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.

Tadashi Onodera
Senior Corporate Advisor KDDI Corporation

Atsushi Horiba
Chairman & Group CEO Horiba Ltd.

Hiroshi Matsumoto
President, RIKEN

Katsuaki Watanabe
Former President, 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, Adjunct Professor, National Graduate Institute for Policy Studies
Kazuhiko Takeuchi, Project Professor, Institute for Future Initiatives, The University of Tokyo
Miwako Doi, Auditor, National Institute of Information and Communications Technology
Yoshiki Makabe, Director/General Manager, Advanced Materials Research Laboratories, TORAY
Yutaka Matsuo, Professor, Graduate School of Engineering, The University of Tokyo
Sakiko Yoshikawa, Vice President & Professor, Kyoto University of the Arts

Senior Visionary Leader
Yoichiro Matsumoto
President
Tokyo University of Science

Deputy Senior Visionary Leader
Masaaki Mizuno
Clinical Professor
Nagoya University

Senior Visionary Leader Adviser
Ryozo Nagai
President
Jichi Medical University

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
Tadafumi Kato
Chief Professor, Graduate School of Medicine, Juntendo University

Visionary Team member
Hideaki Koizumi
Honorary Fellow,Hitachi, Ltd./ Executive Vice President, The Engineering Academy of Japan

Visionary Team member
Atsushi Hasegawa
President, Concent, Inc/ Professor, The Faculty of Musashino Art University

Vision 3

Visionary Leader
Masaaki Mizuno
Clinical Professor
Nagoya University

Visionary Team member
Hiroshi Ishikawa
Medical Device Technical Advisor, NPO Chubu Regional Consortium for Advanced Medicine

Visionary Team member
Yuya Kajikawa
Professor, School of Environment and Society, Tokyo Institute of Technology

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

Miwako Doi
Auditor, NICT

Yuji Furui
Project Professor, The University of Tokyo

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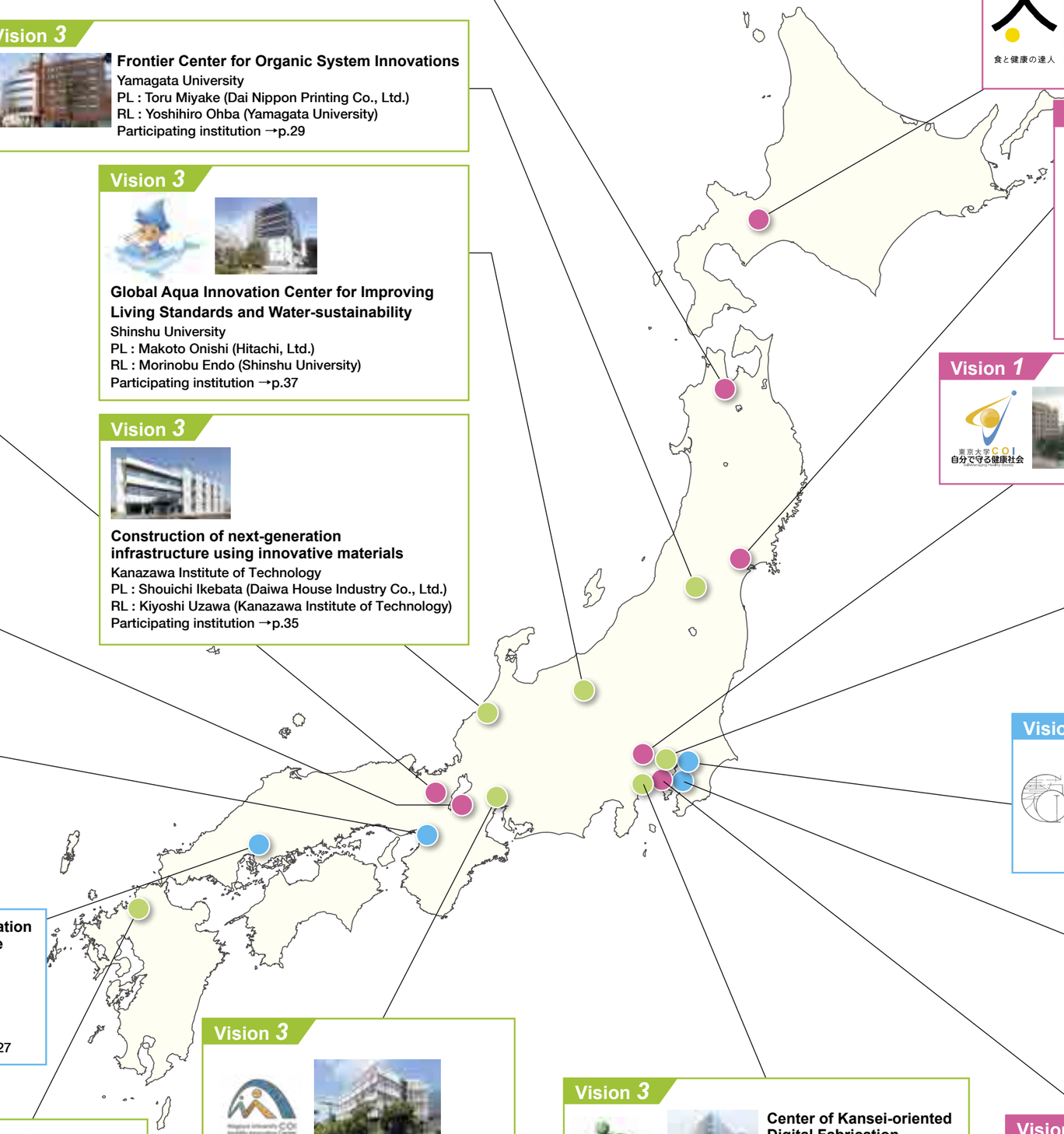


Vision 1

HIROSAKI COI center of innovation

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

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

Center for Active and Self-Reliant Society by Child Brain Development
Osaka University
PL : Takeshi Uenoyama (Panasonic Corporation)
RL : Yasufumi Kaneda (Osaka University)
Participating institution →p.25

Vision 2

KANSEI INNOVATION 感性

Center of KANSEI Innovation Nurturing Mental Welfare
Hiroshima University
PL : Hidetoshi Yoshida (Hiroshima University)
RL : Takafumi Sasaoka (Hiroshima University)
Participating institution →p.27

Vision 3

C²RSC Center of Coevolutionary Research for Sustainable Communities 持続的共進化地域創成拠点

Center of Coevolutionary Research for Sustainable Communities
Kyushu University
PL : Yuichi Nakamura (NEC Corporation)
RL : Yasuhide Fukumoto (Kyushu University)
Participating institution →p.41

Vision 3

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

Vision 3

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

Vision 3

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

Vision 3

Nagoya University COI Mobility Innovation Center

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 University
PL : Kenji Matsubara (Longfellow Inc.)
RL : Jun Murai (Keio University)
Participating institution →p.33

Vision 1

食と健康の達人

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 society with self-help and mutual-assistance through daily unobtrusive sensing and health monitoring
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

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 & Technology
Tokyo University of the Arts
PL : Koshi Yamamoto (JVCKENWOOD Corporation)
RL : Takashi Kiriyama (Tokyo University of the Arts)
Participating institution →p.21

Vision 2

EISESiV Research Center for the Earth Inclusive Sensing Empathizing with Silent Voices

Research Center for the Earth Inclusive Sensing Empathizing with Silent Voices
Tokyo Institute of Technology
PL：Toshiyuki Hiroi (Sony Corporation)
RL：Hitoshi Wakabayashi (Tokyo Institute of Technology)

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

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

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

Center of Innovation for creation of a society with self-help and mutual-assistance through daily unobtrusive sensing and health monitoring 11
Core institution : Tohoku University
PL : Iwao Waga (NEC Solution Innovators, Ltd.) RL : Tomokazu Matsue (Tohoku University)

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

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

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

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

Vision 2

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

Visionary Leader
Satoshi Koike

Creating Innovation for “Synesensory” through Inspirational Arts and Science & Technology 21
Core institution : Tokyo University of the Arts
PL : Koshi Yamamoto (JVCKENWOOD Corporation) RL : Takashi Kiriyama (Tokyo University of the Arts)

Research Center for the Earth Inclusive Sensing Empathizing with Silent Voices 23
Core institution : Tokyo Institute of Technology
PL : Toshiyuki Hiroi (Sony Corporation) RL : Hitoshi Wakabayashi (Tokyo Institute of Technology)

Center for Active and Self-Reliant Society by Child Brain Development 25
Core institution : Osaka University
PL : Takeshi Uenoyama (Panasonic Corporation) RL : Yasufumi Kaneda (Osaka University)

Center of KANSEI Innovation Nurturing Mental Welfare 27
Core institution : Hiroshima University
PL : Hidetoshi Yoshida (Hiroshima University) RL : Takafumi Sasaoka(Hiroshima University)

Vision 3

Establish a sustainable society with vitality : Active Sustainability

Visionary Leader
Masaaki Mizuno

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

Innovative Center for Coherent Photon Technology（ICCPT） 31
Core institution : The University of Tokyo
PL : Junji Yumoto（The University of Tokyo） RL : Shinji Tsuneyuki (The University of Tokyo)

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

Construction of next-generation infrastructure using innovative materials 35
Core institution : Kanazawa Institute of Technology
PL : Shouichi Ikebata (Daiwa House Industry Co., Ltd.) RL : Kiyoshi Uzawa (Kanazawa Institute of Technology)

Global Aqua Innovation Center for Improving Living Standards and Water-sustainability 37
Core institution : Shinshu University
PL : Makoto Onishi (Hitachi, Ltd.) RL : Morinobu Endo (Shinshu University)

Mobility Innovation Center 39
Core institution : Nagoya University
PL :Shigeru Kuroyanagi（Toyota Motor Corporation） RL : Takayuki Morikawa (Nagoya University)

Center of Coevolutionary Research for Sustainable Communities 41
Core institution : Kyushu University
PL : Yuichi Nakamura (NEC Corporation) RL : Yasuhide Fukumoto (Kyushu University)

Project Period : FY2013～FY2021

https://www.fmi.hokudai.ac.jp/coi/

Innovative Food & Healthcare MASTER

A safe and peaceful society for families, focusing on mothers and children (Building a Health and Productivity Management city based on maternal and child wellness)

Project Leader
Masanori Yoshino
Senior Project Manager at Hitachi, Ltd. Fundamental Research Center,

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

For a safe and peaceful society for families, focusing on mothers and children, we aim to build a regional model allowing every citizen to grow up healthy and lively together with children, and to realize a society where the “People” and the “Town” grow as “Food and Healthcare MASTER”

Application & Service

Maternal and child wellness assessment Optimum maternal and child care platform

- A community friendly to families with young children and working women, focusing on the importance of diet and health.
- “Maternal and Child Health Research Program” is established as basic medical checkup of the Health and Productivity Management city. All mothers will be provided with individual guidance on maternal and child wellness (in relation to intestinal environments, breast milk components and other factors) to promote healthy growth of children.

