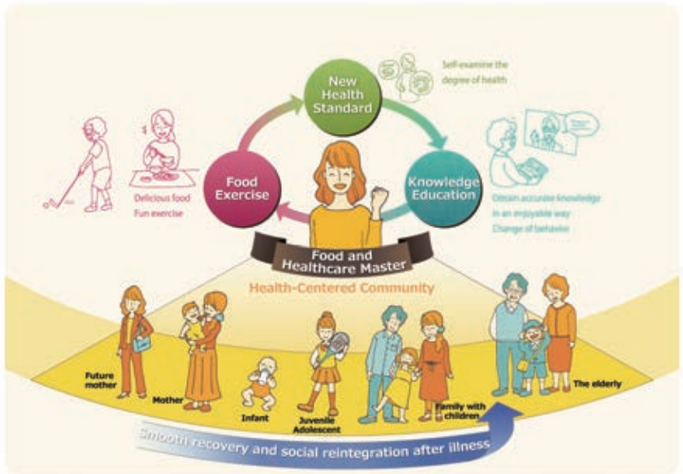
Innovative Food & Healthcare MASTER

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

Research Leader
Akiko Tamakoshi
Professor, Graduate School of Medicine, Hokkaido University
Graduate of the School of Medicine, Nagoya University and Nagoya University Graduate School of Medicine Professor in the Department of Public Health, Hokkaido University, Faculty of Medicine since 2012.

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 excercise. 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.

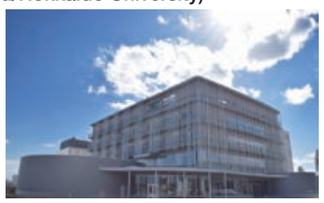
Application & Service

- 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., Daiichi Kishimoto Rinsho Kensa Center, K.K., Tsuruha Holdings, Inc., TechnoSuruga Laboratory Co., Ltd. Data Horizon Co., Ltd., Nakamura Gakuen University, Nitto Denko Corp., Biosensor, Ltd., Hamanasu Information Co., Ltd., Hitachi Maxell, Ltd., BAKE Inc., 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


Global Research Center for Food & Medical Innovation (FMI)

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., Renaissance Inc.

Kitasato University Satellite
Satellite Leader : Hiroshi Odaguchi (Kitasato Univeristy)
【Participating institution】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

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), Ide (Kyushu University), Tanita Corp. and more
Kampo diagnostic: Odaguchi (Kitasato University)
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, sleep, oral muscle, 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

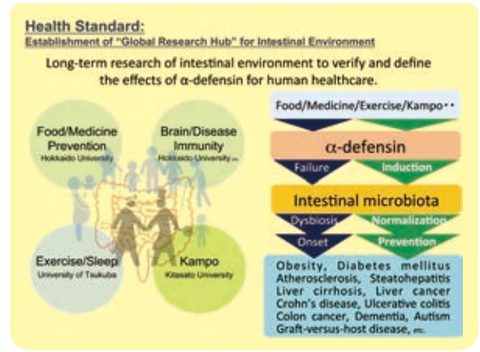
[Food: Miyashita (Hokkaido University), Takeda (Hokkaido University), Isoda (University of Tsukuba), Morinaga Milk Industry Co., Ltd. and more
Exercise: Okura (University of Tsukuba), Renaissance Inc. and more]
Development of food materials and products as well as exercise programs in order to improve the health status indicated by the “new health standard”.

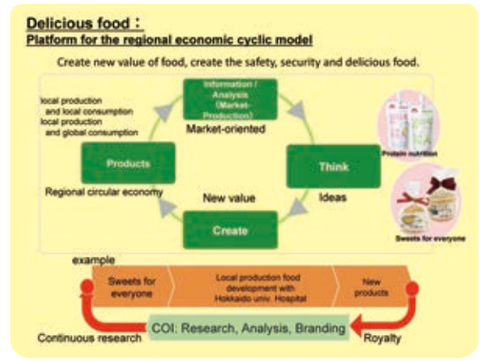
4. Health-centered community

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

①Maternal and Child Health Research Program
We have started “Maternal, Baby and Child Study” at Iwamizawa City from April, 2017.
The study will be based on information about lifestyle habit, and specimens such as stool, urine, and breast milk to be provided from mothers during pregnancy to postpartum, and also their child. The results will be returned to the mothers together with advices for health.

②Establishment of the “Healthcare Center” by Iwamizawa city and Hokkaido University
We have opened “Kenko-Hiroba” where people gather to enjoy and care their health, in April, 2017. To measure babies' weight and height, and they can also participate in various lectures.
Following lectures are scheduled to take place:
・Luncheon lecture for women
・Meeting your grandchildren: Lecture for future grandpas and grandmas
・On-site physical exercise
・Lecture about health
Through these activities, we are developing “Health-centered community”.

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)

～ Organization² 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 : +81-11-706-9602 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

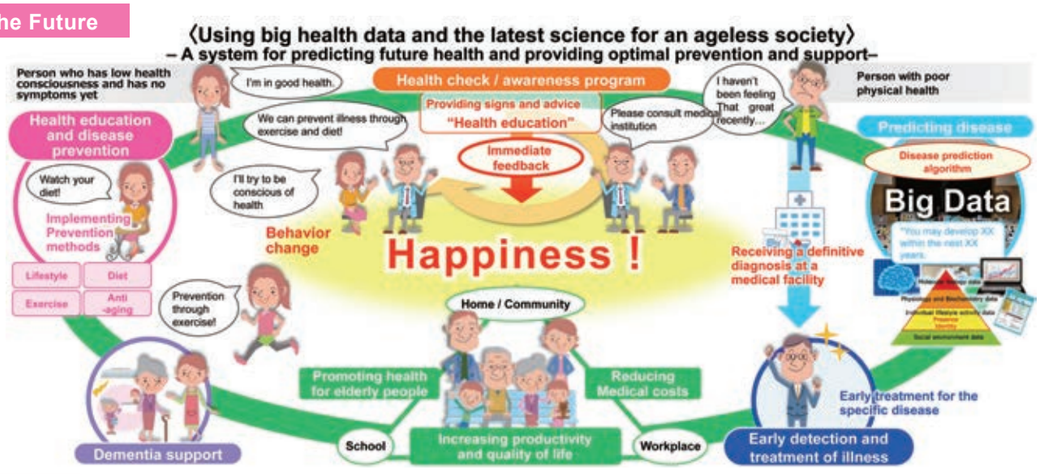
Maruman Computer Service Corp.
1979- Oki Electric Industry Co., Ltd.
1982- Nihon System CO., Ltd. (Establishment officer)
1991- Maruman Computer Service Corp.

Research Leader

Shigeyuki Nakaji

Specially-appointed Professor, Department of Social Medicine, Hirosaki University Graduate School of Medicine
2004-2017 Professor, Department of Social Medicine, Hirosaki University Graduate School of Medicine
2012-2016 Dean, Hirosaki University Graduate School of Medicine

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 for smartphones**
  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, Kyoto University, University of Tokyo, The Institute of Medical Science, The University of Tokyo,Nagoya University, Maruman Computer Service Corp., GE Healthcare,TOHOKU CHEMICAL Co., Ltd., TechnoSuruga Laboratory Co., Ltd., Eiken Co., LTD., AEON Retail CO.,LTD., KAGOME CO., Ltd., Nippon Telegraph and Telephone East Corporation, Eisai Co.,Ltd., Kao Corporation, National Agriculture and Food Research Organization, KYOWA HAKKO BIO CO.,LTD., Lion Corporation, OMRON HEALTHCARE Co., Ltd., Benesse Corpolation., Sysmex Corpolation, Hokkaido System Science Co., Ltd., Life Science,Inc., Human Metabolome Technologies Inc.Japan, CO -OP Insurance Consumers' Co-operative Federation, Kracie Holdings, Ltd., Lawson, Inc., Rakuten, Inc., AXA Life Insurance Co.,Ltd., Aomori Prefectural Government, Hirosaki City Government,Aomori Industrial Technology Center.

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

【Participating institution】Kyoto Prefectural University of Medicine, Chuo University, Keio University, Kyoto Prefectural University, SHIGAKUKAN University, Future University Hakodate, Tokushima University, Doshisha Women's College of Liberal Arts,RFnetworks Corporation, Bank of Kyoto, Ltd., Sansho Shoji Co., Ltd., Murata Manufacturing Co., Ltd., Cisco Systems, Inc., Benesse Style Care Co., Ltd., IIJ Global Solutions Inc., Sumitomo Mitsui Trust Bank, SECOM CO., LTD., Dai Nippon Printing Co., Ltd., Sumitomo Electric Industries, Ltd., SUMITOMO FORESTRY CO., LTD., Fubright-communications inc., Mizuho Information & Research Institute, Inc.

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., NIPPON TELEGRAPH AND TELEPHONE EAST CORPORATION, Eisai Co., Ltd., Kao Corp., KYOWA HAKKO BIO CO. LTD., National Agriculture and Food Research Org., Lion Corp., OMRON HEALTHCARE Co., Ltd., Sysmex Corp., Hokkaido System Science Co., Ltd., Life Science Institute, Inc., Human Metabolome Technologies, Inc.]

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 20, 000 people, examining 2,000 items per person). The "Hisayama Study" is a highly-accurate, ongoing epidemiological study that has been carried out by Kyushu University for more than 50 years. This study involves the residents of Hisayama Town in Fukuoka Prefecture (Approximate population of 8,400 people) investigating 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., TechnoSuruga Laboratory Co., Ltd., Eiken, AEON RETAIL CO., LTD., KAGOME CO., Ltd., Kao Corp., KYOWA HAKKO BIO CO.,LTD., LION CORPORATION, OMRON HEALTHCARE Co., Ltd., Benesse Corporation,INC., CO･OP]

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

[Satoaki Matoba and 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 regional bank: educational methods for regional 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

◆ **Establishment of "Center for Promoting Healthy Aging" attached to Aomori Medical Association**

Center for Promoting Healthy Aging was established on April 1st, 2015. As a core organization for health promotion in Aomori prefecture, the center conducts health promotion and intervention activities and trains "Health Member" to run these activities. We will assist social and behavioral change of Aomori residents to improve healthy life expectancy and create a new social infrastructure. We aim to expand this new social infrastructure to other areas of Japan as Aomori model.

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

◆ **"Big data analysis team"**

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.

◆ **Development of a new health checkup program**

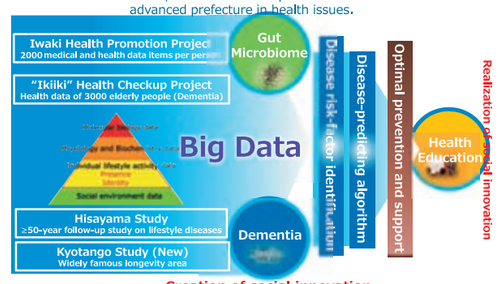
To be aware of healthy everyday life, Hirosaki University and participating institutions are cooperatively working on to develop a new health checkup program which is characterized by providing health knowledge based on the result of a health checkup. We will further brush up the program in order to disseminate to domestic and to the world.

◆ **New health promotion facility**

On February 2016, Hirosaki University was adopted as a project of the Ministry of Education, Culture, Sports, Science and Technology, and created and named the organization "健康未来イノベーションセンター" (Future Health Innovation Center) that consolidates health promotion functions. In 2018, we will set up a new facility where COI participating institutions will meet together and create new industries for revitalization of local communities.

Using big data to predict and prevent disease

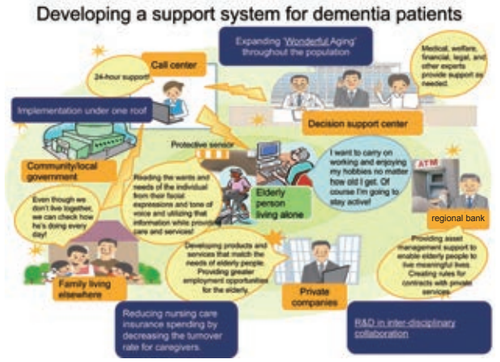
Our research field, "the shortest-life prefecture" Aomori is an advanced prefecture in health issues.



Creation of social innovation

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

Developing a support system for dementia patients



Core organization of social implementation "Center for Promoting Healthy Aging" started

※Correspond to Aomori prefecture health management certification system

Inquiry

Hirosaki University
COI Research Initiatives Organization
Tel : +81-172-39-5538 Fax : +81-172-39-5205
E-mail : coi@hirosaki-u.ac.jp

5 Zaifu-cho Hirosaki city, Aomori Prefecture, JAPAN, 036-8562
[Access] From 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
Iwao Waga
Professional Fellow, NEC Solution Innovators, Ltd.
Until 2004, R&D and Business development missions, General Manager of VALWAY Technology Center NEC Soft. Project Director of Business Innovation Unit, NEC Corporation. From 2014,Director of Innovation Laboratories, NEC Solution Innovators. 2017 Visiting Professor and Project Leader of Tohoku University COI STREAM

Research Leader
Tomokazu MATSUE
Professor, Graduate School of Environmental Studies, Tohoku University.
1981: Ph. D. Pharmaceutical Institute, Tohoku University. 1999- Professor of Graduate School of Engineering, Professor of Graduate School of Environmental Studies, Professor of WPI-AIMR, Tohoku University 2014- Deputy-Director, COI STREAM Research Promotion Institution & Research Leader of Center of Innovation, Tohoku University

The Future

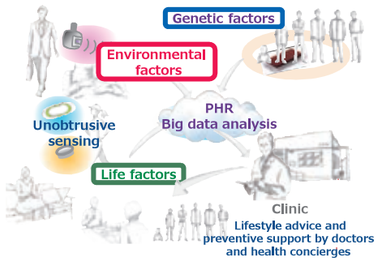
202X – A typical Morning in the GENKI Family Household

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, Allergy sensor, oral cavity bacteria sensor, Physiological Balance Sensing
- 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



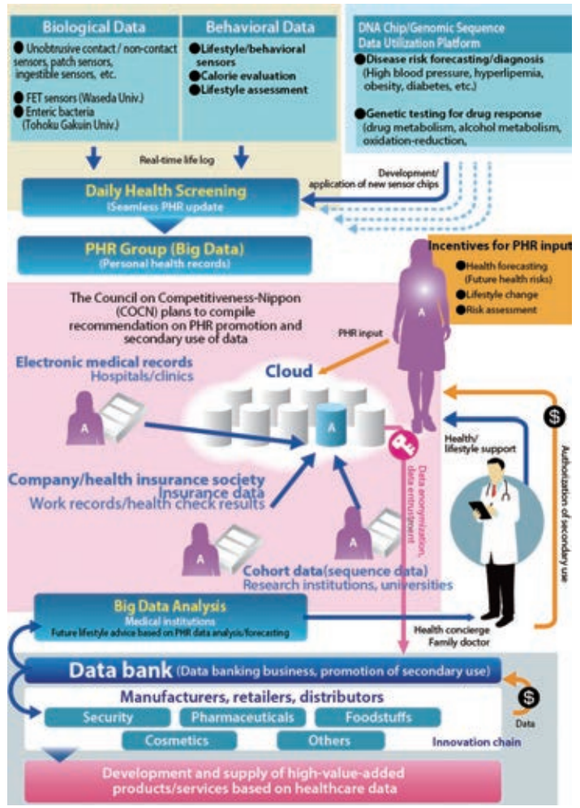
Organization

Project Leader : Iwao Waga (NEC Solution Innovators, Ltd.)
Research Leader : Tomokazu Matsue (Tohoku University)

【Core institution】Tohoku University,
【Participating institution】Toshiba Co., Ltd. , Nihonkoden Co., Ltd. , Omron Healthcare Co., Ltd. , NEC Solution Innovators Co.,Ltd
【Participating institution】Riken Genesis Co., Ltd. , Toppan Printing Co., Ltd. , Right Mfg. Co., Ltd., ADVANTEST CORPORATION, Naigai TEC Corporation, JNS.Co.,Ltd.