Behavioral changes Data-based healthcare platform

- Based on health data relating to residents and the municipality, this service involves data analysis and subsequent prediction of future health status. Analysis results and predictions are shared with residents and the municipality to encourage improved health behavior, promote public health and create new business opportunities. health and create new business opportunities.

Dynamic communities Health and Productivity Management city platform

- Home delivery of food, care and other services to mothers immediately after childbirth and families who have difficulty going out
- Use of information and communication technology (ICT) to provide maternal and child wellness support and health monitoring services
- Programs that allows people to enjoy wellness.

Implementation Structure

Project Leader : Masanori Yoshino (Hitachi, Ltd.) Research Leader : Akiko Tamakoshi (Hokkaido University)
Deputy Project Leader : Yasuhiro Takeda (Morinaga Milk Industry Co., Ltd. Research Adviser : Hiroyuki Tsutsui (Kyushu/Hokkaido University)

【Core institution】Hokkaido University 【Core enterprise】Hitachi, Ltd.
【Participating institution】Iwate Sargassum horneri Production Cooperative, H2O Institute of Research Inc., Oji Nepia Co., Ltd., Cosmo Corp., J-Mac System, Inc. , Secoma Co.,Ltd., Sompo Japan Insurance Inc. , Daiichi Kishimoto Rinsho Kensa Center, K.K. , Tsuruha Holdings, Inc., Techno Suruga Laboratory Co., Ltd. , Data Horizon Co., Ltd., Toyo Rice Co.,Ltd., Nitto Denko Corp., Hamanasu Information Co., Ltd. , First Screening Corp. , Philips Japan, Ltd., Hokkaido Marine innovation Co., Ltd. , Maxell, Ltd., Morinaga Milk Industry Co., Ltd. , Life Science Institute Co., Ltd. , ROHTO Pharmaceutical Co.,Ltd., Hokkaido, Iwamizawa City, Asahikawa Medical University, Kyushu University , Keio University, Sapporo Medical University, Tokushima University, Nakamura Gakuen University , Nara Institute of Science and Technology , Hokusho University, Miyagi University , Japanese Foundation For Cancer Research , Hokkaido University of Education IWAMIZAWA Campus , National Institutes of Biomedical Innovation, Hokkaido Research Organization, Northern Advancement Center for Science & Technology, Hokkaido Food Industry Promotion Organization, Area-wide e-Laboratory for Food, Agriculture & Environment

Global Research Center for Food & Medical Innovation (FMI)

Satellite institution

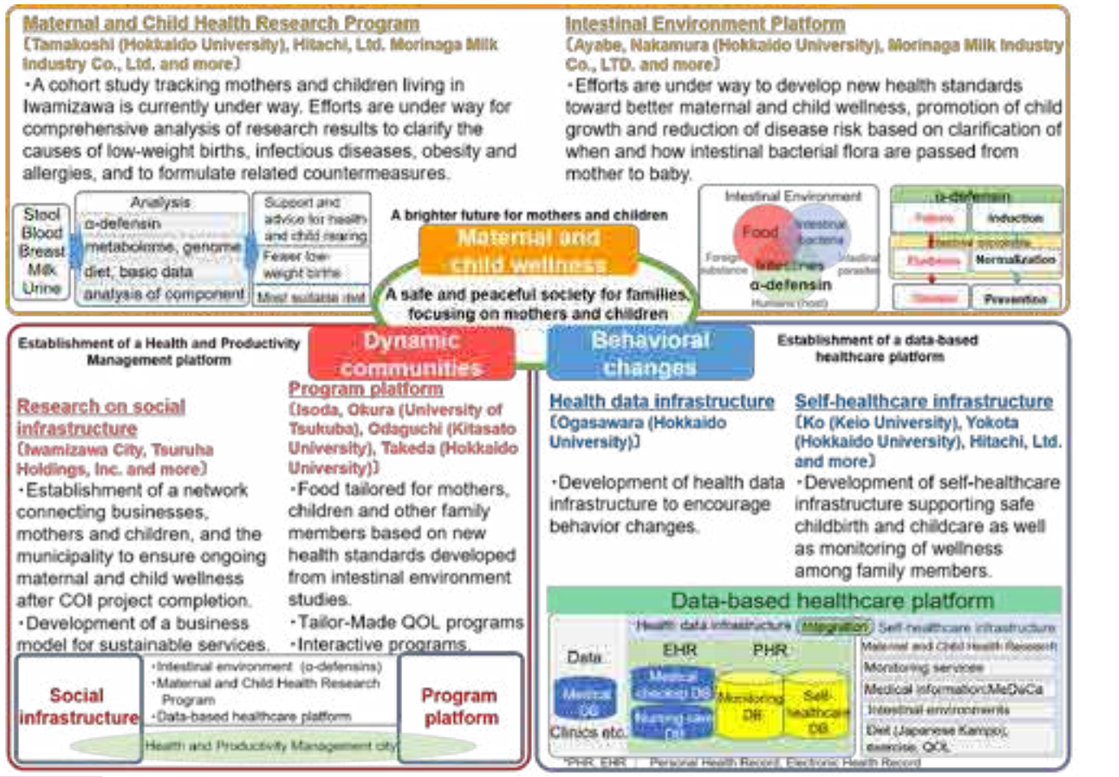
University of Tsukuba Satellite
Satellite Leader : Hiroko Isoda (University of Tsukuba)

【Participating institution】JA Ibaraki Kouseiren, Kyowa Hakko Bio Co., Ltd., Xiroku Inc., Tanita Corp., Nippon Flour Mills Co., Ltd., Renaissance Inc.

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

【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, Tokyo University of Science

Key R&D Themes



Topics

① Causing behavioral changes through “Maternal and Child Health Research Program”

The “Maternal and Child Health Research Program” , a peerless research conducted in Iwamizawa City, has provided new insights into factors affecting maternal wellness and child development based on analyses of diet, intestinal environment, and breast milk composition. The research has also succeeded in reducing low-weight births (from 10.4% in 2015 to 7.8% in 2017). Efforts are underway to promote behavioral changes through sharing of information and issues with mothers and children, in partnership with the City.

② Remote Pregnancy Screening and Diagnosis from Hokkaido to Nationwide

In Hokkaido, the distance between the home and the hospital is long, which is a burden for pregnant women. We aim to reduce the burden and increase the birth rate by developing and introducing a permanent online diagnostic system.

③ Establishment of a company to retain service sustainability

An LLC was established in Iwamizawa to commercialize the fruits of this COI project, and to lead it to further research so as to retain sustainable development in the region. The company has started to develop products and services achieved from the COI project.

④ Development of a big-data analysis platform

We built a health prediction system that analyzes the health status based on medical data of Iwamizawa residents. Our goal is to develop it into a system which makes it possible to predict future health conditions. Furthermore, we will construct a community-based integrated care system through data linkage with individual COI projects.