Satellite leader (institution) : Masatoshi Nakazawa (Tohoku Gakuin University) Dean of the Engineering
Kazuaki Utsumi (Waseda University) Guest Professor

Core Project



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 / Shuji Tanaka
[Satellite research leaders] 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

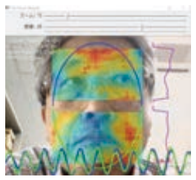
- Accumulate and integrate diverse and multi-layered data seamlessly together with genome information, conduct big data analysis of the information, and develop a platform that allows PHR services to be linked
- Develop various types of services to promote changes in behavior that can further raise the 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

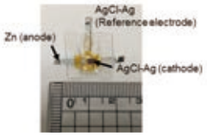
Topics

Prototyping of sensing devices

- **Intelligent mirror:** Technologies for non-contact measurement of pulse wave and blood pressure fluctuations, and for tessellated display of blood circulation status, were developed aimed at social implementation as a health management display.
- **Health glasses:** A wearable, spectacle-type image projection and detection device was developed, for signal detection based on an ocular fundus model of the reflectivity level of the human retina.
- **Photoacoustic sensor:** A resonating photoacoustic sensor has been further modified, achieving successful detection of glucose in test samples.
- **Swelling sensor:** A method combining biocompatible sensor patch material and bioelectric sensor technology was found to be capable of measuring localized swelling, for which no suitable measurement method currently exists.
- **Ingestible sensors:** A micro-battery was designed and prototyped, adopting a silicon MEMS structure. It is aimed at making a battery small enough for use in ingestible sensors.
- **Physiological Balance Sensing:** Monitoring stress at bed side. It detects signal from three stress markers by using an aptamer-immobilized FET sensor.



※Intelligent mirror: tessellated display of blood circulation status

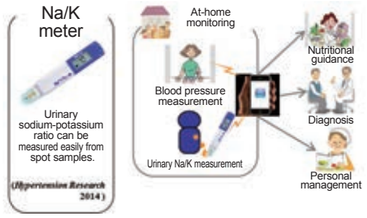


※Micro-size model of battery

※4-channel monitoring system for FET biosensor

Expansion of verification trials

- Verification trials in Shichigahama Town, Miyagi Prefecture are making significant progress in efforts to establish and promote as evidence the indicators and values obtained by Na/K meters, and to reduce the number of hypertension patients.



- Test results using the Japonica Array are steadily increasing, helping to accelerate understanding of how genetic factors relate to predisposition and disease risk.
- In consultation with local municipalities, plans are going forward for verification trials of corporate-promoted mimamori ("watching after") services, and of smart furniture and other sensor-using research and development projects taking place at the COI Tohoku Site.

Consortium Establishment

- The COI Tohoku Consortium was established to accelerate social implementation through the involvement of candidate corporations for social implementation. By building a large business and industry structure made up of multiple universities and corporations, the aim is to go from consortium-created business ventures to achieving social innovation.

Inquiry

Center of Innovation, Tohoku University
Center for Promotion of Innovation Strategy,
Head Office of Enterprise Partnerships, Tohoku University
Tel : +81-22-752-2186 Fax : +81-22-752-2189
E-mail : promo-innov@grp.tohoku.ac.jp

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

Project Period：2013FY～2021FY

http://park.itc.u-tokyo.ac.jp/slcas-coi/en/index.html

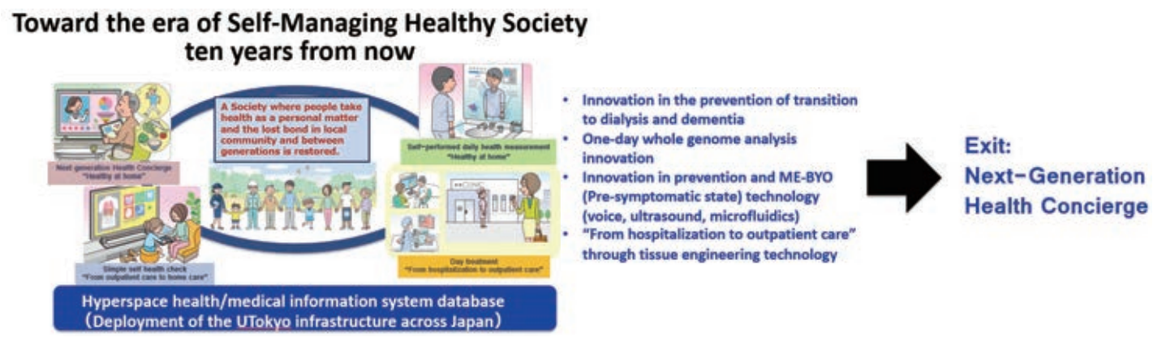
Self-Managing Healthy Society

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

Project Leader/Director
Tomihisa Ikeura
Former Adviser to Mitsubishi Chemical Holdings Corporation

Research Leader/Deputy Director
Ung-il Chung/ Yuichi Tei
Professor, Graduate Schools of Engineering and Medicine, The University of Tokyo

The Future



Outline

Japan, facing the world's most rapidly-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 system for prevention, diagnosis and therapy that drastically decreases hospitalization and outpatient visits and a new health/medical guidance service based on scientific evidence to promote health at home. The University of Tokyo Center of Innovation (COI) has the following features: 1) the graduate schools of medicine, engineering, science and pharmaceutical 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 a 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.

Organization

Project Leader/Director: Tomihisa Ikeura (Former Adviser to Mitsubishi Chemical Holdings Corporation)
Research Leader/Deputy Director: Ung-il Chung/Yuichi Tei (Professor, Graduate Schools of Engineering and Medicine, The University of Tokyo)
【Core institution】The University of Tokyo
【Participating institutions】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, Eisai Co., Ltd., Habitus Care Inc., IBM Japan, Ltd., PST Corporation, Inc., MEDICAL & BIOLOGICAL LABORATORIES CO., LTD., Nippon Sogo Systems, Inc., TANITA CORPORATION, CHUGAI PHARMACEUTICAL CO., LTD., OLYMPUS CORPORATION, Nihon Chouzai Co., Ltd., TOKYU DEPARTMENT STORE CO., LTD.

Core Projects

Group 1. 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】

Group 2. Visualization of Health Risk- Collaboration with Kanagawa Prefecture’s ME-BYO (Pre-symptomatic State) Project -

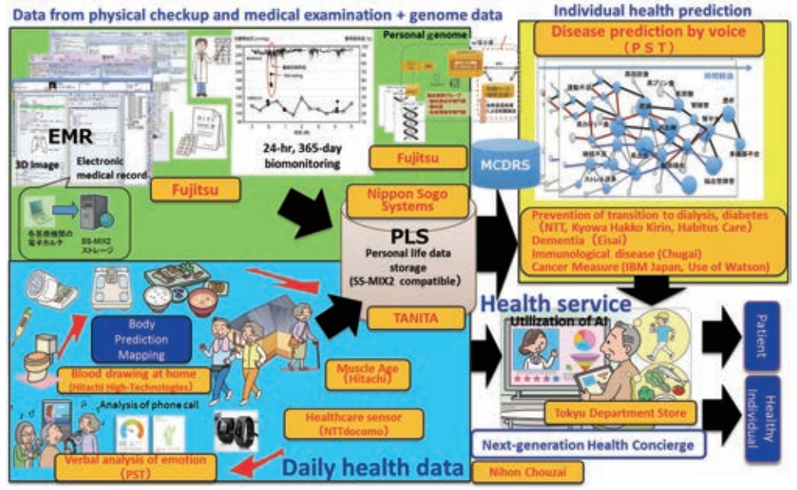
2-1 Establishment of ME-BYO (pre-symptomatic state) evidence and prediction of personal health
【Tsutomu Yamazaki (The University of Tokyo Hospital)】
2-2 Prevention and ultra-early diagnosis by verbal analysis of pathophysiology
【Shinichi Tokuno (Graduate School of Medicine, The University of Tokyo), 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 】

Group 3. Disease Prevention Measures

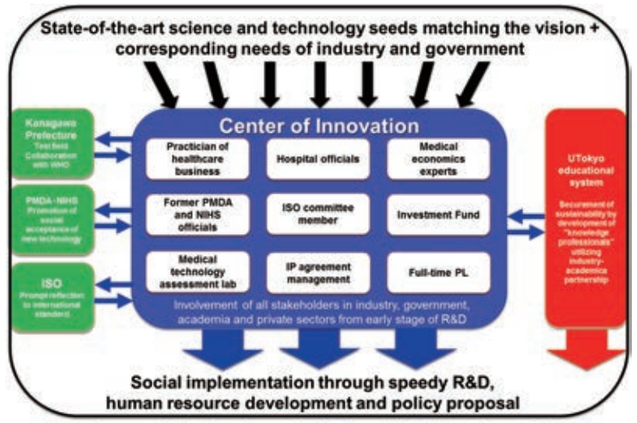
3-1 Prevention of diabetes utilizing ICT
【Kayo Waki (The University of Tokyo Hospital), Nihon Chouzai・Tokyu Department Store】
3-2 Immunological Disease Measures
【Keishi Fujio (The University of Tokyo Hospital), Chugai Pharmaceutical】

Group 4. Medical Technology Innovation

4-1 Development of day treatment technologies utilizing the Health Technology Assessment Laboratory
【Ichiro Sakuma, Shu Takagi (Graduate School of Engineering, The University of Tokyo), Olympus・Toshiba Medical Systems】
4-2 Pluripotent stem cell-based cancer treatment
【Mineo Kurokawa (Graduate School of Medicine, The University of Tokyo), Kyowa Hakko Kirin】
4-3 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】



1. To make the most of the research and clinical resources and the comprehensive strength of the University of Tokyo, we will establish the Social Implementation Promotion Group, aiming at the social implementation of these achievements.
2. We will 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 will develop risk prediction applications that promote behavior changes in individuals and aim at reforming the social system through collaboration with the government. In parallel, we will organize the “Healthy Long Life Loop Society” to serve as a field for inter-program and inter-business collaboration.
   We will also partner with municipal governments and companies to realize a society that helps take health maintenance as a serious personal matter (JIBUNGOTO).
4. We will utilize the Medical Technologies Evaluation Lab to develop globally competitive innovative medical technology.



Contact
The University of Tokyo Center of Innovation (COI)
Self-Managing Healthy Society
Tel : 03-5841-1656 Fax : 03-5841-7798
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/

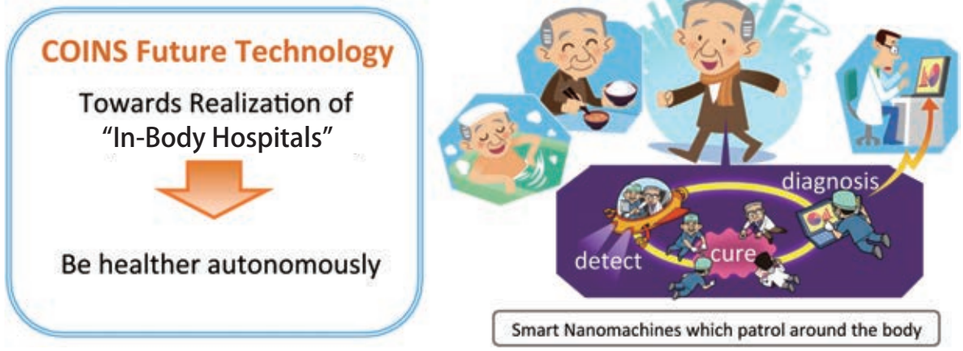
Center of Open Innovation Network for Smart Health (COINS)

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

Project Leader
Hiromichi Kimura
KAWASAKI INSTITUTE OF INDUSTRIAL PROMOTION
In 1979 Kyowa Hakko Kogyo
In 1986 Vice President of J.P. Morgan
In 1989 President and CEO of Pharmacia Biotech K.K.
In 1998 President and CEO of Monsanto Japan Ltd.