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.hirosaki-u.ac.jp/web/

Sustaining national health in an aging society

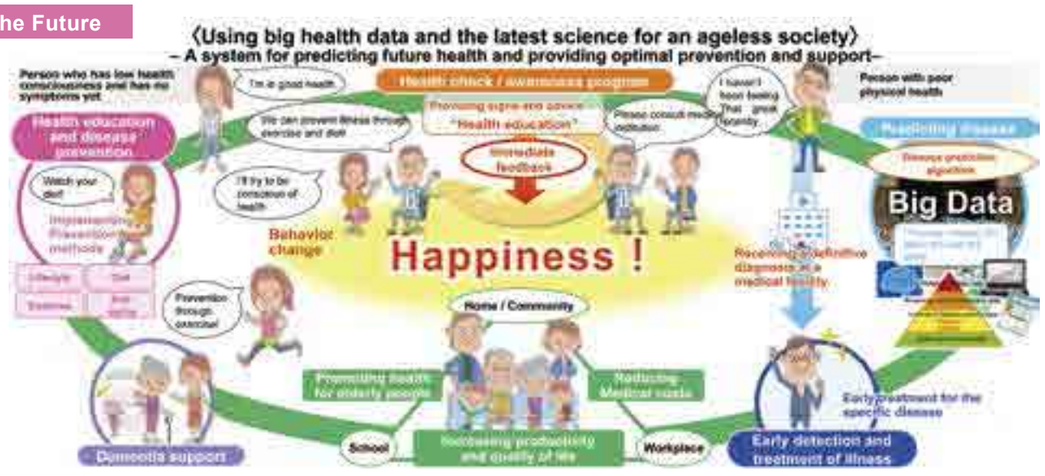
Center of Healthy Aging Innovation (CHAIN)

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) Strategy Leader : Koichi Murashita (Hirosaki University)
Implementation Leader: Takuji Yasukawa (Kao Corp.) Director of Innovation Center for Health Promotion: Koichi Wakabayashi (Hirosaki University)

【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, Meio University, Wakayama Medical University Maruman Computer Service Corp., TOHOKU CHEMICAL Co., Ltd., TechnoSuruga Laboratory Co., Ltd., Eiken Co., LTD., AEON Retail CO.,LTD., KAGOME CO., Ltd., Eisai Co.,Ltd., Kao Corporation, KYOWA HAKKO BIO CO.,LTD., Lion Corporation, OMRON HEALTHCARE Co., Ltd., Benesse Corporation., Sysmex Corporation, 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., Suntory beverage & food Ltd., Otsuka Pharmaceutical Co.,Ltd., AIST, Family Cooking School, Atsugi Co.,Ltd., House Foods Group Inc., Meiji Yasuda Life Insurance, MiRTeL Co.LTD, FANCL CORPORATION, The Aomori Bank,Ltd., The Michinoku Bank,Ltd., Ajinomoto Co., Inc., Taisho Pharmaceutical.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, Bank of Kyoto, Ltd., 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., Mizuho Information & Research Institute, Inc.Elvez,Inc., Money Forward,Inc.

Key R&D Themes

1. Developing prediction methods by using big data

[Maruman Computer Service Corp., TOHOKU CHEMICAL Co., Ltd., Techno-Suruga-lab., Eisai Co., Ltd., Kao Corp., Lion Corp., OMRON HEALTHCARE Co., Ltd., Sysmex Corp., Hokkaido System Science Co., Ltd., Life Science Institute, Inc., Human Metabolome Technologies, Inc. Kracie Holdings, LTD., Suntory beverage & food Ltd., House Foods Group Inc.,Otsuka Pharmaceutical Co.,Ltd.MiRTeL Co.LTD, FANCL CORPORATION, etc.]
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

[Maruman Computer Service Corp., Eiken, AEON RETAIL CO., LTD., KAGOME CO., Ltd., Kao Corp., KYOWA HAKKO BIO CO.,LTD., Benesse Corporation,INC., CO･OP Kracie Holdings, LTD., Lawson Inc., Atsugi Co.,Ltd., Family Cooking School Meiji Yasuda Life Insurance, The Aomori Bank,Ltd., The Michinoku Bank,Ltd., etc.]
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 : 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 Meio University, Wakayama Medical University 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.

◆ **Innovation Center for Health Promotion**
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" (Innovation Center for Health Promotion) that consolidates health promotion functions. On April 2018, we set up a new facility where COI participating institutions meet together and create new industries for revitalization of local communities.

◆ **1st Japan Open Innovation Prize, "Prime Minister Prize" and 7th Platinum Vision Award, "Grand Prize from the Internal Affairs and Communications Minister"**
We won "Prime Minister Prize" of 1st Japan Open Innovation Prize in March 2019 and "Grand Prize from the Internal Affairs and Communications Minister in November 2019. Each awarded as the best institution from the view of open innovation and problem solution.

Inquiry

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COI Research Initiatives Organization
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E-mail : coi_info@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 society with self-help and mutual-assistance through daily unobtrusive sensing and health monitoring

Creating a novel society based on the philosophy to support our own healthy life within a most important relationship.

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
Specially Appointed professor, Head office of Enterprise Partnerships 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

The vision of living in 2030

Envisioning a society based on self-help and mutual-assistance

In our designing future, each people might be comfortable to stand alone, but feeling warm relations with others, and enjoying their almost 100 yearlong living with the connection to our new society

- Enabling people to forecast and manage their health by themselves, thereby eliminating possible concerns about the future
- Enabling people to continue to make active contributions to society even if their intellectual, psychological, or physical capacity declines.
- Enabling people to connect, interact, and support each other between the different generations and beyond the scope of the family.

Outline

No doubt everyone shares the desire to spend their days in health and happiness, living a fulfilling life. Reality, however, can intrude on that ideal in the form of anxiety about potential illness, a sense of isolation, concern about family members living apart, or in other ways. We are developing a Daily Health Screening system that uses unobtrusive sensing, so that anyone, anytime and anywhere can stay aware of their own and their loved ones' health and everyday status, and can obtain multigenerational support going beyond the family. The Daily Health Screening system consists of three elements: "HaKaRu," "WaKaRu," and "OKuRu." Applying various sensing techniques, the system unobtrusively collects information about health and health factors (lifestyle factors, environmental factors). This information is combined with predisposition data (hereditary factors) and centrally managed as a big **PDS(personal data service/store)**in the cloud. Besides aiming for understanding and sharing of this information, it is put to various uses from the standpoints of self-assistance and mutual assistance.

Application & Service

- Lineup of innovative sensing devices to realize unobtrusive sensing of environmental factors and life factors
  - Intelligent mirror, ingestible sensor, health glasses, bacteria sen sor, 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 **PDS** 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
- Creation of many different kinds of businesses by integrating sensor data and by connecting services through AI analysis and open API provision

Organization

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

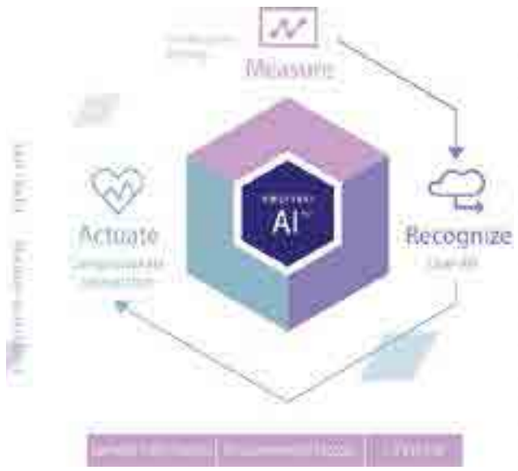
【Core institution】Tohoku University

【Participating institution】**NECSolution Innovators, Ltd.** , TOSHIBA CORPORATION , NIHON KOHDEN CORPORATION , OMRON HEALTHCARE Co., Ltd. , KAGOME CO.,LTD. , CAC Corporation , TOKYU SPORTS OASIS Inc. , MITSUI & CO., LTD. , COOP TOHOKU , CASIO COMPUTER CO., LTD. , ALPS ALPINE CO., LTD. , ELECOM CO.,LTD. , Tokio Marine & Nichido Fire Insurance Co., Ltd. , DENTSU INC. , Ryoden Corporation , JTB Corp. , ANABUKI Housing Service Co.,Ltd. , Future Sessions Inc. , AT CO., LTD., asuken Inc. , CREWT Medical Systems, Inc.

Satellite leader : Yukio Iwaya (Tohoku Gakuin University)
Kazuaki Utsumi (Waseda University)

【Satellite participating institution】RIKEN GENESIS CO., LTD. , Toppan Printing CO., LTD. , ADVANTEST CORPORATION, JNS.Co.,Ltd. , DREAM·TRUST COMPANY

Core Project



Collaborations with participating companies (B-U-B)

To accelerate social implementation of our concept, our university welcomed to join many kinds of companies from divest different industrial fields, and encouraged our collaborations. Then, we are forming a large healthcare industrial "structure" based on a B-U-B platform—a novel framework of business styles among companies with university. Our aim is to create a future, in which people and the society itself also will be transformed with the sensor sharing businesses that would be made with "Health Screening during a daily life" such as relaxing time at home, traveling, physical exercise, even in an eating time.

*B-U-B (Business-University-Business): A collaboration platform with a multi-corporation and university intellectual property.

1."Daily Health Screening Platform" implementation

Prof. Mitsuyuki Nakao (Tohoku University), NEC Solution Innovators, Ltd., and others are working to develop a unique PDS Business Platform on the "OMOIYARI AI" system, which is composed with OMOIYARI, compassionate interaction, Artificial Intelligence,PSD business and social implementation trials.

2."House B-U-B" implementation for a Daily Health Screening.

Prof. Hideki Kojima (Tohoku University), Anabuki Housing Service Co., Ltd., Waseda University, Tohoku Gakuin University, and others are trying to realize a novel house system with unobtrusive sensing for Daily Health Screening, which is developed with communication robot, health indicators, eye health sensors, biological balance sensor and bacteria detection systems.

3."Travel B-U-B" implementation for a Daily Health Screening.

Prof. Ryoichi Nagatomi (Tohoku University), JTB Corporation, and some are planning to verify the novel health tourism project with the technologies of unobtrusive sensing system in a daily time, which leads to the health screening verification.

4."Food B-U-B" implementation for a Daily Health Screening.

Prof. Atsushi Hozawa (Tohoku University), Kagome Co., Ltd., Omron Healthcare Co., Ltd., and others are creating Food based health control business from the research results on the blood pressure with salt intake, and/or supplements to improve blood circulation, which is based on the sensing that links food and health, and on the sensing and genome collaborative researches.

5."Exercise B-U-B"implementation for Daily Health Screening.

Prof. Toshiyuki Hayase (Tohoku University), Elecom Co., Ltd., Tokyu Sports Oasis, Inc., and Dentsu Inc. are creating service packages for a Daily Health Screening system with physical activities to solve people's health issues with contacting sensor technologies, ingestible sensors and smart furniture.

6."Mirror B-U-B" implementation for a Daily Health Screening.

Prof. Makoto Yoshizawa (Tohoku University), CAC Corporation, and others are trying to create business models during the daily human behavior in front of the mirror with the intelligent mirror technology.

7."Eye and Health B-U-B" implementation for a Daily Health Screening.

Prof. Toru Nakazawa (Tohoku University), At Co., and Crewt Medical Systems have created a database that synthesizes the information from their respective sensing devices with genome information. In addition to ocular disorder diagnosis, they aim to develop new systemic disorder diagnoses and build a prognostic prediction system.

Topics

■Social implementation of our daily life sensing technologies

・COI Tohoku participant CAC has just begun their new service based on an "intelligent mirror" technology which indicates blood circulation, pulse waves and autonomic nervous system conditions without any body contact. Ryoden Corp. plans to use the technology in vehicles, with a driver monitoring system on the way.

・Our small type of novel ingestible sensor was successfully tested in animals, which leads us more practical application phase for human healthcare soon.

■Establishment of indicators about food balance and blood pressure

We made a success with people in Tome-city, Miyagi, with empirical studies of urinary sodium—potassium ratio monitoring. In a car-dependent community with high salt intake, measurement over two years with just one type of sensor brought down blood pressure throughout the community, the possibility of an effective community intervention was revealed. Next, we raise awareness through sodium—potassium map distribution, as well as addressing specific job types.

(C) Omron Healthcare

■COI Tohoku startups

Following the launch of EC SENSING in February 2019 and AzulEnergy in July 2019, SensChip was set up in February 2020. We look forward to more startups from the COI Tohoku initiative taking their technologies out into society.

■Improving QOL of the people living in our healthy longevity society with eyesight dominant care

To improve our quality of life with prevention and management of glaucoma and other eye afflictions, We are establishing a personalized medical care platform using of sensor and genome data, etc. with the great contribution of Japonica Array, a Japanese genome analysis platform designed by the Tohoku Medical Megabank Organization. Drug and inspection equipment companies are also part of this new B-U-B platform.

■Overseas expansion of our sensor-centric social ecosystem

(C) Dentsu Inc.

In North America, We introduced our technology of a sensor-embedded cushion inspired by cross-legged Zen meditation, then we do make some business partnerships in Europe and Asia, and other overseas alliances, we are now aiming to solve our common health care related problems globally.

■"OMOIYARI AI" as our innovation platform

Starting with LAVITA, a network system service developed by Nihon Kohden, Tohoku University is now developing novel health management capabilities under encryption and security considerations based on an open source community-based platform and is working to provide into the new B-U-B lifestyle services companies.

Inquiry

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Project Period：FY2013～FY2021

http://coi.t.u-tokyo.ac.jp

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 Advisor to Mitsubishi Chemical Holdings
Joined then Mitsubishi Chemical Industries Limited in 1976. Worked on management strategy, served as Managing Executive Officer, before appointment as adviser in 2012. Project Leader/Director of COI since 2013.

Research Leader/Deputy Director
Ung-il Chung/Yuichi Tei
Professor, Graduate Schools of Engineering and Medicine, The University of Tokyo
MD from The University of Tokyo School of Medicine in 1989, and Ph.D. from the Graduate School of Medicine in 1997. Conducted research and education at Massachusetts General Hospital, Harvard Medical School and the University of Tokyo, before appointment as Professor of alma mater in 2007. Research Leader/Deputy Director of COI since 2013.

The Future

Toward the Self-Managing Healthy Society in the Future

Vision of the “Self-Managing Healthy Society”

Backcasting the services that will be needed in “A Society in which we actively climb the stairs of life (in the 100-year life)”

■Data reform
Develop a data platform that unites data in the medical domain and the daily life domain, and create new value through big-data analysis

■Social system reform
Working practice: Set a social environment where active people can continue to work for the rest of one’s life, reconsidering the relationship between the young and the elderly as a continuum, not as a dichotomy.
Insurance system: From the system to “help cope with loss of one’s health” to “help maintain one’s health”, by changing the flow of money

Tackle these issues across barriers among COI Sites and government agencies

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 Advisor to Mitsubishi Chemical Holdings)
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】Kyowa Kirin Co., Ltd., CANON MEDICAL SYSTEMS CORPORATION, FUJITSU LIMITED, IBM Japan, Ltd., PST Inc., Nippon Sogo Systems, Inc., TANITA HEALTH LINK, INC., CHUGAI PHARMACEUTICAL CO., LTD., Olympus Corporation
(The University of Tokyo COI-initiated venture: Lily MedTech Inc.)

Core Projects

Group 1. Standardization of Health/Medical ICT（Platform）

【Kazuhiko Ohe (Graduate School of Medicine), Fujitsu, Nippon Sogo Systems, Tanita Health Link】

In order to build a platform that enables prediction of an individual's health and medical condition using health and medical data, we shall expand the platform we developed based on the SS-MIX2 Storage System that does not rely on specific database system, by adding data from health checkups, data measured at home, and finally, personal genome data, in addition to data from medical examination.

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

【Akiko Kishi Svensson (Graduate School of Engineering), Noriko Yoshimura (Graduate School of Medicine), Shinichi Tokuno (Graduate School of Engineering), PST】

We shall develop a system that helps people consider health maintenance as a serious personal matter, for all ages ranging from the young to the elderly, by developing (1) a program that encourages behavioral transformation to maintain and improve personal health using data from health checkup and wearable devices, (2) a program that enables prediction of diseases including cognitive disease using the voice, and (3) a program that predicts the risk of becoming under nursing care based on the analysis of accumulated data from elderly cohort studies.

Group 3. Disease Prevention Measures

【Masaomi Nangaku, Keishi Fujio （Graduate School of Medicine), Seiya Imoto (Institute of Medical Science), Kyowa Kirin, Chugai Pharmaceutical, IBM Japan】

In order to prevent nephropathy due to aggravation of diabetes, we shall develop methods to predict the degree of severity progression and treatment methods through the identification of biomarkers in patients showing rapid renal function decline.

We shall also develop preventive methods of immunological disorders and diagnostic methods for diseases including colon cancer, using whole genome analysis, whole metagenome analysis of intestinal flora and eQTL analysis.

Group 4. Medical Technology Innovation

【Ichiro Sakuma (Graduate School of Engineering), Canon Medical Systems, Olympus】

By utilizing the Medical Technologies Evaluation Laboratory (MTEL), we shall develop (1) ultrasound diagnostic devices for home use that do not involve radiation exposure, (2) endoscope for use within blood vessels, (3) novel operating system using image guided technology.

Strategy of Todai COI: “Prevent” at every step (Seamless care Under One Roof)

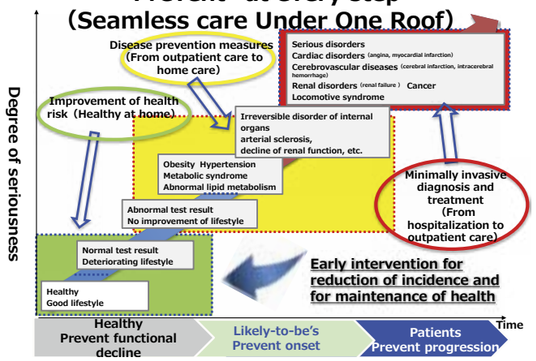
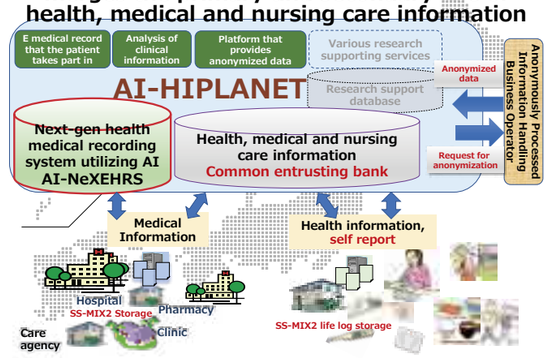


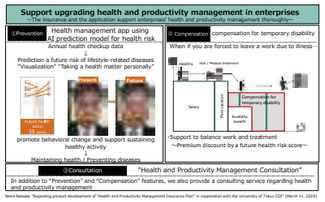
Image of the platform AI-HIPLANET that merges the primary and secondary use of health, medical and nursing care information



Topics

■ Cooperation with Mitsui Sumitomo Insurance Company, Limited and Aioi Nissay Dowa Insurance Co., Ltd.

The function of our "MIRAMED" application to visualize the risk of metabolic syndrome and promote behavioral change, was adopted by MS&AD for their insurance product "Health and Productivity Management Supporting Insurance" for corporate customers. In combination with the insurance that compensates for temporary absence from work, said function of MIRAMED will be implemented as a health promotion service for employees.



■ Lily MedTech Inc. was awarded the Director prize of the Small and Medium Enterprise Agency of the Japan Venture Awards 2020

Lily MedTech Inc., a start-up company based on the fruit of the COI, was awarded the Director prize of the Small and Medium Enterprise Agency of the Japan Venture Awards 2020.

■ Development of obesity and diabetes vaccines targeting intestinal flora

Development of an obesity vaccine that keeps one thin even after eating has progressed through the analysis of intestinal flora, and its effect was confirmed in mice.

Development of new therapy for Intestinal bacteria-mediated diseases

■ MIMOSYS has been adopted as part of the “ME-BYO index” by the Kanagawa Prefecture government

This enables residents of Kanagawa Prefecture to measure their mental health & stress condition at any time.
(MIMOSYS has been adopted as a measurement item of the ME-BYO index.)