Research Leader
Kazunori Kataoka
KAWASAKI INSTITUTE OF INDUSTRIAL PROMOTION
Graduate School of Engineering・Graduate School of Medicine, The University of Tokyo, Successive occupation, Professor Emeritus of the University of Tokyo

The Future



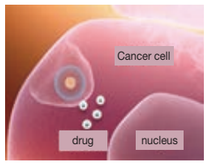
"In-Body Hospitals (internal body hospital)" was introduced as one of the concepts that leads the future nanotechnology on international scientific journal “Nature Nanotechnology”.
Nat.Nanotech. 11,828-834 (2016) Published online 05 October 2016

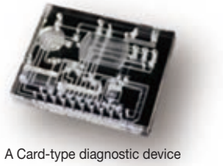
Outline

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

- 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 devicer





A Card-type diagnostic device

Implementation Structure

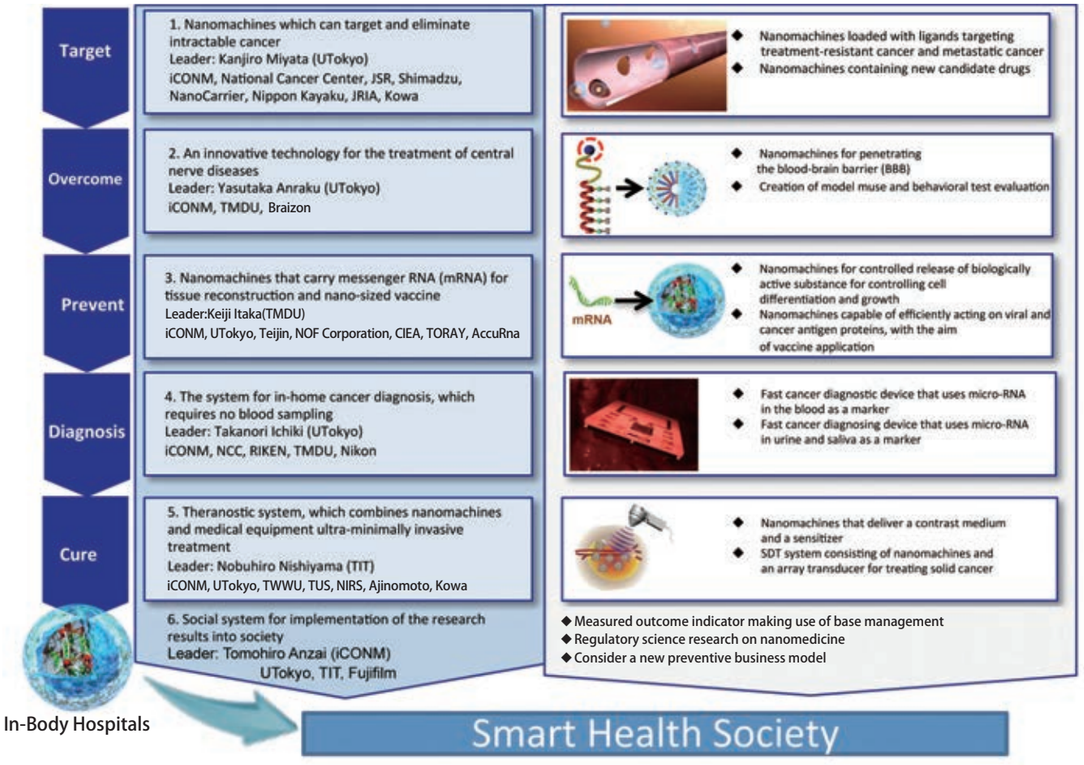
Project Leader : Hiromichi Kimura
(KAWASAKI INSTITUTE OF INDUSTRIAL PROMOTION)
Research Leader : Kazunori Kataoka
(KAWASAKI INSTITUTE OF INDUSTRIAL PROMOTION)

【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, Tokyo University of Science, National Cancer Center, National Institutes for Quantum and Radiological Science and Technology, RIKEN, Medical Industry Innovation Institute, Central Institute for Experimental Animals, Japan Radioisotope Association, AccuRna Inc., Ajinomoto Co., Ltd., Kowa Company Ltd., Shimadzu Corporation, JSR Life Sciences Corporation, Teijin Limited, Toray Industries, Inc., NanoCarrier Co., Ltd., Nikon Corporation, NOF Corporation, Nippon Kayaku Co., Ltd., Fujifilm Corporation, Braizon Therapeutics Inc., Kanagawa prefecture, Kawasaki city

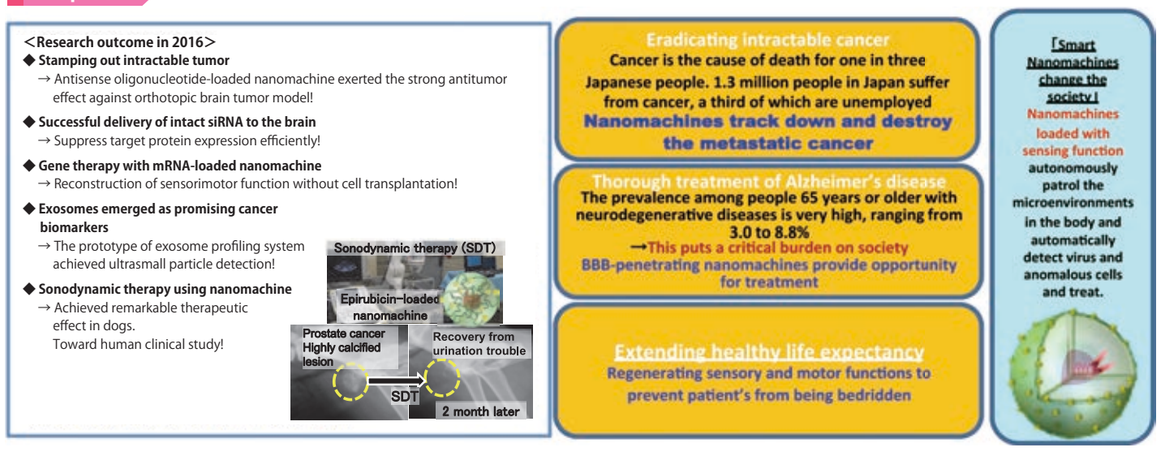
◇In operation◇
- Innovation Center of NanoMedicine (iCONM)
- Life Science & Environment Reserch Center
- Central Institute for Experimental Animals
- Fujifilm RI Pharma Co., Ltd.
- Create Medic Co., Ltd.
- Johnson & Johnson Tokyo Science Center
- Japan Radioisotope Association
- Life Innovation Center

◇Moving to the site◇
- Daiwa House Industry Co., Ltd.
- JSR Life Sciences Corporation
- Kawasumi Laboratories, Incorporated
- National Institute of Health Science
- CYBERDYNE Inc.
- PeptiDream Inc.

Key R&D Themes



Topics



-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 has an excellentlocation 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 INDUSTRIAL 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
Takahide Tanaka
Omron Healthcare Co., Ltd.
Technology Development HQ
Senior General Manager
Managing Officer

Mr. Tanaka began his career at Omron Life Science Corporation (currently Omron Healthcare Co., Ltd.) in 1985. He is involved in the product development of sphygmomanometers and other devices. He was promoted to Executive Officer in 2010, and to Senior Executive Officer in 2016.

Research Leader
Dr. Tadao Isaka
Ritsumeikan University College of Sport and Health Science Dean and Professor

Dr. Tadao Isaka received his Doctorate in Engineering from Ritsumeikan University. Following his work as a professor at Ritsumeikan University’ s College of Science and Engineering and as a guest researcher at the University of Texas, he began working at his current position in 2016.

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 : Takahide Tanaka (OMRON HEALTHCARE Co., Ltd.)　Research Leader : Tadao Isaka (Ritsumeikan University)
Satellite Leader : Eiki Kominami (Juntendo University)
【Core institution】Ritsumeikan University
【Satellite institution】Juntendo University
【Participating institution】Shiga University of Medical Science, OMRON HEALTHCARE Co., Ltd., TOYOBO CO.,LTD., Panasonic Corporation, Daiwa House Industry Co.,Ltd, HIGASHI OSAKA STADIUM., Ltd., Hitachi, Ltd.,, Nippi. Inc., Kao Corporation, TOKYU LAND CORPORATION, Togo Institution Service Co.,Ltd.

Key R&D Themes

1. The Practical Application of Smartwear

Naruhiro Shiozawa
(College of Sport and Health Science, Ritsumeikan Universty)
OMRON HEALTHCARE Co., Ltd.
TOYOBO 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 Health and Sports 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

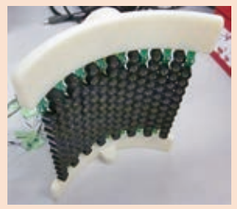
Eri Hirasawa (Graduate School of Medicine, Juntendo University)
Nippi. Inc. Hitachi, Ltd., TOKYU LAND CORPORATION,
Togo Institution Service Co.,Ltd.

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. Smartwear is drawing closer to practical application as underwear through the use of biometric sensors and conductive paste wiring. Not limited to the measurement of biological data during exercise, we has also conducted a demonstration test in which drowsiness was detected while wearing the underwear during long distance driving. In the future, we are also considering using the underwear for predictive testing during rehabilitation following the onset of heart disease.

2. We have conducted the social implementation experiments of space-sharing technology at athletic facilities equipped with ultrasonic speakers possessing strong directionality and linearity. By sharing and dividing the exercise space by sound, we realized effective utilization of space and time, and succeeded in creating a place in which multi-generation can communicate.



3. The activities to identify persons at risk of locomotive syndrome began with persons working at urban department stores in the cities of Shiroi, 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
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[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

Realize “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.

Research Leader
Hidetoshi Kotera
Graduate School of Engineering, Kyoto University Professor
1982-1993 Matsushita Electric Industrial Co., Ltd
2000-2012 Professor of Graduate SchoolofEngineering, Kyoto University2012-2013 Executive Vice President of Kyoto University

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 disaster, and release anxiety of energy, 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

- **Support system for mental and physical health of women, expectant and nursing mothers**
  Health support system for release anxiety of women, expectant and nursing mothers, which connect doctors or midwives using quantitative indicators by sensors.
- **Supplement developing tool for judging effects and side effects of supplement**
  Supplement developing tool which differentiation cultivates iPS cell in organ function call, and can be judged by cell level.
- **Walking assist robot for rehabilitation of obstacle patients by cerebral infarction**
  Walking assist robot which easily attach by sensor having internal, and walking convalescent effect follows by learning effect.
- **Cordless infrastructure system**
  Cordless infrastructure system which supply with microwave to mobility charging and sensor of vital, volcanic observation, accident rescue and preventive maitenance.

Organization

Project Leader : Tsuyoshi Nomura (Panasonic Corporation)
Research Leader : Hidetoshi Kotera (Kyoto University)

【Core institution】Kyoto University
【Participating institution】Panasonic Corporation, ARKRAY, Inc., OIKE & Co., Ltd., Konica Minolta Inc., SUNCALL Corporation, SHO ENGNEERING K.K., Daicel Corporation, HORIBA, Ltd., Unicharm Corporation Kyoto College of Nursing, Kyoto Institute of Technology, Kyoto Prefecture, City of Kyoto, Town of Seika, Dai Nippon Printing Co., Ltd., Takeda Pharmaceutical Company Limited., Techno Smart Corp., TOYOBO CO., LTD., Fujipream Corporation, Plascoat Co., Ltd., Mitsubishi Heavy Industries, Ltd., MinebearMItsumi Ltd.

International Science Innovation Building

Core Project

1. Support for mental and physical health of women and children

Konica Minolta Inc., Unicharm Corp.
Daicel Corp.
Masako Myowa, Nobuya Inagaki, Kazuyoshi Nakabe, Motofumi Suzuki, Toru Sato, Miho Egawa (Kyoto Univ.)
Yoko Chiba (Kyoto College of Nursing)

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

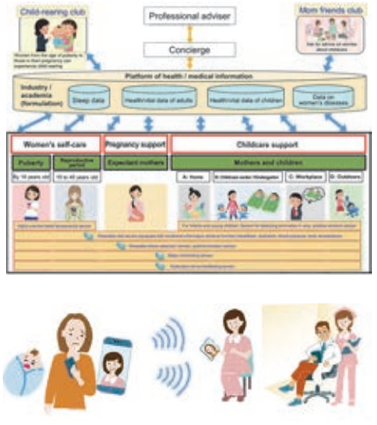
Panasonic Corp., ARKRAY INC.
Tadao Tsuboyama, Nobuya Inagaki, Yusuke Arima
(Kyoto Univ.)

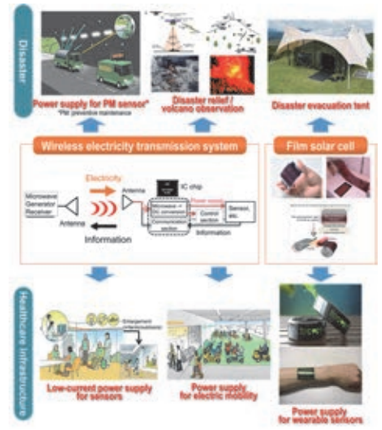
Through developing scientific evaluation tool of supplement and walking assist robot, we realize healthy and peaceful society for elderly from child.

3. Disaster-resilient infrastructure

SHO ENGINEERING K.K.,
Oike & Co., Ltd.,
HORIBA, Ltd.
Naoki Shinohara, Atsushi Wakamiya
(Kyoto Univ.)

Through developing various wireless electricity transmission system and film solar cell, and collaborating other fields, we realize peaceful society which supply electricity anytime, anywhere, and even disaster.





Topics

1. We started demonstration experiment of various **wireless electricity transmission system** at Town of Seika using “National Strategic Special Zones”

1) Wireless charge to electric assist bicycle. (start on 7 Mar. 2017)

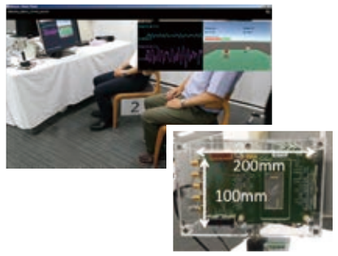
2) Wireless electricity supply to battery less sensor (start on 26 May 2017)

2. We started proof field in Town of Seika. We had demonstration experiment of clock type vital sensor by cooperating citizens in 2016.

3. We succeeded monitoring of neutron therapy (BNCT) by “**Compton camera**” in the world for the first time, and started venture from Kyoto University.

4. We released “application for toilet training” which **encourage to apart from child’s diaper by** based on developmental science

5. In developing non-contact heartbeat measurement by a millimeter wave radar, we realized to measure **multiple people at same time** and miniaturize.



Inquiry
Research Promotion Institution for COI Site, Kyoto University
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E-mail : 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/

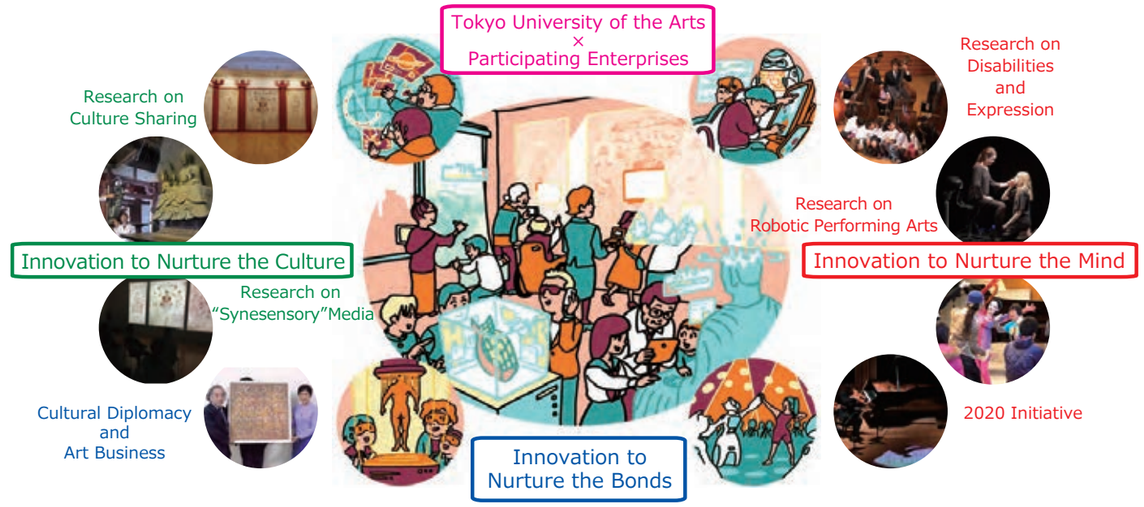
Creating Innovation for “Synesensory” through Inspirational Arts and Science & Technology

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

Project Leader
Koshi Yamamoto
JVCKENWOOD Corporation
General Manager, Branding, Advertising & Publicity Department
After engaging in consumer audio design and product planning at KENWOOD, he worked on growth strategies including M&As and business integrations at the Corporate Planning Department of KENWOOD, and he is currently engaged in branding strategies.