* The ME-BYO index visualizes individual ME-BYO status in figures from 4 (four) aspects, i.e. lifestyle, mental health & stress, cognitive function and life function. It is implemented in the smartphone app ‘My ME-BYO Record’ which is provided by Kanagawa prefectural government free of charge.

Contact
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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

https://coins.kawasaki-net.ne.jp/en/

Center of Open Innovation Network for Smart Health (COINS)

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

Project Leader
Hiromichi Kimura
KAWASAKI INSTITUTE OF INDUSTRIAL PROMOTION
1979 Kyowa Hakko Kogyo
1986 Vice President of J.P. Morgan
1989 President and CEO of Pharmacia Biotech K.K.
1998 President and CEO of Monsanto Japan Ltd
2018 Prof. The University of Tokyo

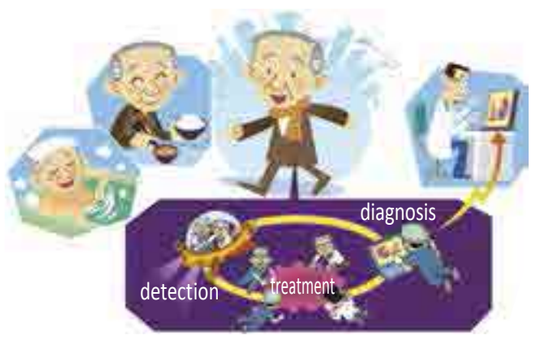
Research Leader
Kazunori Kataoka
KAWASAKI INSTITUTE OF INDUSTRIAL PROMOTION
1998 Prof. Graduate School of Engineering/Medicine,The University of Tokyo
2015 Director General, iCONM
2016 Prof. The University of Tokyo

The Future

COINS Future Technology

Towards Realization of
“In-Body Hospitals”

Be healthier autonomously



Smart Nanomachines patrolling around the body

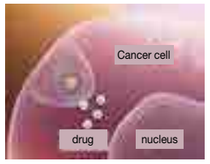
"In-Body Hospitals (internal body hospital)" was introduced as one of the concepts leading the future nanotechnology on international scientific journal “Nature Nanotechnology”. Nat.Nanotech. 11,828-834 (2016) Published online 05 October 2016

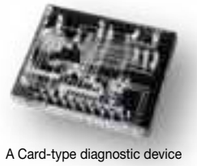
Outline

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 lives. We think it is the development of dream-like smart nanomachines patrolling around the body 24 hours a day to detect any signs of diseases, treat them and immediately report the information to medical 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. COINS vigorously promotes integrated researches with universities, industries and governmental organizations to implement cutting edge medical care at iCONM as a core research center.

Application & Service

- Nanomachines which target and eliminate intractable cancers
  - Delivering drugs without hurting normal cells → less side effects
- The system for in-home cancer diagnosis without blood sampling
  - Medical checkups are feasible at home with a card-type diagnostic device





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 institutions】The University of Tokyo, Tokyo Institute of Technology, Tokyo Women’s Medical University, Tokyo Medical and Dental University, Tokyo University of Science,Tokyo Medical University, National Cancer Center, National Institutes for Quantum and Radiological Science and Technology, Medical Industry Innovation Institute, Central Institute for Experimental Animals, Japan Radioisotope Association., SBI Pharmaceuticals Co., Ltd., Kowa Company Ltd., Shimadzu Corporation, JSR Corporation, Toray Industries, Inc., NanoCarrier Co., Ltd., NOF Corporation, Nitto Denko Corporation, Nitto Boseki Co., Ltd., Nippon Kayaku Co., Ltd., Fujifilm Corporation, Braizon Therapeutics Inc., Kanagawa prefecture, Kawasaki city

◇**In operation**◇
- Innovation Center of NanoMedicine (iCONM)
- Life Science & Environment Research Center
- National Institute of Health Science
- Central Institute for Experimental Animals
- Fujifilm RI Pharma Co., Ltd.
- Johnson & Johnson Tokyo Science Center
- Japan Radioisotope Association
- PeptiDream Inc.
- Life Innovation Center.
- Medtronic Innovation Center Japan

etc.

◇**Moving to the site**◇
- JSR Corporation
- Kawasumi Laboratories, Incorporated
- CYBERDYNE Inc.
- Shimadzu Corporation

Key R&D Themes

Targeting	1. Nanomachines which can target and eliminate intractable cancer Leader: Kanjiro Miyata (UTokyo) iCONM, NCC, JSR, NanoCarrier, Nittobo, Nippon Kayaku, JRIA, Kowa	◆ Nanomachines loaded with ligands targeting treatment-resistant cancer and metastatic cancer ◆ Nanomachines containing new candidate drugs
Overcoming	2. An innovative technology for the treatment of central nerve diseases Leader: Yasutaka Anraku (UTokyo) iCONM, TMDU, Braizon	◆ Nanomachines for penetrating the blood-brain barrier (BBB) ◆ Creation of model mouse and behavioral test evaluation
Prevention	3. Nanomachines that carry messenger RNA (mRNA) for tissue reconstruction and nano-sized vaccine Leader: Keiji Itaka (TMDU) iCONM, Utokyo, NOF, CIEA, NanoCarrier	◆ Nanomachines for controlled release of biologically active substance for controlling cell differentiation and growth ◆ Nanomachines capable of efficiently acting on viral and cancer antigen proteins, with the aim of vaccine application
Diagnosis	4. The system for in-home cancer diagnosis, which requires no blood sampling Leader: Takanori Ichiki (UTokyo) iCONM, TMDU, TMU	◆ Fast cancer diagnostic device that uses micro-RNA in the blood as a marker ◆ Fast cancer diagnosing device that uses micro-RNA in urine and saliva as a marker
Treatment	5. Theranostic system, which combines nanomachines and medical equipment ultra-minimally invasive treatment Leader: Nobuhiro Nishiyama (Titech) iCONM, UTokyo, TWMU, TUS, QST, SBI Pharma, TORAY	◆ Nanomachines that deliver a contrast medium and a sensitizer ◆ SDT system consisting of nanomachines and an array transducer for treating solid cancer
	6. Social system for implementation of the research results into society Leader: Tomohiro Anzai (iCONM) UTokyo, Titech, Fujifilm, Mi3, Shimadzu, Nitto Denko	◆ Measured outcome indicator making use of base management ◆ Regulatory science on nanomedicine ◆ Consider a new preventive business model

In-Body Hospitals → Smart Health Society

Topics

Nanomachines for the treatment of cancer and brain diseases

- Anticancer drugs are encapsulated in the nanomachines for tumor cells and the clinical trials are undergoing for systemic therapies of cancer patients with lower adverse events.
- The usefulness of target-oriented nanomachines has been demonstrated in clinical trials conducted in collaboration with other institutions.
- Nanomachines penetrating Blood-Brain Barrier has been successfully developed.

Development of new medical devices for diagnosing and preventing diseases

- In the development of a prototyping quick cancer diagnostic device with micro-RNA, it was improved as a mobile type.
- “A patch-type artificial pancreas” was developed to integrate detection, diagnosis and treatment.

Establishment of start-ups

① AcuuRna Inc.: Implementing nanomachines with nucleic acid medicines including RNA medicines (09/2020 AccuRna was merged into NanoCarrier.)
② Braizon Therapeutics Inc.: Implementing Blood-Brain Barrier permeable nanomachines.
③ iXstream, Inc.: Developing new methods for exosome analysis and micro-RNA detection systems.
④ SONIRE Therapeutics Inc.: Implementing SDT (Sono-dynamic Therapy). Established in February 2020.

Our concept “In-Body Hospitals” appeared in Nature (15 Nov. 2018)

“A nano-hospital in every body” Nanoscale doctors curing the body from within sounds like science fiction, but for Japanese research centre COINS, it’s a serious goal.

-The world’s most innovative research center which creates new medical technologies to realize human dream-

iCONM’s Vision

➢To become the hub of Keihin-area Health Kombinat;
➢To be the civic pride of Kawasaki;
➢To continuously create new medical technologies to realize human dream;
➢To aim for the world’s most innovative research center.

- iCONM has an excellent location on the opposite shore to Haneda Airport. it is expected to be the open innovation platform as the hub for promoting integrated research in and out of Japan.
- Host an International Symposium to present the activities of COINS inviting research institutions outside Japan. iCONM welcomes visitors of overseas delegates for international research collaboration.
- iCONM respects and promotes young researchers’ independence. We employ young researchers 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 #2104,
3-25-14, Tonomachi, Kawasaki-ku,
Kawasaki 210-0821 JAPAN
[Access] 15-minutes walk from KEIKYU “Kojimashinden” Station

Project Period : FY2013～FY2021

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 Maneging Executive 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. Senior Managing Executive Officer in 2020.

Research Leader
Dr. Tadao Isaka
Ritsumeikan University,
Vice President,
Professor, College of Sport and Health Science

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

- **Smart educational teaching materials that allow you to exercise while learning physical information and having fun**
- **Smart fitness to encourage and continue exercise**
- **Provision of products and space utilizing audio spot technology**
- **Guidance and continuation of exercise through visualization of vital data**

Implementation Structure

Project Leader : Takahide Tanaka (OMRON HEALTHCARE Co., Ltd.)　Research Leader : Tadao Isaka (Ritsumeikan University)
Satellite Leader : Hisashi Naito (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, HOS., Ltd., Nippi. Inc., TOKYU LAND CORPORATION, Togo Institution Service Co.,Ltd. WELLNESS MEDICAL INSTITUTE,Ltd.

Key R&D Themes

At this site, focusing on the following R & D themes, we will summarize the indispensable issues for commercialization into four, and provide services for residents and medical implementation.

1. The Practical Application of Smartwear

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

Nippi. inc. TOKYO LAND CORPORATION. Togo Institution Service Co., Ltd.

Roll out exercise programs developed to Creating a lifestyle of exercise to industry and government,Maintaining and improving muscle strength contributes to extending healthy life expectancy.

Must be commercialized

Educational teaching materials	Fitness	Vital date art system	Space-Sharing

Topics

1. We proceed with three business plans for the smartwear; the educational tool,the fitness gym. Below picture indicates the demonstration experiment in the primary school. Conducting such experiment, we elaborate the productive specification.

2. The business model for the ultrasonic speakers with strong directionality and linearity was adopted as a program of Start-up Incubation from Core Research (SCORE) by JST (Japan Science and Technology Agency). Conducting quantitative and qualitative surveys for specific product development.

3. By making the vital data developed by the Young Partner Fund available for viewing, we are promoting the commercialization of a variety of exercise content in the health and medical fields.

Inquiry
Division of Research, Research Office at BKC
Tel : +81-77-561-2802　Fax : +81-77-561-2811
E-mail : smart-r@activeforall.jp
1-1-1, Nojihigashi,Kusatsu,Shiga 525-8577
[Access] 15 minutes by Bus from JR Minami Kusatsu Station

Project Period：FY2013～FY2021

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

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

Realize “Smart, flexible and accommodating society”

Project Leader
Tsuyoshi Nomura
Visiting member
Panasonic Corporation
2013-2015 Managing Director, Director of Manufacturing Headquarters
2009-2013 Managing Executive Officer, Director of Manufacturing Innovation Division
2004-2009 Director of Mount Engineering Lab.

Research Leader
Hidetoshi Kotera
Program-Specific Professor
Kyoto university
2018- Executive Director, RIKEN
2012-2013 Executive Vice President of Kyoto Univ.
2000-2012 Professor of Graduate School of Engineering, Kyoto Univ.
1982-1993 Matsushita Electric Industrial Co., Ltd

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 and AI.
- **Smart nutritious food for solving lack of nutrition of ladies and elderly people**
  Smart nutritious food which have high protein and add various nutriment by vegetable origin.
- **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 by wireless electricity transmission, solar cell, and power storage device**
  Cordless infrastructure system which supply with microwave to mobility charging and sensor of vital, volcanic observation, accident rescue and preventive maintenance, and by film solar cell and power storage device.

Organization

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

【Core institution】Kyoto University
【Participating institution】Panasonic Corporation, Otsuka Food Co., Ltd., KONICA MINOLTA, INC., SUNCALL Corporation, SHINMEI Co., LTD., Daicel Corporation, Plascoat Co., Ltd., HORIBA, Ltd., Hokkori-no Plus Co. Ltd., MaRI Co., Ltd., Unicharm Corporation, Kyoto Institute of Technology, Bukkyo University, Kansai Medical University, Nihon University, AOYAMA GAKUIN University, RIKEN, Doshisya University, Nara Women’s University, Osaka University, Kyoto Prefecture, Kyoto City, Seika Town AGC Inc., Oike & Co., Ltd., Kewpie Corporation, Cykinso, Inc., SAKATA INX CORPORATION, JSR Corporation, Cellspect Co., Ltd., Dai Nippon Printing Co., Ltd., Taiyo Kogyo Corporation, Techno Smart Corp., IBM Japan, Ltd., FINGGAL LINK CO.,LTD., Fujipream Corporation,MARUBUN CORPORATION, Minebear Mitsumi Ltd.

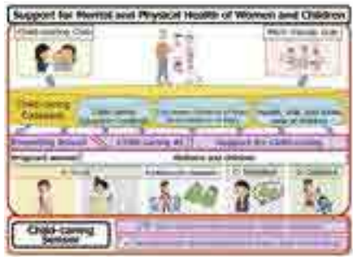
International Science Innovation Building

Core Project

1.Support for women and child-caring

Unicharm Corp., Konica Minolta Inc.
Hokkori-no Plus Co. Ltd., Daicel Corp.
MaRI Co. Ltd.
Masako Myowa, Koji Koyamada,
Takeo Nakayama, Kazuyoshi Nakabe,
Motofumi Suzuki, Takuya Sakamoto (Kyoto Univ.)

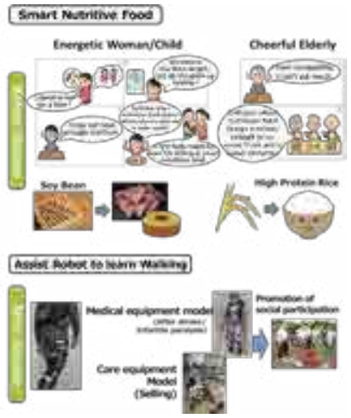
Through developing parenting school for pregnant women, child-caring AI for solving worries, and support to growing care of children, we **realize a society that women can raise children without fearing.**



2. Healthcare

Otsuka Foods Co., Ltd., SHINMEI Co., LTD.
SUNCALL Corp.
Kyuya Nakagawa, Takanori Yoshikawa,
Koji Ohata (Kyoto Univ.)

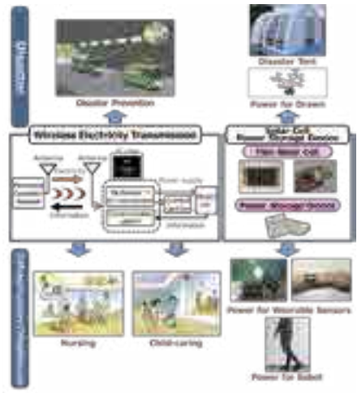
Through developing smart nutritious food of delicious meat soybean-derived and high protein rice for support health, and assist robot to learn walking attached easy, we **realize healthy and peaceful society for elderly from**



3. Disaster-resilient infrastructure

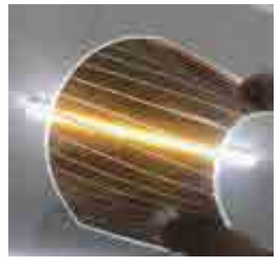
Panasonic Corp., Plascoat Co., Ltd.
HORIBA, Ltd.
Naoki Shinohara, Atsushi Wakamiya，
Takeshi Abe (Kyoto Univ.)

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



Topic

1. ”Film solar cell” was given press release.
We succeeded in development of a versatile method in large area application in a high-performance Perovskite solar cell.



2. ”Assist robot to learn walking” was given press release.
SUNCALL released nursing model **“Orthobot® “**.

3. ”Wireless Electricity Transmission” “Power supply for sensor” was started field experiment in “Kami no sono” of Seika town. It detect position of the elders on the bed by battery-less sensor, and prevent fall of them.

4. ”Wireless Electricity Transmission” “Disaster prevention” was authorized in “National strategic zone” about the field experiment in “Jizo tunnel” of Miyazu city in 2020.

5. ”Support for women & child-caring” “Non-contact monitoring” was conducted field experiment in a kinder garden in Kakogawa city. We monitor children taking a nap.

Inquiry

Research Promotion Institution for COI Site, Kyoto University
Tel : +81-75-753-5641/5642 Fax : +81-75-753-5643
E-mail : info@coi.kyoto-u.ac.jp
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

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
Motor Sports Supervisor / Brand Strategy Dpt.
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
Takashi Kiriyama
Professor of New Media at Tokyo University of the Arts
Head of Graduate School of Film and New Media at Tokyo University of the Arts, Ph.D. from Graduate School of Engineering, the University of Tokyo. He worked at Research into Artifacts, Center for Engineering (RACE), the University of Tokyo, and Center for Design Research (CDR), Stanford University. His research interests lie in the areas of media technology and interactive media.

The Future Vision

Results (Up to Phase.2)
- Construction of " Research & Development platform" & "Social Implementation Support Platform “

Target(Phase.3)
- Create A New Normal in Artistic Activities
- DX for Art Education
- Succession of the 2platforms inside and outside the university

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

Outline

The Group is led by 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. By fusing the arts together with science and technology, and by conducting a diverse range of activities to create innovation, based on the unique ideas generated here, the possibilities of social implementation of art are being applied in many different fields. In the third phase, while handing over to the university the platforms, created through the Group’s activities, which can be socially implemented, the Group also aims to hand over the know-how in creating innovation and realizing social implementation as a platform to the university, for a post-COI response. Furthermore, to tackle social issues caused by the recent outbreak of the novel coronavirus, the Group will apply DX (digital transformation) using the power of art and science, and seek to achieve “Establishment of Japan as a Cultural Nation and the Realization of a Symbiotic International Society”, taking into consideration the changing environment with coronavirus and after coronavirus.

Application & Service

- Hand over various functions and projects within and outside of the university towards social implementation
- Application of DX in relation to social issues
- Community development, human resources training, STEAM education, education in sensibility, creation of the concept and foundation of a new-generation society through creation of a new-generation cultural industry
- Synesthetic contents such as highly accurate cultural property reproductions and mobile art exhibits contributing to cultural diplomacy and promotion of cultural sharing, development support for the tourism industry, and promotion of education in sensibility
- Learn from people with disabilities, to research and develop education in “synesensory” and sensibility, and pursue new possibilities in artistic expressions
- Contribution to the cultural programs of the Tokyo 2020 Olympic and Paralympic Games, and the Expo 2025 Osaka

Implementation Structure

Project Leader : Koshi Yamamoto (JVCKENWOOD Corporation)
Research Leader : Takashi Kiriyama (Tokyo University of the Arts)

【Core institution】Tokyo University of the Arts
【Lead Company】JVCKENWOOD Corporation
【Participating institution】Nagoya University, National Institute of Information and Communications Technology(NICT), YAMAHA CORPORATION, Benesse Holdings, Inc., Ogawa & Co., Ltd., TAKEO Co., Ltd., Technology Seed Incubation Co., Ltd., NHK Engineering System,Inc., The Asahi Shimbun Company, Makers' Inc. , Nikkei Inc., NHK Promotions Ins.