Research Leader
Masaaki Miyasako
Tokyo University of the Arts
Professor, Graduate School of Fine Arts
Director, Public Collaboration Center
He is a Japanese-style painter and has held numerous solo exhibitions both in Japan and overseas. As part of new initiatives to preserve cultural properties, he received a patent for “Clone Cultural Asset,” and is currently engaged in the restoration of various lost cultural properties.

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 : Koshi Yamamoto (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, Ogawa & Co., Ltd.

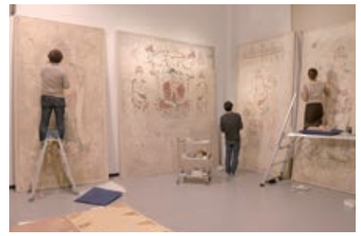
Arts & Science LAB.

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),
Takashi Fukai (Professor, Faculty of Fine Arts, Tokyo University of the Arts),
Yuichiro Taira (Project Associate Professor, Public Collaboration Center, Tokyo University of the Arts),
Benesse Holdings, Inc., NHK Promotions Inc., Takeo, The Asahi Shimbun,
Ogawa & Co., Ltd.

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 Kiriyama (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),
Takenobu Chikaraishi (Project Assistant Professor, Public Collaboration Center, Tokyo University of the Arts)
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.

6. The 2020 initiative

Isao Matsushita (Vice President, Tokyo University of the Arts/Professor, Performing Arts Center)
Rui Ogawa (Project Associate Professor, Public Collaboration Center, Tokyo University of the Arts)
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.

Disabilities and the Arts 2014

Topics

① 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.

② Clone Cultural Asset of Myanmar’s Bagan archeological site, one of the three greatest Buddhist sites in the world, were displayed at Myanmar’s National Museum (Nay Pyi Taw) as part of its public collection. The Clone Cultural Asset were reproduced using patented technology for reproducing cultural property, which was awarded the 21st Century Invention Encouragement Prize in the 2017 National Commendation for Invention by the Japan Institute of Invention and Innovation. It is hoped that this will contribute to the development of the tourism industry and to the reconstruction of disaster-stricken areas of Myanmar.

Inquiry
Tokyo University of the Arts
COI Research Promotion Office
Tel : +81-50-5525-2032 Fax : +81-3-5685-7761
E-mail : kenkyo@ml.geidai.ac.jp

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

Project Period：2013FY～2021FY ※Executed as trial FY2013~FY2014 URL:http://www.coi.titech.ac.jp/

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

Recognize the atmosphere, measure the empathy, and connect people

Project Leader
Dr. Shigeyuki Akiba
Director, Collaborative Research Center for Happiness Co-Creation Society through Intelligent Communications
He joined KDD Corp. in 1976.
Former President & CEO, KDDI R&D Labs., Inc.

Research Leader
Dr. Shunri Oda
Professor, Tokyo Institute of Technology
1979 Research Associate,Tokyo Tech
1986 Associate Professor, Tokyo Tech
1995 Professor, Tokyo Tech

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 lines. We call such a 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.

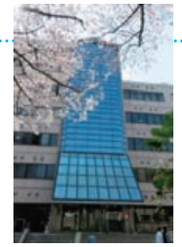
Application & Service

- **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.
- **New tele-existence communication:** 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.
- **Innovative space for new co-creation as a liaison between people:** New types of work will evolve through a novel scheme which connects people by identifying common intention and promotes empathy in the shared work place.

Organization

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, LAPIS Semiconductor Co.,Ltd., Littlesoftware Inc., Ricoh Company, Ltd., Information Services International-Dentsu, Ltd., Sony Corporation, 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**



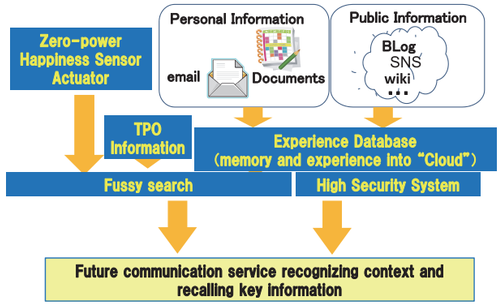
Ookayama Campus Ishikawadai Bldg.1

Core Project

1. “Future communication service recognizing context and recalling key information”

[Hitoshi Wakabayashi, Manabu Okumura, Kayoko Nohara (Tokyo Institute of Technology), KDDI Research, Littlesoftware Inc., etc.]
We aim to realize new type of future communication services. Those services will bring us revolutionary heart-to-heart communications. With happiness Sensor, we will help those having miscommunication by giving them some appropriate information timely. This way, everyone will have heart-to-heart relationships.

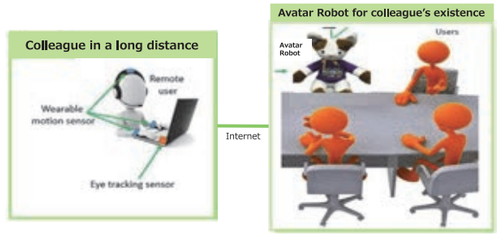
- Experience database and fuzzy search technology for recognizing context and recalling key information
- Vital data analysis such as predicting emotions from sensing data.
- High-security technique for information transfer and high speed network such as Body Area Network (BAN)



2. “New tele-existence communication”

[Shoichi Hasegawa (Tokyo Institute of Technology), Ricoh, etc.]
New tele-existence communication gives the feeling to other members as if you are in the same space.

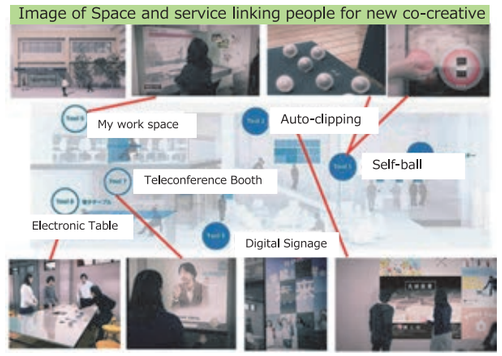
- Avatar robot with motion sensors and eye-tracking gives your existence to other people in a conference.



3. “Innovative space for new co-creation as a liaison between people”

[Yoshihiro Miyake, Takako Yoshida (Tokyo Institute of Technology), Fuji Zerox, etc.]
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.

- Visualization technique of empathy in communications and method to vitalize people in communities



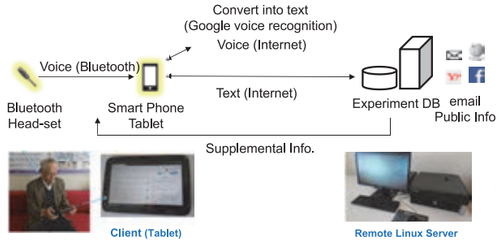
4. Zero-Power Happiness Sensors and Actuators as core technologies

[Hitoshi Wakabayashi (Tokyo Institute of Technology), LAPIS Semiconductor, etc.]
We realize methods of real time detection for emotions : empathy and troubles.

- Happiness sensor technology, such as EEG and 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.

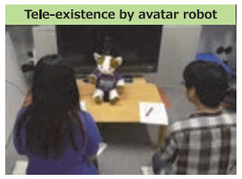
Topics

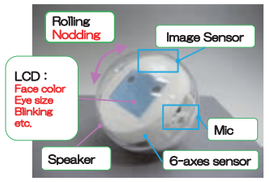
(1) Fuzzy Search Technology
We are making a trial model of fuzzy search system based on experience database. In particular, we have prototyped a fuzzy search device by combination of a tablet device and a bluetooth headset to conduct a performance evaluation, and so on.



(2) Avatar Robot
We prototyped an avatar robot synchronized with the movement of conference participants in remote. Also, we observed that people interacted better at the conference thanks to this robot.

(3) Self-ball
We prototyped a ball-type device “Self-ball” which expressed his motion with color. He also blinks his eyes and nods his head. It will help people establish emotional connections. During the demonstration experiment, we will see how this device builds empathy among persons or groups that are in the same space.





Inquiry
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Collaborative Research Center for Happiness Co-Creation Society through Intelligent Communications
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E-mail : coi.info@coi.titech.ac.jp
2-12-1, Ookayama, Meguro-ku, Tokyo, 152-8550, Japan
[Access] 10-minute walk from Ookayama Station on the Tokyu Lines

Project Period：FY2013～FY2021

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

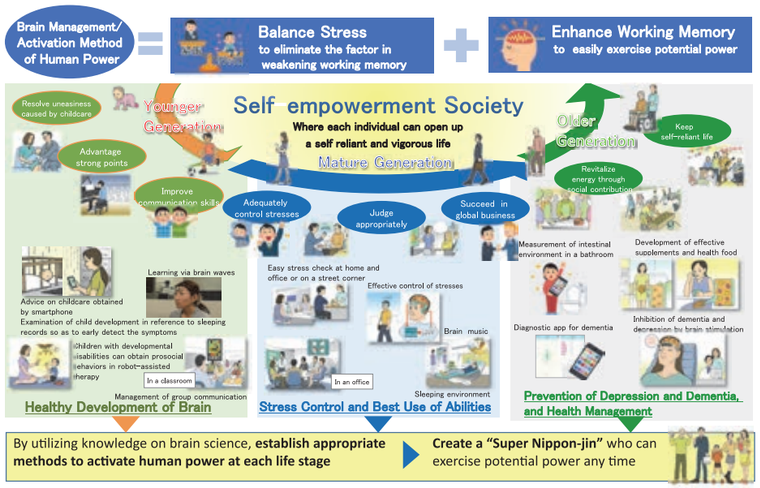
COI Site to develop a "Super Nippon-jin" by activating human power

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

Project Leader
Takeshi Uenoyama
Advisor, Panasonic Corporation
1981 Joined Panasonic
2008 Executive Officer
2013 Fellow
2017 Current position

Research Leader
Kazuhiko Matsumoto
Professor, The Institute of Scientific and Industrial Research (ISIR) / Osaka University
1981 Joined ETL/MITI
2001 Chief Researcher, AIST
2003 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, Hamamatsu University School of Medicine, Chubu University, Kansai Medical University, Hokkaido University, Fuji Women’s University, Ritsumeikan University, Doshisha University, imec international, Hitachi, Ltd., SHOWA DENKO K.K., CEMEDINE Co., Ltd., KANEKA Corporation, NIPPON MEKTRON, LTD., DAIKIN INDUSTRIES,LTD., MEDINET, FINE JAPAN CO., LTD., CRIMSON TECHNOLOGY, Inc., NISSIN KASEI CO.,LTD., SHINKO Manufacturing Co., Ltd., Yamaha Corporation, JSOL Corporation, NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc., Ricoh Co., Ltd., PI-CRYSTAL INC., MSI.TOKYO, Inc., Brains Corporation, FIRST SYSTEM Co., Ltd., TANAKA SHOJI INC., LTD., SCREEN Holdings Co., Ltd., TOHO KASEI CO., LTD., ORGANO CORPORATION, Evidence Finder’s Club, BrainShare Inc.,

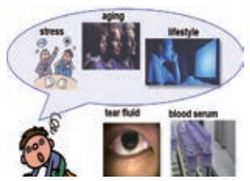
Satellite institution : Kanazawa University
Satellite Leader : Yoshio Minabe（Kanazawa University）
【Participating institution】Osaka University, The University of Tokyo, Hamamatsu University School of Medicine, Kanazawa Institute of Technology, University of Fukui, National Center of Neurology and Psychiatry, PFU Limited, Ricoh Co., Ltd.

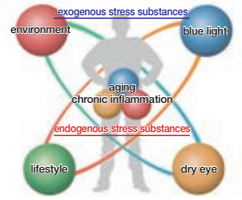

ISIR, Osaka Univ. (Incubation Research Building)

Key R&D Themes

1. Stress biomarker search and stress substance detection technologies

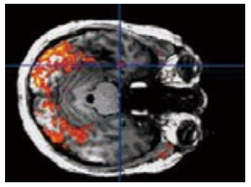
Leader: Koji Nishida (Graduate School of Medicine, Osaka Univ.)
(MEDINET, FINE JAPAN, Panasonic, etc.)
The stress is one of the big factors to inhibit the human activation.
We search for the most suitable stress biomarker that is detectable even from a small amount of tear and blood. Simple detection methods to quickly measure stress substances and intestinal flora improvement to enhance the immunity are also developed.

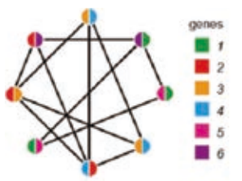




2. Brain function imaging and modeling of neural network

Leader: Takahisa Taguchi (NICT･CiNet) (Panasonic, Hitachi, etc.)
Installing state-of–the-art 7T-fMRI, we try to 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 as the analogy.



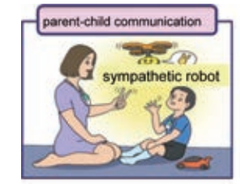


3. Imperceptible wearable sensors and activation devices

Leader: Kazuhiko Matsumoto (ISIR, Osaka Univ.) (imec, SHOWA DENKO, CEMEDINE, KANEKA , NIPPON MEKTRON, etc.)
For appropriate treatment after evaluating the stress, it is required to monitor brain waves, etc. We perform medical inspection for state-of–the-art wearable sensors and develop imperceptible wearable devices. Integrated devices are also developed to activate brain by music or by transcranial direct current stimulation (tDCS) monitoring brain waves.

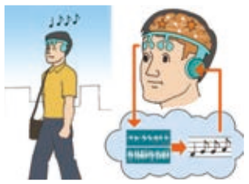
4. Quantification of and activation by communication

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 personal activation degree, or stress level, in associated with the brain status.



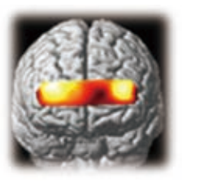
5. Deep sleep and brain music for activation

Leader: Masako Taniike (Graduate School of Medicine, Osaka Univ.)
(DAIKIN, Yamaha, CRIMSON TECHNOLOGY, etc.)
Since the sleep has significant effects on the human activity, we try to estimate both quality and quantity of sleeping and to provide pleasant sleep with environmentally optimizing sound, temperature, etc. We also study on the activation by auditory stimulation, that is, automatic composition of the most suitable music contents according to the brain status.



6. Child mental development with respecting diversity

Leader: Yoshio Minabe (Research Center for Child Mental Development, Kanazawa Univ.) (PFU, Ricoh)
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 tDCS, superconducting sensors for advanced MEG and human-robot interaction are now in progress.



Topics

①Intestinal Flora
Yacon, a local specialty of Toyono/Osaka, attracts attention for improving immunity. We identified inulin as an active ingredient for good bacteria and developed the extraction method. By securing the supply route, the condensed powder and the functional food will be on sale. The anti-fat and immunity enhancement effects are now explored.

②Brain Music
A headset-type EEG sensor integrated with headphone is newly developed. Based on AI technology, brain waves while listening to music are recorded under machine learning automatically to compose original music which changes a user’s feelings. Applications to music therapy, entertainment, etc. are expected.

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
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.

Research Leader
Shigeto Yamawaki
MD, Ph.D Distinguished Prof., Hiroshima Univ.
1979: Graduate from Hiroshima Univ. School. of Medicine.
1990: Prof. of Psychiatry & Neuroscience, School of Medicine, Hiroshima Univ.
2017: Distinguished Prof., Hiroshima Univ.
Major in Psychiatry, Neuroscience of Depression and KANSEI

The Future

Outline

At the Center of KANSEI Innovation, we develop BEIs (Brain Emotion Interfaces) that enriches inter-human and object-human relations connected by KANSEI with a combination of state-of-the-art brain sciences, optical technology, and information communication technology. Our mission is to exploit products and services in various fields such as clothing, food, housing, vehicles, household electrics, education, and medical care that nurture its mental values as their usage. Leading to innovation in the inter-human and object-human relations, we aim to create a society full of happiness where “objects” are in harmony with our “minds”.

Application & Service

- **Wearable and real-time KANSEI meters based on brain science**
  - Facilitates “heartful” life and society with our meter (sensing devices) that can comfortably read out our KANSEI in daily life.
- **Products and services accurately reflect users’ trait and instantaneously responds to KANSEI information in real time**
  - Nurtures their own values with attachment just like a lifelong partner.
  - Provides KANSEI communication services to allow your feelings to be passed to your family members and acquaintances at a distance.

Implementation Structure

Project Leader : Takahide Nouzawa (Mazda Motor Corporation)
Research Leader : Shigeto Yamawaki (Hiroshima University)
【Central organization】Hiroshima University
【Participating organizations】National Institute of Advanced Industrial Science and Technology, Hiroshima City University, Andersen Group, Kobelco Construction Machinery Co., Ltd., Sapporo Holdings, TOPPAN PRINTING Co., Ltd., HIROSHIMA GAS Co., Ltd, TOTO Ltd., Mazda Motor Corporation, Mitsubishi Chemical Corporation, and Mitsui Chemicals, Inc.

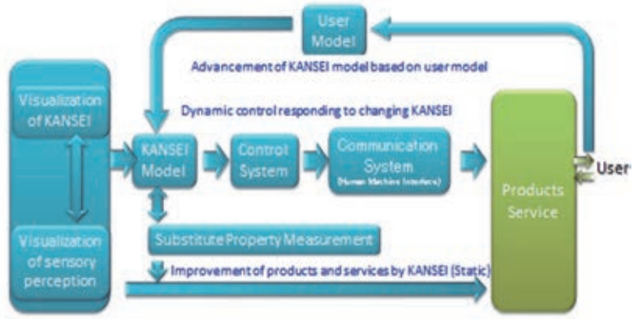
■ Satellite institution : National Institute for Physiological Sciences
Satellite Project Leader: Ippei Hagiwara
(NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, INC.)
Satellite Research Leader: Keiji Imoto
(National Institute for Physiological Sciences)
【Participating organizations】National Institute of Natural Sciences, NIPS, Yokohama National University, Kyoto University, NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc., NTT DATA Corporation, Oki Electric Industry Co. Ltd., Takenaka Corporation, and Tokai Optical Co., Ltd.

■ Satellite institution : Innovative Photonics Evolution Research Center
Satellite Project Leader: Tsutomu Hara
(Hamamatsu Photonics K. K.)
Satellite Research Leader: Shoji Kawahito
(Shizuoka University)
【Participating organizations】Shizuoka University, Hamamatsu University School of Medicine, The Graduate School for the Creation of New Photonics Industries, Hamamatsu Photonics K. K., Pulstec Industrial Co., Ltd., Brookman Technology, Inc., Honda Electronics Co., Ltd., and Yamaha Motor. Co., Ltd.

Key R&D Themes

Definition of KANSEI

We define KANSEI as a state of higher brain functions that monitor and predict affective responses evoked by comparing the exteroceptive and interceptive sensory information by referring to ones past experiences and memories at a higher level.



R&D Themes

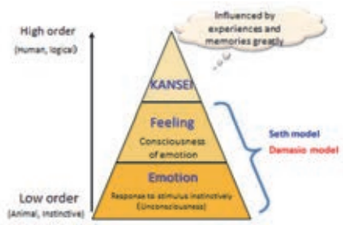
It is essential to exploit research in visualization of KANSEI for the social implementation of BEIs as well as develop various technologies including visualization of perception, alternative measures, mathematical models, controlling systems, human machine interfaces, and user models.
These technologies need to be developed collaboratively, but not independently. To accomplish this, we have formed sub-committee groups where researchers of related themes work together for the social implementation.

Major R & D Examples

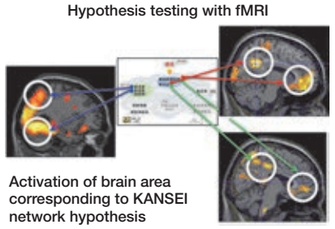
1. Visualization of KANSEI Hiroshima University & Mazda Motor Corporation

Based on a model of emotion (Seth, *Trends Cogn. Sci.*,2013), KANSEI brain network is hypothesized as a higher order network over the emotional and feeling networks. We develop the KANSEI visualization technologies through examining the hypothesis by experimentations with MRIs or EEGs. Built prototypes of BEI, we purposefully advance social implementation of our research outcome.

Hypothesis for KANSEI brain network based on Seth’s model



Hypothesis testing with fMRI



Activation of brain area corresponding to KANSEI network hypothesis

2. Sensory perception visualization NIPS, Mazda Motor Corporation etc.

We aim to visualize sensory information by examining brain mechanisms of five perceptual senses. Furthermore, such sensory perception visualization technology is to be applied to various products and services by investigating the relationship between sensory perception and KANSEI as well as by building models for the technology of senses visualization.

Application of ‘saliency map’ to evaluate visual attention at the windshield

Focusing of saliency with window frame

3. Substitute property measurement Shizuoka University , Brookman Technology, Inc., etc.

We aim to develop a camera sensoring device such as a high-sensitive, wide and dynamic range image sensor to measure alternative features associated with KANSEI such as capturing facial expressions even under drastic environmental changes where luminosity changes from daylight brightness to nighttime darkness.

Topics

Example of social implementation

We built a COI prototype vehicle by utilizing our study outcome. Evaluating the prototype vehicle, to-be-solved issues for its social implementation have been identified and shared across each research theme group to accelerate R&D toward the social implementation.

COI prototype vehicle

BEI prototype in vehicle

Real-time visualization of a state of “Waku-Waku”*

*A state of mind of being happily excited

Inquiry

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Tel : +81-82-257-1737 Fax : +81-82-257-1723
E-mail : 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.

ResearchLeader
Yoshihiro Ohba
Director, Vice-president of Yamagata University (in charge of intellectual property, enrollment management, admission, social responsibility)

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., KONICA MINOLTA, INC., ZEON CORPORATION, KANEKA CORPORATION, Mitsubishi Heavy Industries, Ltd., Lumiotec 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)


Frontier Center for Organic Materials


Smart MIRAI House (smart-future house)

Key R&D Themes

1. Creating a Pleasant Life-Style

[Prof. Junji Kido (Yamagata Univ.), Dai Nippon Printing, Sekisui House, NEC Lighting,KONICA MINOLTA, ZEON, KANEKA, Mitsubishi Heavy Industries, Lumiotec,KEN OKUYAMA DESIGN, ITO Electronic, NEC, PARAMOUNT BED, Tohoku University of Art and Design, Sendai National College of Technology]

1-1. Comfortable Lighting and Space
Innovative technologies such as highly efficient organic LEDs (OLEDs), transparent and flexible OLEDs, and well-controlled lighting systems with circadian rhythm to create a pleasant life-style.

1-2. Wall Display
Ultra slim, super light and flexible displays that are wall-mountable.

1-3. ICT System for Good Sleeping
Advanced ICT system infrastructures capable of enriching quality of sleep for a more vibrant life style.

1-4. Organic Photovoltaic System
Ultra light, flexible and transparent organic solar cells for novel applications.

1-5. Food Process Innovation
Novel technologies for creating healthy food utilizing OLED plant cultivation and low-temperature dehumidification drying.

2. Creating Self-Sustaining Health Care for a Long and Healthy Life

[Prof. Shizuo Tokito (Yamagata Univ.), Prof. Masaru Tanaka (Yamagata Univ./Kyushu Univ.),Toray Engineering, JSR, Yokogawa Electric, SATO HOLDINGS, DIC, Sony, Otsuka Chemical, Piolax Medical Devices, Sumitomo Rubber Industries, AIST]

2-1. Organic Biosensors
Stress sensors capable of detecting physiologically active substances included in saliva or sweat with a high degree of sensitivity.

2-2. Organic Sensing System
New printing process technologies that can combine FET sensors and wireless communication circuits on super-thin films to create new wearable sensors.

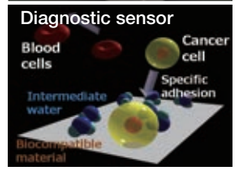
2-3. Smart Device Printer
Roll-to-roll printing process and equipment for manufacturing electronic devices with highly accurate ink-jet printing and self-assembled line formation technologies.

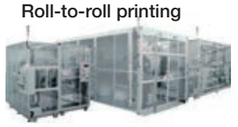
2-4. Micro and Nano Processing
Complex device formation technologies using micro and nano structure moldings.

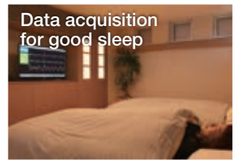
2-5. Soft Biomaterials
New therapeutic and diagnostic devices based on our original “intermediate water concept”, including simple diagnostic sensors for metastatic cancers and a long-term use stent for bile duct cancer therapy.


Transparent and flexible OLED


Smart organic hybrid system device chip

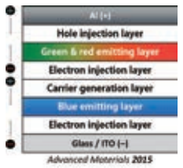



Roll-to-roll printing


Data acquisition for good sleep

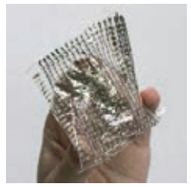
Topics

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.

Future Ink Corporation is developing printable metal nanoparticle and organic semiconductor inks, ink-jet and roll-to-roll printing processes, integrated organic electronic devices, and related technologies.

Vegea Corporation is promoting research and development on practical applications of low-temperature dehumidification drying, and engaging in OLED plant cultivation systems.

Inquiry
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Tel : +81-238-26-3585 Fax : +81-238-26-3240
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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/

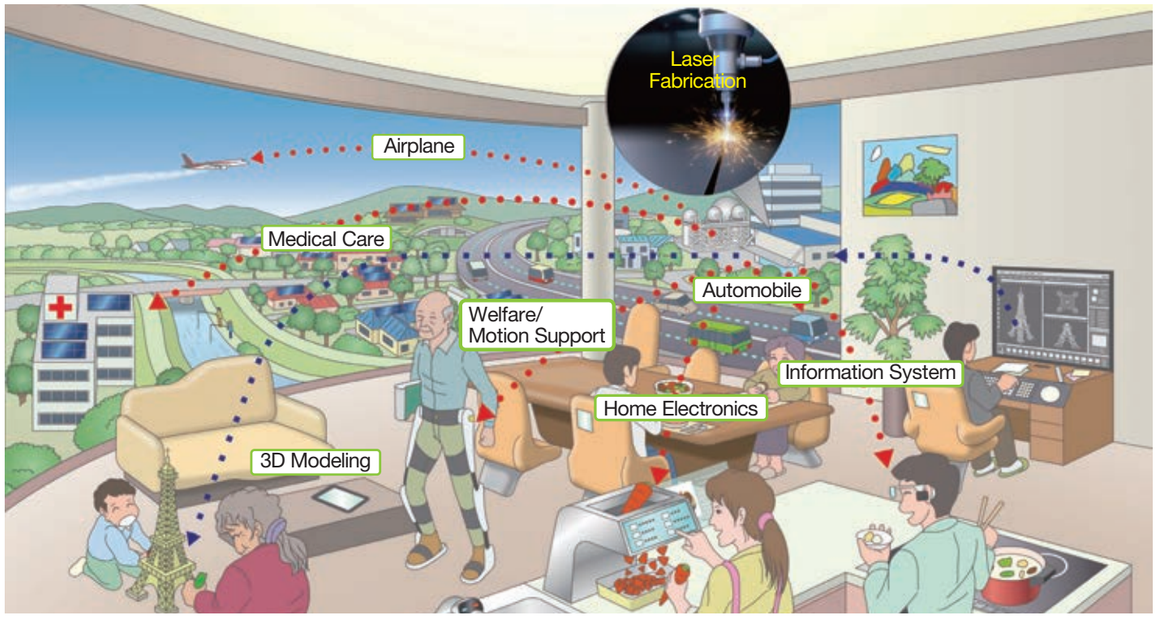
Innovative Center for Coherent Photon Technology (ICCPT)

Comfortable, personalized lifestyles realized by coherent photon technology

Project Leader
Junji Yumoto
Univ. of Tokyo
Graduate School of Science, Professor
Former President &CEO of NEL America

Research Leader
Shinji Tsuneyuki
Univ. of Tokyo Graduate School of Science, Professor
Concurrent Prof., Institute for Solid State Physics

The Future



Outline

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

Applications & Services

- **High-precision laser fabrication techniques**
  Non-thermal processing using short-wavelength, ultrashort-pulse, and high-intensity lasers will be applied to the high-precision freeform fabrication of carbon-fiber reinforced plastics (CFRPs). Considered to be a next-generation material, CFRP is a high-strength, light-weight, and highly reliable material with applications in the aircraft and automobile industries.
- **3D printier; RECILS**
  Our RECILS is a new 3D printer that has realized both of high-speed and high-resolution molding for the first time. RECILS has wide application in; microfluidics, optical communication devices, honeycomb structures, several plastic parts, and so on.
- **Internal-organ observation system**
  A unique microscope will be developed for observing lesions, such as tumors, inside organs using organ-transparent techniques realized by a tissue-clarification metjhod “LUCID”, which has been developed by us. Using this microscope technique, the cost and time spent in diagnostic techniques in pathology will be reduced.

Rat’s body treated using our tissue-transparency techniques

Implementation Structure

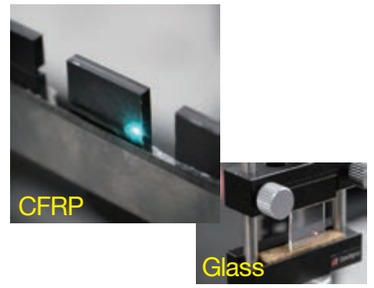
Project Leader : Junji Yumoto（Univ. of Tokyo） Research Leader : Shinji Tsuneyuki（Univ. of Tokyo）

【Core institution】The University of Tokyo
【Participating institutions】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 methods will be established for materials such as CFRPs and tempered glass, which are difficult to process using a laser.



2. Advanced laser molding and modifying techniques

[Norikatsu Mio (Univ. of Tokyo), Toray Industries, Inc]
Using improved stereolithographic techniques, high-performance 3D printers and their applications (product prototypes), will be developed. Additionally, photomodification techniques for repairing microscopic defects in functional materials will also be developed.