Arts & Science LAB.

Key R&D Themes

1. Research on cultural sharing

Masaaki Miyasako (Professor Emeritus, Project Professor, Tokyo University of the Arts),
Takashi Fukai (Professor Emeritus, Project Professor, Tokyo University of the Arts),
Kazuhiro Mihashi (Project Professor, Tokyo University of the Arts)
Yuichiro Taira (Project Associate Professor, Tokyo University of the Arts),
NHK Promotions Inc., Takeo, The Asahi Shimbun, Ogawa & Co., Ltd., Nikkei Inc.

By combining the achievements of the arts, history and technology, the sub-group will create synesthetic contents such as “Clone Cultural Properties” which reproduce the DNA of arts and mobile museums. The sub-group will contribute to creating the respected country through deploying these cultural properties as ‘exquisite resources’, as well as the sustainable growth through tourism industry and education for the AI era.

Creating clone cultural properties

2. Research on synesthetic media

Takashi Kiriyama (Professor of New Media, Tokyo University of the Arts)
Toshiyuki Kuwabara (Project Lecturer, Tokyo University of the Arts)
NICT, YAMAHA

The sub-group aims to construct a media that stimulates vision, hearing, touch, etc. by making full use of advanced technology, such as live animation concerts that apply AI and synesthetic applications that use AR.

3. Cultural diplomacy and art business

Junji Ito (Project Professor, Tokyo University of the Arts),
Akira Senju (Project Professor, Tokyo University of the Arts)
JVCKENWOOD

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.

4. Research on robotics & performing arts

Oriza Hirata (Project Professor, Tokyo University of the Arts),
Takenobu Chikaraishi (Project Lecturer, Tokyo University of the Arts)
Benesse Holdings

While creating and presenting cutting-edge "Robot Performing Arts" works, the sub-group will develop the educational contents and aim to develop a new sightseeing center that directs the whole town with theatrical methods.

‘Everybody can play the piano’ workshop

5. Research on Inclusive Arts

Oko Arai (Project Professor, Tokyo University of the Arts)
Akitaka Sugishita(Assistant Professor, Nagoya University Hospital),
Benesse Holdings, YAMAHA, JVCKENWOOD , Ogawa & Co.,Ltd.

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. Designing Music & Science

Rui Ogawa (Project Associate Professor, Tokyo University of the Arts)
Ritsumeikan University,
Juntendo University,TSI Co., Ltd., JVCKENWOOD, JVCKENWOOD Victor Entertainment Corp., NHK Engineering System,Inc.

The sub-group aims to integrate arts, science and sports. We will develop Art Creation System Using Vital data and Circus Opera as cultural program.

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 Properties” in full size and exhibited at Tokyo University of the Arts Museum Annex. Furthermore, the restored mural was presented in the G7 Ise-Shima Summit. It was a meaningful opportunity to show that even a vanished culture could be shared worldwide with Clone Cultural Properties technology.

② We are researching and developing the state of art looking into a society in which AI and people coexist. For the first time in the world, we have utilized the original "AI-based animation synchronization technology" that synchronizes animation with the live tempo of music performances. This technology has already been successfully utilized in the live animation concerts such as in Los Angeles, Lisbon, Annecy, and other overseas locations as well as in Japan.

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
coi-mng@ml.geidai.ac.jp

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

Project Period：FY2013～FY2021 https://www.coi.titech.ac.jp/

Research Center for the Earth Inclusive Sensing Empathizing with Silent Voices

Aim for a prosperity and tolerant coexistence society that lasts a thousand years by getting “healthy connections between people, society and nature” by IoT/AI sensing.

Project Leader
Toshiyuki Hiroi
VP
R&D Center
Sony Corporation

Research Leader
Hitoshi Wakabayashi
Professor
Tokyo Institute of Technology
Director
Research Institute for
the Earth Inclusive Sensing

The Future

Outline

For human beings who aim for lasting prosperity in the limited environment surrounding the earth from now on a coexistence society is desired where humanity becomes rich with the earth. By creating cutting-edge IoT/AI sensing technology that gives us awareness of connections between people, society and nature, and promoting change in human behavior to build new connections and to make it cyclic, we aim to realize a prosperity and tolerant coexistence society in which both people and the earth are fruitful.

Application & Service

■ **Empathizing with the Silent Voices of Animals**
In “society-nature interface”, ethical production and consumption are essential for foods which are a blessing from nature in order to realize a rich coexistence society, Animal welfare (AW) is urgently required in livestock industry treated as important sources of protein. We will build a mechanism to promote ethical production and consumption by intensifying the “connection” between cattle, producers, consumers and Satoyama, which are giving us large impacts on economic and resource recyclings.

■ **Empathizing with the Silent Voices in Communications**
In “human-society interface,” where ICT technology and globalization are rapidly expanding to communicate each other, vulnerable communication is becoming a problem. Fostering empathy and co-creation with diverse people is an important issue to realize a tolerant coexistence society. We promote awareness and learning of “connections” by visualizing the characteristics of communication in a group, and build a mechanism to support mutual understanding among diverse people.

■ **Empathizing with the Silent Voices in Atmosphere**
One of the issues between humans and nature is the loss of many lives and damage to equipment and infrastructure due to lightning. We may be aware of the connection between nature and human, predict the occurrence of lightning in advance, and use it to evacuate people and back up equipment. To minimize damage from lightning, we will build a lightning prediction system and aim to realize a safe and secure coexistence society.

Organization

Project Leader : Toshiyuki Hiroi (Sony Corporation)
Research Leader : Hitoshi Wakabayashi (Tokyo Institute of Technology)

【Core institution】Tokyo Institute of Technology
【Participating institution】Sony Corporation, LAPIS Semiconductor Co.,Ltd.,
Information Services International-Dentsu, Ltd., Murata Manufacturing Co.,Ltd.,
OTOWA Electric Co.,Ltd., NITTOKU Co.,Ltd., CM Engneering Co.,Ltd., TechnoPro Inc.,
Farmnote Holdings Inc., TAIYO YUDEN Co.,Ltd., HATAPRO Inc.,Renesas Electronics Corporation,
EBIMarketing Co.,Ltd., Nissan Koseikai Tamagawa Hospital, Kanto Central Hospital,
Ota City, Ota City Industrial Promotion Organization

■ **Satellite Leader : Hiroshi Mizuta (Japan Advanced Institute of Science and Technology)**
■ **Satellite Leader : Ken-ichi Takeda (Shinshu University)**


O-okayama Campus Ishikawadai Bldg.1

Core Projects

1. Application & Service of Earth Inclusive Sensing

[Hiroyuki Ito, Yoshihiro Miyake, Takayuki Nozawa(Tokyo Institute of Technology), Ken-ichi Takeda(Shinshu University), Hiroshi Mizuta(JAIST), Sony Corporation, LAPIS Semiconductor, ISID, Murata Manufacturing, OTOWA Elec., NITTOKU, CM Engineering, TechnoPro, Farmnote, EBIMarketing]

■ **Empathizing with Silent Voices of Animals**
The goal is to detect animal silent voices (conditions, feelings, etc.) with a collar-type device, then to provide feedback in a form that is easy for people to understand. Introducing animal-welfare and grazing-compatible real-time breeding management system to the production site in the livestock industry as AI smart technology.

■ **Empathizing with the Silent Voices in Communications**
IoT / AI sensing systems that visualize and improve communication in real time have been developed for the first time, and is implemented at universities as a scientific tool for innovative human resource development. In addition, it will be expanded for organizations such as companies.

■ **Empathizing with the Silent Voices in Atmosphere**
We have developed a significantly smaller and lower cost electric field sensor using graphene, a novel two-dimensional material made of single layer carbon. AI technology will analyze electric field data in the atmosphere obtained from electric field sensors at multiple points in order to built a lightning prediction system.

2. Fundamental Technology of Earth Inclusive Sensing

[Hiroshi Funakubo, Shunichiro Ohmi, Kuniyuki Kakushima, Hirotaka Nakahara, Yukio Kawano, Mutsuko Hatano, Miki Saijo (Tokyo Institute of Technology), Hiroshi Mizuta (JAIST), Sony Corporation, TAIYO YUDEN, HATAPRO, Renesas Electronics]

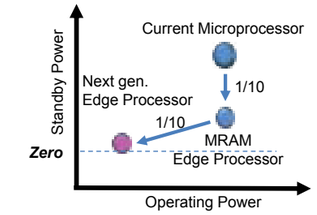
■ **Ultra-high Sensitivity Sensors**
We will develop sensors that detect various natural phenomena with ultra-high sensitivity, targeting human, social and natural areas.
Carbon Nano-Tube Tera-Hertz Sensor, Diamond Quantum Sensor, Graphene Sensor

■ **Zero Power AI/IoT Platform**

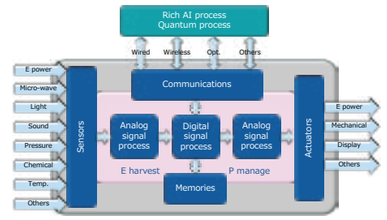
● **Non-Volatile Memory and Logic**
IoT edge devices require low standby and operating power. Non-volatile memory and logic technologies are used to reduce standby power, and low-voltage operation is used to reduce operating power. We aim to develop low voltage operated ferroelectric non-volatile memory by Tokyo Tech's original HfO_2 ferroelectric film.