3. Short-wavelength light sources and application technologies

[Katsumi Midorikawa (RIKEN), Univ. of Tokyo, Gigaphoton, Inc.]
High-intensity laser sources, such as short-pulse sources in UV-THz regions, as the core of coherent technology and a coherent light source for testing extreme ultraviolet lithography (EUV) optics will be developed.

fundamental research bases

4. Exploration of individual needs

[Hiroshi Onodera (Univ. of Tokyo)]
Wearable systems for walking support will be developed using the abovementioned laser fabrication and the 3D-printing techniques.
Additionally, internal-organ observation systems that unfailingly detect interior lesions will be developed.

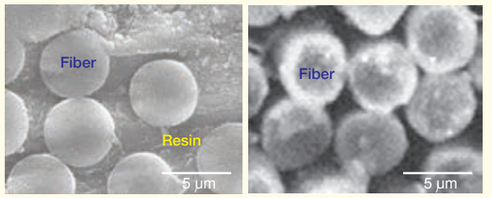
5. Development of new non-equilibrium photo processes

[Shinji Tsuneyuki (Univ.of Tokyo)]
We aim to accomplish the following goals through this project: (1) development of a simulation method for predicting atom dynamics in pseudo-thermal-equilibrium electron excited states; (2) integration of atoms into a computational code for electron dynamics simulations in high-intensity laser pulses on the basis of a time-dependent, multiconfiguration theory; (3) development of an angular-resolved photon–electron spectroscope with high energy resolution and efficiency.

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 less than 5 μm by optimizing the process conditions, such as wavelength and pulse width. In the near future, we will attempt to accomplish high spped laser processing of CFRPs via laser development.



CFRP cutting surface processed under optimized laer conditions

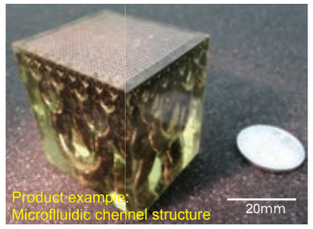
CFRP cutting surface processed under conventional laser conditions

SEM images of laser-processed CFRP surfaces

● 3D printer; RECILS

We have been investigating stereolithographic 3D printer elements with the aim of satisfying both the resolution- and enlargement-related requirements of 3D molding products. Consequently, new 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 μm or less allows complicated and fine structures to be formed.

RECILS overview



Inquiry

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E-mail : iccpt-office@ipst.s.u-tokyo.ac.jp

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

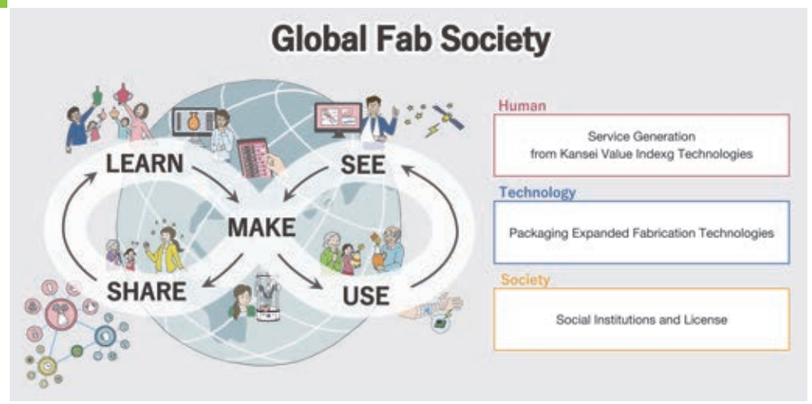
Center of Kansei-oriented Digital Fabrication

Realizing Global Fab Society where digital fabrication based on kansei and creativity make real contributions.

Project Leader
Kenji Matsubara
President and CEO of Longfellow Inc.
President and COO of SEGA Games Co., Ltd.

Research Leader
Jun Murai
Professor of Faculty of Environment and Information Studies, Keio University
Member of the IT Strategic Headquarters
Member of the Cybersecurity Strategic Headquarters, NISC

The Future



Outline

Global fab society firmly connects the potential of digital fabrication technologies with uniqueness, kansei, and creativity each person has, thereby maximizing their roles and meaning in the society. Such society continuously produce necessary and new things and solve various social problems. It is a pleasurable and dynamic society. To realize such society, we tackle challenges of service generation from kansei value indexing technologies, packaging expanded fabrication technologies, and development of social institutions and licenses.

Application & Service

1) Co-medical area (nursing, care, welfare and disability support)
Use of digital fabrication technologies in home care and other relevant fields, design of prosthetic limbs for daily rehabilitation and QOL improvement. Development of tools and licenses to support people with disabilities with burden-free fabrication process covering from product conceptualization to production to sales.
2) Food printing area
Development of 3D food printer technologies for enhanced pleasure and joy at the table, enabling flexible design and shaping of food with preferred hardness and size.
3) Architecture and urban renovation area
Development of architectural and urban design elements to generate new attractiveness of the locality for areas with obsolete infrastructure obsolescence, declining population, and other challenges.
4) Fashon and cosmetic
Development of kansei value metrics technology for designing outfitting with their own kansei according to taste and purpose of use.

Implementation Structure

Organization leader
Project Leader, overall supervision :
Kenji Matsubara (President and CEO of Longfellow Inc.)

Deputy organization leader
Research Leader, research supervision :
Jun Murai (Professor of Faculty of Environment and Information Studies, KeioUniversity)

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

Assistant organization leader :
Jun Murai (Professor of Faculty of Environment and Information Studies, Keio University)

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

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

【Core institution】Keio University
【Satellite institutions】Meiji University, Kwansei Gakuin University, and Yamagata University
【Participating institutions】Institute of Advanced Media Arts and Sciences, Kanazawa College of Art, Chukyo University, Tottori University, Tsukuba University, National Institute of Advanced Industrial Science and Technology, InterLocus Corporation, Okamura Corporation, Kanagawa Prefecture, Kose Corporation, JSR Corporation, Sunarrow Co., Ltd., Studio Midas, Nippon Steel & Sumitomo Metal Corporation, teamLab Inc., Digital Fashion Ltd., Toppan Printing Co., Ltd., Naris Cosmetics Co., Ltd., Nikon Corporation, Panasonic Corporation, Fuji Xerox Co., Ltd., Honda R&D Co., Ltd., Mitsubishi Electric Corporation, Mitsubishi Chemical Corporation, Mozilla Japan, RICOH JAPAN Corporation

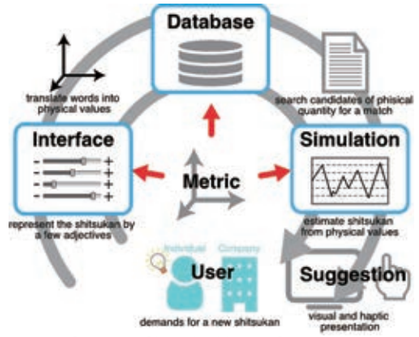
Yokohama Center, Social Fabrication Laboratory (NU Kannai Building 2F)

Key R&D Themes

1. Service Generation from Kansei Value Indexing Technologies

1-1.Developing a system for automatic expansion of kansei value metrics
[Leader :Noriko Nagata (Kwansei Gakuin University)
Participating institutions : Kwansei Gakuin University, Kanazawa College of Art, Chukyo University, Tottori University, Honda R&D Co., Nikon Corporation, Panasonic Corporation, Mitsubishi Electric Corporation, Digital Fashion Ltd., Naris Cosmetics Co., Ltd., Nippon Steel & Sumitomo Metal Corporation, RICOH JAPAN Corporation]

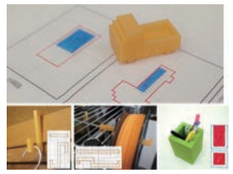
Modeling and indexing diverse human kansei and value-generating creativities, and generating metrics as a society's resource usable for industries as well as individuals. Development of Kansei Sommelier, a framework for selecting materials with the desired texture, and Kansei Digital Bespoke, a framework for supporting individuals' design work to give shape to their own values.



Concept Chart for Kansei Sommelier

1-2.Developing a design method to directly connect kansei and creativity
[Leader :Kaoru Arakawa (Meiji University)
Participating institutions : Meiji University, Kose Corporation, teamLab Inc., InterLocus Corporation]

Researching on design system to effectively estimate people's preferences, through easy to use dialogue - style interface, to give concrete design to what people truly wants or needs.



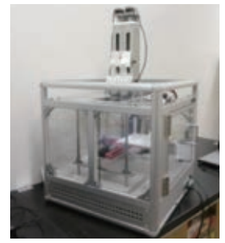
3D modeling method with 2D drawings

Webmo, a IoT motor module

2.Packaging Expanded Fabrication Technologies

2-1. A system to define and use materials with digital information
[Leader : Hidemitsu Furukawa (Yamagata University)
Participating institutions : Yamagata University, Keio University,Kwansei Gakuin University, Meiji University, Sunarrow Co., Ltd., Mitsubishi Chemical Corporation, Studio Midas]

Research on soft, strong, and elastic materials especially gels and other soft materials. It enables creation of items and devices fit to a user's body by allowing softer materials as output from 3D printers, which has been dealing with hard materials such as polymers and metals.



Food-y, 3D food printer

HACKberry with 3D-printed gel fingers

2-2. Packaging and standardizing digital fabrication technologies
[Leader : Hiroya Tanaka (Keio University)
Participating institutions : Keio University, Mozilla Japan, JSR Corporation, Okamura Corporation, Kanagawa Prefecture, Fuji Xerox Co., Ltd., Toppan Printing Co., Ltd.]

Realizing instantaneous fabrication from data to objects with the Fabricator, and standardization and opening up of fabrication related data formats.

The image of Fabricator

fab3d.cc, a 3D shape -similarity search engine

Mechanical quality texting for 3D-printed objects

3. Developing Social Institutions and Licenses

Development of social institutions for the use of fab technologies
[Leader : Shigeru Kobayashi (Institute of Advanced Media Arts and Science)
Participating institutions : Institute of Advanced Media Arts and Sciences, Keio University]

Depicting concrete pictures of creative citizens in such context as hardware start-ups and welfare institutions, proposing and implementing rules and tools related to such things as intellectual property rights and product liabilities to accelerate their activities. Policy proposals will be developed where the issue is better resolved at the national level than at the field.

Workshops to train fab nurses

Inquiry

Office of Research Development and Sponsored Projects, Shonan Fujisawa Campus, Keio University
5322 Endo, Fujisawa-shi, Kanagawa 252-0882 Japan
Tel : +81-466-49-3436 Fax : +81-466-49-3594
E-mail : coi@sfc.keio.ac.jp

Office of Center of Innovation Program, Keio University
NU Kannai Bld.2F, Yamashitacho, 223-1, Naka-ku, Yokohama-shi, Kanagawa 223-0023, Japan
Tel : +81 45-319-4763 Fax : +81 45-319-4764
E-mail: coi@sfc.keio.ac.jp

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)

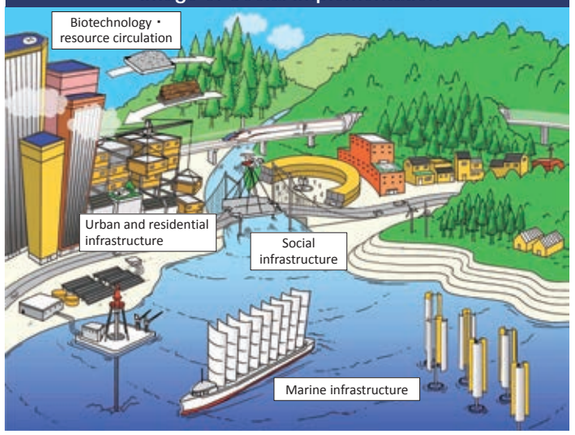
ResearchLeader

Kiyoshi Uzawa

Kanazawa Institute of Technology
Director/Professor, Innovative Composite Center
1985 Joined Honda Motor Co., Ltd.
1990 R&D Manager, GH Craft Ltd.
2003 Assistant, The University of Tokyo
2009 Associate Professor
2012 Professor, KIT(current post)
2013 Director, ICC(current post)

The Future

Image of Social Implementation



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.

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

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, easy process 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 with salt damage resistance, 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., 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, MORIN Chemical Industries Co., Ltd., Nippon Paper Industries Co., Ltd.

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

Key R&D

1. Molding/forming technologies of CFRTP common 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]

We will develop innovative high-speed technology and large, continuous molding technology for a large plate and long structural element, common members of infrastructure, through three sub-themes: impregnation process technology, press molding and secondary process, and we will achieve high productivity at low cost.

2. Fundamental technology (Material 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 work in R&D on the development of raw materials having high functionality and environmental performance and assist its practical use.

3. Application (Task Team)

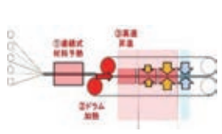
Leader: Shinichi MIYAZATO, Kanazawa Institute of Technology

[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.]

We have launched six teams: housing panels, tension rod for aseismic reinforcement, PC tendon for bridges, large panel for blades of wind turbine, large panel for rigid sails, and ground anchor. We will work on an early realization of the implementation.

Topics

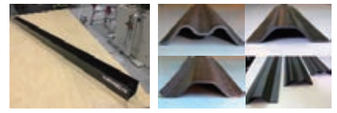
◆ Molding/forming technologies of CFRTP common structural members (continuous molding/forming, large - sized molding)



Development of quick heat-up process of Double Belt Press

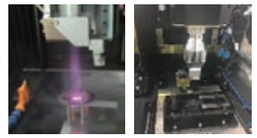
World’s first random sheet by continuous molding

Sequential Press Molding Continuous Forming



Development of Sequential process and Continuous forming process

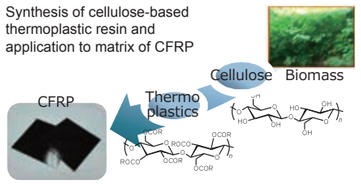
Laser bonding Ultrasound bonding



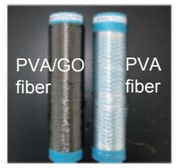
Development of Continuous bonding by laser, ultrasound and electromagnetic induction

◆ Fundamental technology (Material 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



Low density(1.30g/cm3), High mechanical properties (5.1GPa)

Nano carbon dispersed PVA high strength fiber

Synthesis and filming of ultrahigh heat-resistant aromatic polyamide

Creep test of tension rod

◆ Application Task Team

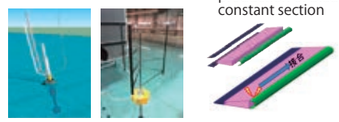
<Application of tension rods into aseismic reinforcement, etc.>

- CABKOMA strand rod (Komatsu Seiren Co., Ltd.)
- Aseismic reinforcement of Zenkoji Temple

T-b Tension Rod （Aseismic reinforcement）

<Development of blade modules of Vertical axis wind turbine>

- Test in water （A-Step）
- Continuous and rapid production of blades with constant section



T-d Large panel (Blades of wind turbine)

<Large panel for large rigid sails>

- The Wind Challenger Project plans to install the sail on an actual vessel in 2017 FY
- 60m-high(Max), 15m-wide, extendable

Image of Sail on Board (single sail)

T-e Large panel （Rigid sail）

Efforts towards the Social Implementation

- ● In order to promote R&D and implementation, we started to expand our facilities (scheduled to be completed in March, 2018) with support from the Ministry of Education, Culture, Sports, Science and Technology Japan (MEXT). The expanded area is aimed at developing the demonstration phase close to implementation. By setting up this closed R&D area, we will improve the previous open platform and environment for seamless development, and accelerate the COI project.
- ● Not only to develop a domestic market but also to expand overseas, we started regional exchange between domestic companies and German companies relating to CFK-Valley in cooperation with Tokai-Hokuriku Composite High Way Project. We are planning to have a BtoB meeting event in 2017FY (RIT Program by JETRO) .

Inquiry

Organization for Advancement of COI Research, Kanazawa Institute of Technology
Tel : +81-76-276-3175 Fax : +81-76-276-3101
E-mail : icc-info@mlist.kanazawa-it.ac.jp

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/

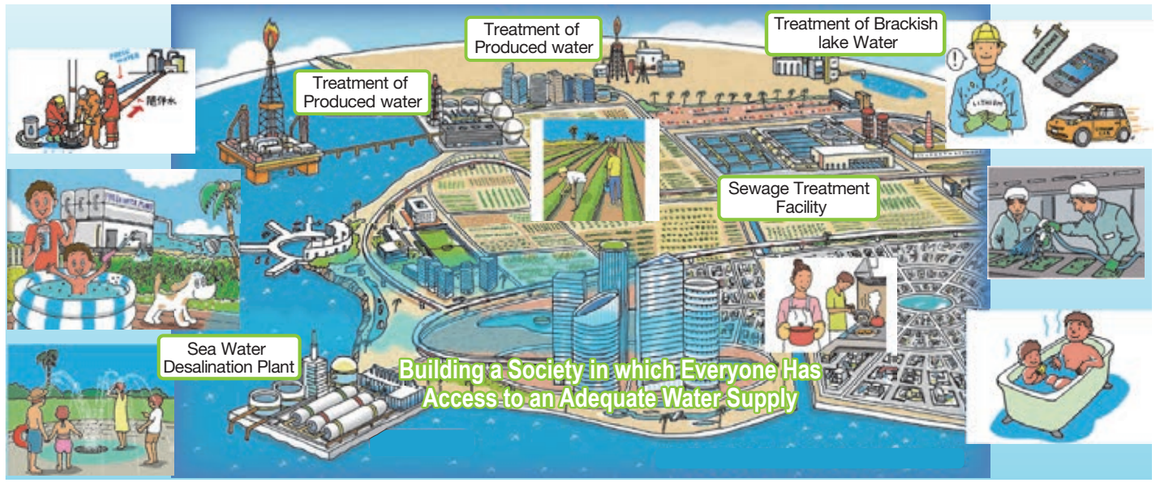
Global Aqua Innovation Center for Improving Living Standards and Water-sustainability

Innovative Water Desalination and Reclamation Systems

Project Leader
Shinjiro Ueda
The Former 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.

Research Leader
Morinobu Endo
Distinguished Professor, Shinshu University
2012 Director of Institute of Carbon Science and Technology, Shinshu University
1999 Professor, Faculty of Engineering, Shinshu University

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 (The Former 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, Kurita Water Industries Ltd., 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), 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

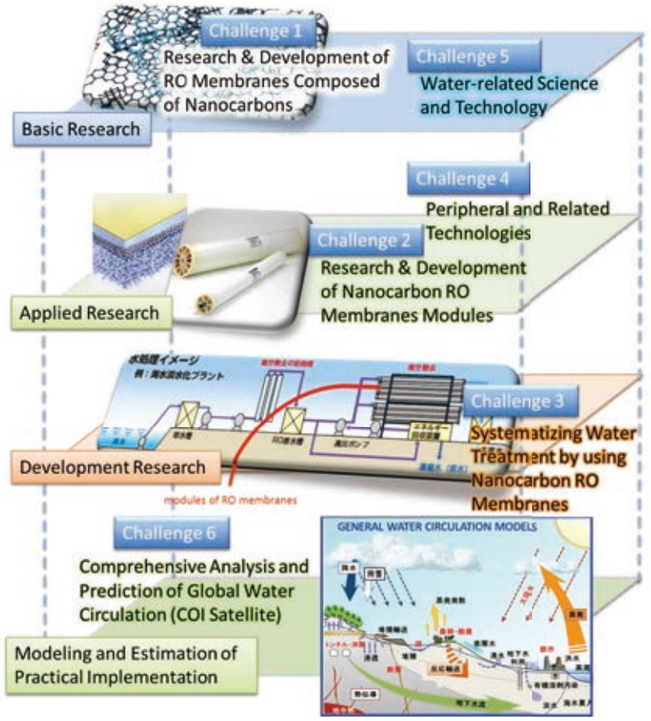
[Toray Industries, Inc.]
Toray aims to develop module production technology which can be used in desalination plant and treatment of produced water. The module has to be adapted to various water sources and consist of a heat-and-chemical resistant nanocarbon membrane and support layer.

3. Systematizing Water Treatment by Using Nanocarbon RO Membranes

[Hitachi, Ltd., Kurita Water Industries 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.



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

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, 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.

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 Nanostructured Carbon-based Membranes: Nitrogen Doping Effects on Reverse Osmosis Performance**
  Using a novel dry process-based membrane formation technique, researchers have developed novel carbon-based water separation membranes that are more flexible than conventional diamond-like carbon (DLC) membranes, and also show outstanding desalination performance of up to 96%. Researchers found that salt rejection, water permeability and chlorine resistance could be optimized by adjusting the amount of nitrogen added.
- **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
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Tel : +81-26-269-5763 Fax : +81-26-269-5710
E-mail : 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/

Mobility Innovation Center

Empowering an aging society through advanced mobility

Project Leader

Shigeru Kuroyanagi

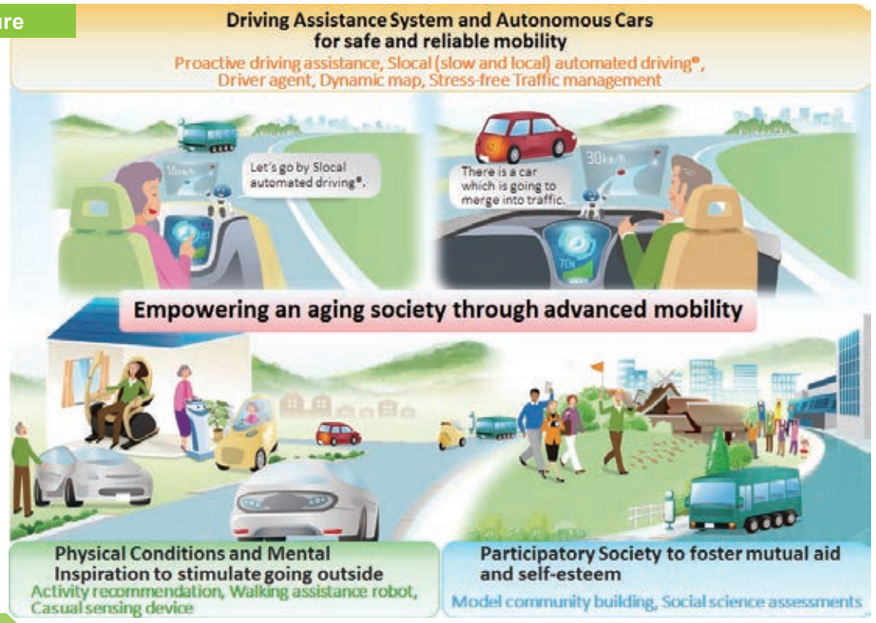
Project General Manager
Frontier Research Planning Dept.,
Frontier Research Center
Toyota Motor Corporation

Research Leader

Takayuki Morikawa

Professor
Nagoya University

The Future



Outline

In an aging society, we want to create a world in which everyone, regardless of where they live or who they are, can play a meaningful role in their communities throughout their entire lives. We're getting there by empowering an aging society through advanced mobility. Our work allows senior citizens to stay actively mobile whenever and wherever they like, helping more of them to participate in the community and enhancing subjective measures of well-being.

Application & Service

- **Provide an enjoyable mobility experience even for those who cannot or do not like to drive**
  Proactive driving assistance, Slocal (slow and local) automated driving®, Driver agent, Dynamic map, Stress-free Traffic management
- **Use the personal information gathered through casual sensing to maintain physical and mental health**
  Activity recommendation, Walking assistance robot, Casual sensing device
- **Participatory Society to foster mutual aid and self-esteem**
  Model community building, Social science assessments

Implementation Structure

Project Leader : Shigeru Kuroyanagi (Toyota Motor Corporation)
Research Leader : Takayuki Morikawa (Nagoya University)

【Core institution】Nagoya University
【Participating institution】Tokyo University of Agriculture and Technology, University of Tokyo, Aichi Prefectural University, National Graduate Institute for Policy Studies, Tokyo Institute of Technology, Aichi Prefecture, Toyota City, Nagoya 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

Core Project

Mobility Research

Mobility research is steadily making advances in the fields of human-centered cutting-edge technologies and social acceptance. We are engaged in research, development, and public road testing in (1) environmental recognition, (2) a Supervisory Driver Assistance System based on Proactive Driving (predicting vehicle position, proactive planning, evaluation systems that detect hidden risks, supervisory driver modeling, and agent systems), (3) human characteristics research based on a senior database. Finally, we are making use of our progress in all of these areas to propose and do real-world testing {Slocal (slow and local) automated driving®, etc.)} on next-generation traffic systems.

Information Platform Research

We are developing 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 in the community 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.

Daily Healthcare Platform Research

We have developed a substance called intellectual glass, which uses high-speed, high-precision filtering of bodily components. The ability to detect cancer, stress, fatigue, and other conditions outside of medical settings will broaden horizons not only in mobility but in a variety of medical service industries as well.

Sustainable Platform Research

We are putting together databases that use casual sensing technologies to gain lifestyle information and more. This department also develops intelligent agents (such as walking assistance robots) that link systems and people together as well as exercise programs that combat the limitations of aging. By combining these advances, we aim to create attentive support systems that give individuals their daily health status and other information.

Cooperative Research

We are using dynamic maps, real-world evaluations of senior support technologies, and our model community project research to (1) create a database that can be used with information services that lower driving stress and help prevent traffic accidents, (2) analyze the impact of human-inspiring technology (HIT) R&D and mobility technologies on senior happiness, and (3) verifying the degree to which a strategic package of enhanced mobility, health monitoring, and outside activity inducements is effective at improving seniors' quality of life in a rural model community.

Environment Recognition

Supervisory Driver Assistance System based on Proactive Driving

Database of Senior Drivers

Next-generation traffic systems

Watch Over , Activity recommendation

Slocal(slow and local) automated driving®

Walking assistance robot

Topics

Environment Recognition

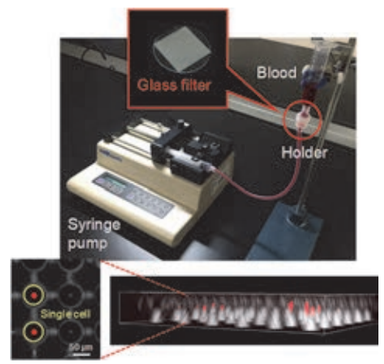
While maintaining a world-class level of pedestrian detection performance, we' ve proposed an algorithm capable of recognizing five extra pedestrian attributes, including body orientation. We have also created a system that detects distracted pedestrians who are walking while using their smartphones.

Implement the control model into the driving simulator

We have installed the Supervisory Driver Assistance System and Agent System in the driving simulator to create a prototype. It also has been found that experiencing the driver assistance system results in improved driving skills.

Bioaerosol Measurement Device

Device prototyping with intellectual glass enabled single-cell measurement.



Inquiry

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Project Period : FY2013～FY2021

http://coi.Kyushu-u.ac.jp/

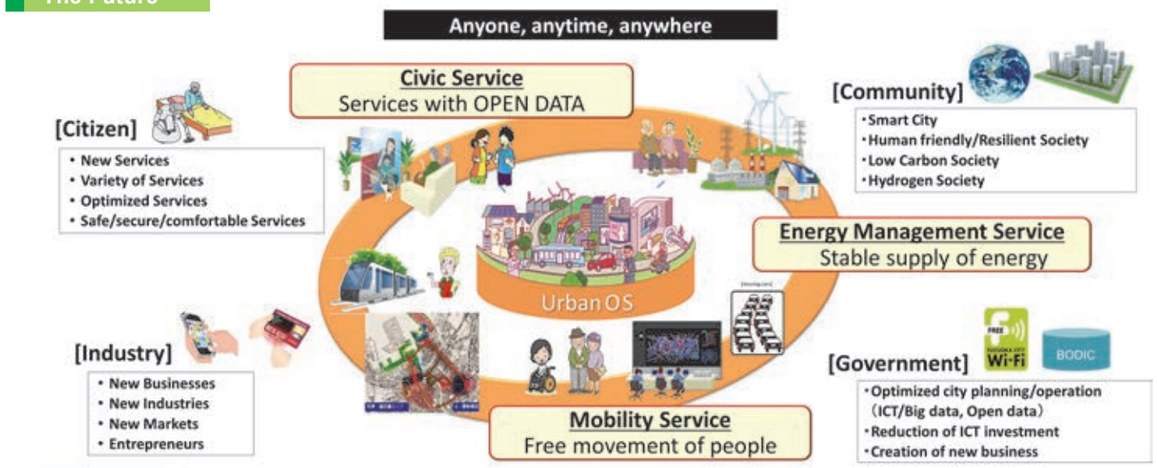
Center for Co-Evolutional Social Systems

Urban OS for Smart Community

Project Leader
Shinya Ishihara
Director, R&D Center, NTT WEST CORPORATION
1994 NIPPON TELEGRAPH AND TELEPHONE CORPORATION
2014 Director, NTT Research and Development Planning Department
2016 Senior Research Engineer, Supervisor, Group Leader, Media Innovation Laboratory NTT Network Innovation Laboratories
2017 Director, R&D planning group, R&D Center, NTT WEST CORPORATION

Research Leader
Masato Wakayama
Executive Vice President, Kyushu University
1985 Doctor of Science, Hiroshima University
1997 Professor, Kyushu University
2006 Dean of Graduate School/Faculty of Mathematics, Kyushu University
2010 Director of Center for Research and Advancement in Higher Education, Kyushu University
2011 Director of Institute of Mathematics for Industry, Kyushu University

The Future



Outline

The Center for Co-evolutional Social Systems (CESS) aims to resolve issues related to environmental change, globalization and global population, 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 using mathematical methods and performs simulations and optimizations. The Urban OS enables new traffic/energy systems and through its provision of open environments, it will be an inspiration for future innovations.

Application & Service

- New energy systems
  New devices and services to realize a low carbon society, such as through the use of fuel cells and hydrogen infrastructures.
- Next generation mobility systems
  Establishment of multi modal mobility and cooperating/sharing mobility systems for a sustainable society.
- Smart community services
  Various types of civic services such as a monitoring system for the elderly or robot assistance.

Implementation Structure

Project Leader : Shinya Ishihara (NTT WEST CORPORATION)
Research Leader : Masato Wakayama (Kyushu University)
【Core institution】 Kyushu University
【Participating institutions】City of Fukuoka, Organization for Promotion Academic City by Kyushu University, Kyushu Bureau of Economy, Trade and Industry, Seiko Electric Co., Ltd., EDAC, ENERES Co., Ltd., YEAAH Inc., Hitachi Ltd., NEC Corporation, Institute of Systems, Information Technologies and Nanotechnologies (ISIT), hapi-robo st Inc., JXTG Nippon Oil & Energy Corporation, Nissan Motor Co., Ltd. EV System Laboratory, Tokyo Gas Co., Ltd., Konica Minolta Inc., Fukuoka Industry, Science & Technology Foundation, OLM Digital, Inc., Nippon Telegraph and Telephone Corporation

Satellite institution

Yokohama National University
Leader : Fumihiko Nakamura
【Participating institutions】Fujitsu Limited, NAVITIME JAPAN Co., Ltd., Nishi-Nippon Railroad Co., Ltd, The Institute of Behavioral Sciences, Relations Inc., Hino Motors, Ltd., Nissan Motor Co., Ltd. Mobility Service Laboratory, Esri Japan Corporation, Microsoft Japan Co., Ltd., Fuji Xerox Co., Ltd., Park24 Co., Ltd., Hitachi Ltd., City of Yokohama

The University of Tokyo
Leader : Ryuji Matsuhashi
【Participating institutions】Shin-Etsu Chemical Co., Ltd., Shizuoka GAS Company, Ltd., EDION Corporation

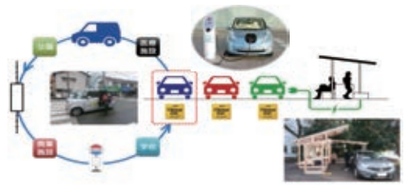
Key R&D Themes

1. Energy : Kazunari Sasaki (Kyushu University)
[Participating institutions: Shizuoka Gas Company, Ltd EDION Corporation, Nissan Motor Co., Ltd. EV System Laboratory, JXTG Nippon Oil & Energy Corporation, Tokyo Gas Co., Ltd., Shin-Etsu Chemical Co., Ltd.]
Global warming is progressing due to the mass consumption of fossil fuels. To counteract this global issue, the industry, academia and government collaborate together to conduct studies on hydrogen technologies and energy systems for the future society to realize a paradigm shift of technology, industry and society. In addition, an energy saving and low carbon society is achieved by integrating technology innovations with the social system.

- Development of stable, economical and environmentally friendly policies and EMSs for low carbonization.
- Hydrogen infrastructure such as water electrolysis technologies that comply with the fluctuating renewable energies.
- Development of stationary fuel cell systems to improve efficiency.
- Achievement of high durability and high power in mobility systems.

2. Mobility : Fumihiko Nakamura (Yokohama National University)
[Participating institutions: Nissan Motor Co., Ltd. Mobility Service Laboratory, NAVITIME JAPAN Co., Ltd., Nishi-Nippon Railroad Co., Ltd., Hino Motors, Ltd., Park24 Co., Ltd., Fujitsu Limited, Climate Change Policy Headquarters, City of Yokohama, Policy Bureau, City of Yokohama, The Institute of Behavioral Sciences, Esri Japan Corporation, Relations Inc., Fuji Xerox Co., Ltd., Microsoft Japan Co., Ltd., Hitachi Ltd.]
Studies on developing a smart and multi-modal mobility system which is economical, environmentally friendly and easy to use are conducted to efficiently solve issues related to the movement of people and things. In addition, studies on urban redesign for traffic nodes (hub space) and developments for cooperating/sharing mobility systems such as car-sharing are in progress.

- Development of multi modal information systems and mobility assistance applications.
- Development of redesign methods for vehicles and hub space.
- Development of cooperating/sharing mobility systems (e.g. riding-together, car-sharing).
- Development of a road maintenance and management system.

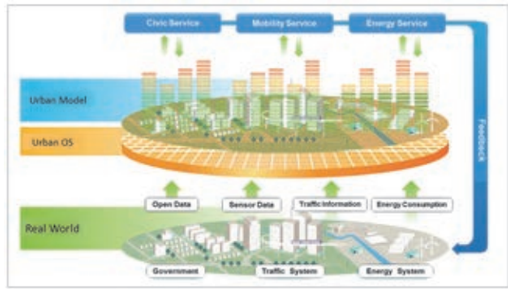


3. Civic Service : Rin-ichiro Taniguchi (Kyushu University)
[Participating institutions: Fukuoka Industry, Science & Technology Foundation, Institute of Systems, Information Technologies and Nanotechnologies (ISIT), Nippon Telegraph and Telephone Corporation. OLM Digital, Inc., Hitachi Ltd., hapi-robo st Inc., Konica Minolta Inc., NEC Corporation]
Studies on monitoring systems for the elderly based on power consumption, urban monitoring systems based on people flow sensors, nursing assistance using a robot, and mobility assistance with personal mobility are being conducted to achieve a more vibrant and sustainable society. In addition, an Urban OS Platform based on the Cyber Physical System (CPS) and analysis technologies using Mathematics for Industry and organic devices are being developed along with progress in studies on the Science and Technology Innovation Policy.

- Monitoring service for the elderly to realize a safe and secure community.
- Life support with robot assistance.
- ICT platform based on Mathematics for Industry to support co-evolutional social systems.

Topics

The Center develops the Urban OS Platform to resolve issues concerning urban regions and its societies. Urban issues are analyzed and countermeasures are evaluated.
The Urban OS Platform performs an analysis and simulation, based on mathematical approaches which incorporate 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 Platform and developing a prototype for 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 implementation as well as preparation including the legal systems will 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, a collaboration with Smart EAST has started which is an urban renewal project that includes the Hakozaki Campus of Kyushu University and also research results will be utilized by the next generation transportation systems promoted by the Fukuoka Directive Council. In addition, studies and tests have been conducted for smart city projects in collaboration with local governments such as those of Yokohama, Kasuga and Miyama City. U-Tokyo Satellite (EMS) is proceeding demonstration tests for the Japanese version of the green deal in collaboration with local governments such as from Shimokawa Town, Hokkaido.

Inquiry
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In order to achieve sustainable development of the innovation platform, it is essential to cultivate human resources that will continue to be active after COI Program support has ended. The COI program focuses on activities of the Structuring Team "Next Generation working group," and promotes the use of next generation human resources by engaging in initiatives such as the COI 2021 Conference, the COI Next Generation Researchers Collaborative Research Fund, and others.

COI2021 Conference

- The COI 2021 Conference is a forum for co-creation by next generation human resources who will pioneer the future. The aim is to train human resources who will become leaders after the end of the program, discover research themes, and generate business ideas for commercialization.
  (Main aims)
  1. Discover projects and research proposals that have social impact, with the aim of creating future society
  2. Develop human resources, and discover and nurture producers
  3. Create high risk, high impact research projects

The Second COI2021 Conference
March 18th(Sar.)-20th(Mon.), 2017

COI20.0

- COI 20.0 is the system created from the proposal at the 2nd COI 2021 Conference.
- COI 20.0 is a system in which next generation human resources (such as postdoctoral researchers, University Research Administrators, etc.) employed with R&D expenses entrusted to the COI Program are able to devote 20% of their efforts (work rate) subject to labor costs to freely conduct activities that contribute to the creation of future innovation based on their own initiative.
- Promotes activities that contribute to free research and career development of next generation human resources, and encourages the training of human resources who will be responsible for the activities of the innovation platform.

COI Next Generation Researchers Collaborative Research Fund

- Revitalizes collaboration in R&D (collaborative research) that transcends visions and COI sites in order to accelerate R&D for commercialization.
- The COI Next Generation Researchers Collaborative Research Fund is being implemented within the COI Program as a system in support of collaborative research for next generation researchers engaged in collaborative research from planning as leaders who have the ability to take action to execute innovative and flexible ideas that go beyond the ordinary, who can interact with different fields, different industries, and with other organizations.

Outline

Comprised of collaborative research themes involving two or more COI sites, it promotes collaborative research by soliciting and selecting proposals from research teams headed by next generation researchers in charge of collaborative research themes.

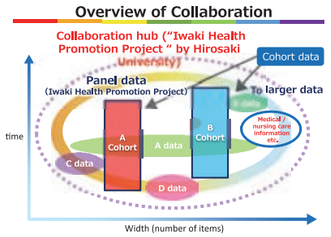
(12 research projects at FY 2017) *Top row: Collaborative research theme, Bottom row: Research leader

Gastric-acid-battery-driven ultrasmall ingestible sensor realized by combining MEMS and 3D fabrication technologies
Shinya Yoshida(Tohoku University), Yuji Ogi(Keio University)
Development of ATP-responsive patches for skin cancer theranostics
Kou Okuro(The University of Tokyo), Hiroyuki Kai(Tohoku University)
Measurement of emotional response during image viewing using patch-type EEG
Noriaki Kanayama(Hiroshima University), Shusuke Yoshimoto(Osaka University)
Development of a sensor for stagnant toilet water measurement and the elucidation of the relationship between health conditions and feces components in water
Seiji Yamasaki(Osaka University), Kumi Inoue(Tohoku University)
Non-invasive therapies for stroke using bioengineering technology towards sustainable medical care
Yuji Teramura(The University of Tokyo), Hiroyuki Fujimoto(Kyoto University)
Development of the system for preventing and improving "locomotive syndrome" at community / work area
Muneaki Ishijima(Juntendo University), Tomohiro Okura(University of Tsukuba), Kohei Matsumura(Ritsumeikan University), Yuki Soma(Hirosaki University)
Food innovation for improving healthy life expectancy using Japanese northern country's agriculture, forestry and fishery products
Hayato Maeda(Hirosaki University), Kazuo Miyashita(Hokkaido University)
Exploring biomarkers for cognitive impairment through genome and multi-omics analyses
Hiromi Yamazaki(Hirosaki University), Fumiki Katsuoka(Tohoku University), Yota Tatara(Hirosaki University)
Design of the system for vital data to change into art and its social implementation
Shima Okada(Ritsumeikan University), Rui Ogawa(Tokyo University of the Arts)
Battery-less Patch-type Sensing Systems Using Wireless Power Transmission
Hiroyuki Matsui(Yamagata University), Naoki Shinohara(Kyoto University)
Resident participation-based Hybrid Mobility System for revitalization of suburban area
Ryo Ariyoshi(Yokohama National University), Tomio Miwa(Nagoya University)
Co-creating civic-tech applications for traffic safety : collaboration with Traffic Dynamic Map and Urban OS
Sachiko Ono(Nagoya University), Shigeru Takano(Kyushu University)

"COI Health and Medical Data Collaboration Promotion Organization" (hereinafter referred to as "COI Data Collaboration Organization") was established in 2015, as a cross-sectional activities with the theme, "Promotion of collaboration among COI sites on utilization of health and medical information". Hirosaki University is set as the administration office.

Overview of the COI Health and Medical Data Collaboration Organization

- The COI Data Collaboration Organization was established with the aim to obtain efficient social implementation by sharing health and medical data collected in each COI site, which can increase reliability of research results gained in each COI site.
- Currently, many cohort studies are being conducted in Japan. However, those data has been collected and kept at each university or research institution independently, and there is not enough mutual utilization between research institution. Collecting data in a cohort study takes a great deal of time and effort. The fact that such precious data is "buried" is a major loss for improving Japanese research capabilities.
- The COI Data Collaboration Organization will create an open platform structure to enable mutual use/verification and comparative analysis of health and medical data collected from cohort studies or wearable devices, etc.



COI Health and Medical Data Collaboration Organization

the Steering Committee

- Protocol Planning and Coordination Group
- Data Quality Management Group
- Data Quality Assurance Group
- Data Analysis Group
- Data Utilization Promotion Group

Structure of the COI Health and Medical Data Collaboration Organization

- The COI Data Cooperation Organization is composed of the Steering Committee that discusses matters related to planning and overall coordination, and several other groups that are responsible for specific tasks.
- Members of the Steering Committee are elected by recommendation from each COI site.

Chairman : Shigeyuki NAKAJI M.D., Ph.D.
Research Leader of Hirosaki University Center of Innovation(COI) "the Center of Healthy Aging Innovation" / Research Professor Department of Social Medicine, Hirosaki University Graduate School of Medicine

The brochure "Research to provide healthy aging"

Activities of the COI Health and Medical Data Collaboration Organization

1. Major collaborative activities

We have two main issues to be addressed, which are "data collaboration" including aggregation and utilization data, and "theme collaboration" , which is a collaboration on specific themes among sites (for example, "Exercise / physical fitness"," Nutrition / meal", "Rest / sleep" and "Intestinal flora").

2. Collaboration with health and medical data of other cohort studies

The "Data Analysis Group" has started to collaborate on health and medical data obtained from a series of cohort studies. For example, "Hisayama Study" targeted to residents of Hisayama-machi in Kusaya-gun, Fukuoka Prefecture, and "Kyotango Longevity Cohort Study" targeted to residents of Kyotango city in Kyoto Prefecture.

3. Improvement of the Open Data Platform of COI

The "Data Quality Management Group" is working to create an environment for sharing data to be enhanced in a wide range of research, especially for industrial revitalization. We use the Personal Genome Information and Clinical Information Database System linked to SS - MIX 2 Standard Storage as the basic system.; It is approved as a standard in the field of health and medical information by the Japanese Ministry of Health, Labor and Welfare (issued by the MHLW Health Policy Bureau on March 28, 2016, No. 6) . In the future, we will aim for the CDISC standards.

4. Promotion of collaborative research・Research ethics support

The "Protocol Planning and Coordination Group" supports each university / research institution / researcher related to the COI Data Cooperation Organization to comply with the Government Ethics Guidelines and the Helsinki Declaration to conduct research properly, promptly and smoothly.

① Creating the informed consent document

We have created a "standard format" with the aim of facilitating and understanding the research purpose and method easily. It enables research that is based on researcher's free ideas as well as flexible use of samples and information, while complying with related laws and guidelines.

※After "Identification of common items" of each COI site and discussion with the steering committee, we have created a First edition of Common IC (informed consent) in cohort research (Genome research ver. and non-genome research ver.) in March 2016.

② A brochure for introducing activities of the COI Data Collaboration Organization

A brochure that describes the purpose and the meaning of data cooperation and activities of the COI Data Collaboration Organization has been distributed and used since March 2017.

contact us

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