● **IoT-edge AI smart sensing processor**
We will develop machine learning algorithms that significantly reduce the amount of computation for ultra-low-power high-speed processing specialized for edge devices, and demonstrate AI processing of sensor data on a low power processor that can be installed in IoT edge devices.

■ **Feedback to elucidate awareness and supportive actions**
Using robots incorporating AI, we will develop a feedback method that alert frail elderly’ s bad conditions or the abnormal postures causing an accident. We aim to establish feedback system which enhance awareness of frail elderly and supportive actions of family or care professionals to prevent accidents.



Power Consumption of next generation edge processor



Topics

■ **Field testing of cattle behavior estimation system using state-of-the-art IoT edge AI technology in progress**

● Using the collar-type IoT edge AI device attached to cattle, AI processing succeeds in estimating cattle postures and behavior (eating and drinking water/ prone posture, standing and walking position, etc.) with an accuracy of 98% or more.
⇒ “Sense and Think Collar" device (Low-power/LPWA compatible)

● Started field testing using a “Sense and Think Collar” device to estimate multiple behaviors and status of cattle at low cost while deeply considering animal welfare.


Experiment at AFC Farm, Faculty of Agriculture, Shinshu University

■ **Development of "SyncViewer" to visualize communication quality**

● Developed "SyncViewer", the world's first system that visualizes communication (relationships among multiple speakers) in real time.

● Utilizing "SyncViewer" in participatory lessons as an application (EdTech) in the educational field, predicting improvement of students' positive emotions and ability to manage the situation.

● Extending “SyncViewer” with multi-modal sensing that include not only physical movements but also images and sounds, and developing communication tools that are meaningful for human relations (HRTech) such as meetings and interviews in general workplaces

Verification Test of SyncViewer at Tokyo Tech

Inquiry
Tokyo Institute of Technology (Tokyo Tech)
Research Institute for the Earth Inclusive Sensing
Tel : +81-3-5734-3562 Fax : +81-3-5734-3153
E-mail : coi.info@coi.titech.ac.jp
URL：http://www.coi.titech.ac.jp/

2-12-1, O-okayama, Meguro-ku, Tokyo, 152-8552, Japan
[Access] 10-minute walk from O-okayama Station on the Tokyu Lines

Project Period：FY2013～FY2021

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

Center for Active and Self-Reliant Society by Child Brain Development

Project Leader
Takeshi Uenoyama
Visiting member,
Panasonic Corporation
1981 Joined Panasonic
2008 Executive Officer
2013 Fellow
2017 Advisor
2018 Current position

Research Leader
Yasufumi Kaneda
Executive Vice President, Osaka University
1984 Assistant, Center of Cell Engineering, Osaka University
1992 Assistant Professor, Institute for Molecular and Cellular Biology
1998 Professor, Faculty of Medicine
2013-2014,2017-2018 Dean, Faculty/Graduate School of Medicine
2019 Current position

The Future

Outline

We will endeavor to realize our vision in ten years time; an active and self-reliant society where people of all ages can proactively face and conquer challenges by exercising their latent talents. We will make special efforts to foster healthy brain development in early childhood, which is considered as the most essential source of physical and mental health. Under one roof of the medicine-brain science-engineering close collaboration, we will contribute to establish an innovative and enriched environment, focusing on “health” and “education”. More specifically, we will explore human power determinants, elucidate network functions in a multiple of communities, provide a comfortable living environment and a highly communicative educational environment where the brain is fully activated without excessive stress.

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 lessons, strengthening strategy of team sports, etc.

Organization

Project Leader : Takeshi Uenoyama (Panasonic Corporation)
Research Leader : Yasufumi Kaneda (Osaka University)

【Core institution】Osaka University and Panasonic Corporation
【Participating institution】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, Tohoku University, Kansai Medical University, Hokkaido University, Hokkaido University of Education, Ritsumeikan University, Doshisha University, Otemon Gakuin University, imec international, Hitachi, Ltd., SHOWA DENKO K.K., KANEKA Corporation, NIPPON MEKTRON, LTD., DAIKIN INDUSTRIES, LTD., Takenaka Corporation, FINE JAPAN CO., LTD., JAPAN CHC CO., LTD., CRIMSON TECHNOLOGY, Inc., NISSIN KASEI CO., LTD., SHINKO Manufacturing Co., Ltd., NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc., Ricoh Co., Ltd., Shinhodo Inc.

■ Satellite institution : Kanazawa University
Satellite Leader： Mitsuru Kikuchi（Kanazawa University）
【Participating institution】Kanazawa University, Osaka University, Kanazawa Institute of Technology, PFU Limited, Ricoh Co., Ltd.

(ISIR, Osaka Univ.)

Core Project

1. Stress biomarker search and stress substance detection technologies

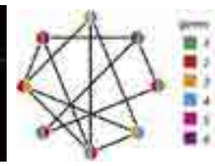
Leader: Koji Nishida (Graduate School of Medicine, Osaka Univ.)
(Panasonic, etc.)
The stress is one of the big factors to inhibit the human activation. We search for the stress biomarker that is most detectable even from a small amount of tear or blood. We also develop simple methods to quickly measure stress substances and to improve intestinal flora to enhance the immunity.

2. Immunity enhancement by intestinal flora improvement and by hydrogen generation in the body

Leader: Kunihiko Nishida, Hikaru Kobayashi (ISIR, Osaka Univ.)
(FINE JAPAN, Ricoh, JAPAN CHC, etc.)
The gut plays an important role in the immunity enhancement as the “second brain”. We develop medicinal products and supplements to improve intestinal flora and a gas sensor to monitor it. We work on enhancing immunity by eliminating oxystress-induced substances with hydrogen generated upon intake of silicon nanoparticles.

3. Brain function imaging and visualization of communication

Leader: Takahisa Taguchi (NICT・CiNet),
Takeshi Yagi (Graduate School of Frontier Bioscience, Osaka Univ.)
(Panasonic, Hitachi, etc.)
Installing state-of–the-art 7T-fMRI, we strive to elucidate brain functions and incorporate them into other sensing technologies. Furthermore, a basic principle of neural network in the brain is proposed as a new model and analogously applied to a community model. We aim to activate our society as a whole by visualizing and optimizing communication at school, at work and in communities.

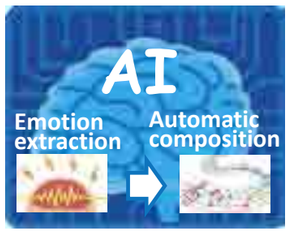


4. Imperceptible wearable sensors and activation devices

Leader: Tsuyoshi Sekitani, Mototsugu Ogura (ISIR, Osaka Univ.)
(imec international, NIPPON MEKTRON, Shinhodo, etc.)
For appropriate treatment, it is required to monitor brain waves. We inspect them with the latest wearable sensors and strive to develop imperceptible wearable devices. Integrated devices are also developed to activate brain by music or by transcranial direct current stimulation while monitoring brain waves.

5. Deep sleep and brain music for activation

Leader: Masako Taniike (Graduate School of Medicine, Osaka Univ.)
Masayuki Numao (ISIR, Osaka Univ.)
(DAIKIN, Takenaka, CRIMSON TECHNOLOGY, etc.)
Since sleeping has significant effects on brain activities, we attempt to develop application for sleep education and to provide good sleep by diagnosing sleep disorder and optimizing ambient temperature, etc. We also study emotion extraction and brain activation by auditory stimulation, i.e., automatically composed music in response to the brain status.

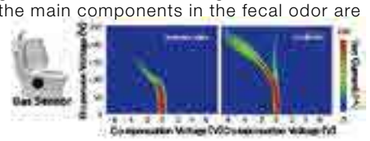


6. Children’s mental development with respecting diversity

Leader: Mitsuru Kikuchi (Research Center for Child Mental Development, Kanazawa Univ.) (PFU, Ricoh)
Respecting individuality and diversity of children, we measure the brain functions by a child-sized MEG, one of the three in the world. We also strive to evaluate the brain functions of elderly people, develop superconducting sensors for advanced MEG and promote human-robot interaction.

Topics

①Toilet gas sensor for health monitoring
We develop fecal odor analytical techniques to improve intestinal flora and physical condition. We also produce a prototype gas sensor system with adjusting external factors, assuming actual toilet use. Specific profiles of the main components in the fecal odor are identified. It is now under study in simulated environments.



②ASD diagnosis during an easy exercise with a child-customized MEG
MEG measurements of physical task enabled to visualize motor skills and the related brain activities in children with ASD. Autistic children show the longer response time and the reduced power of gamma band in the motor cortex, which is associated with autistic symptoms with more than 80% of diagnostic accuracy.

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

Co-Creation Coordination Division,
Department of Co-Creation Promotion,
Osaka University
2-8 Yamadaoka, Suita, Osaka 565-0871, Japan

Tel:+81-6-6879-4986 Fax:+81-6-6879-4204
Email:coi-info@coistream.osaka-u.ac.jp
[Access] 25-minute walk from Kita-Senri,
15-minute walk 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 well-being is nurtured

Project Leader
Hidetoshi Yoshida

Visiting Professor, Office for Academic and Social Collaboration, Hiroshima University

1980 Joined Victor Company of Japan (now JVC Kenwood Co., Ltd.)
2017 President and Representative Director, VAIO Corporation
2019 Visiting Professor, Office of Academic and Social Collaboration, Hiroshima University, Director, KANSEI Innovation Research Promotion Organization

Research Leader
Takafumi Sasaoka

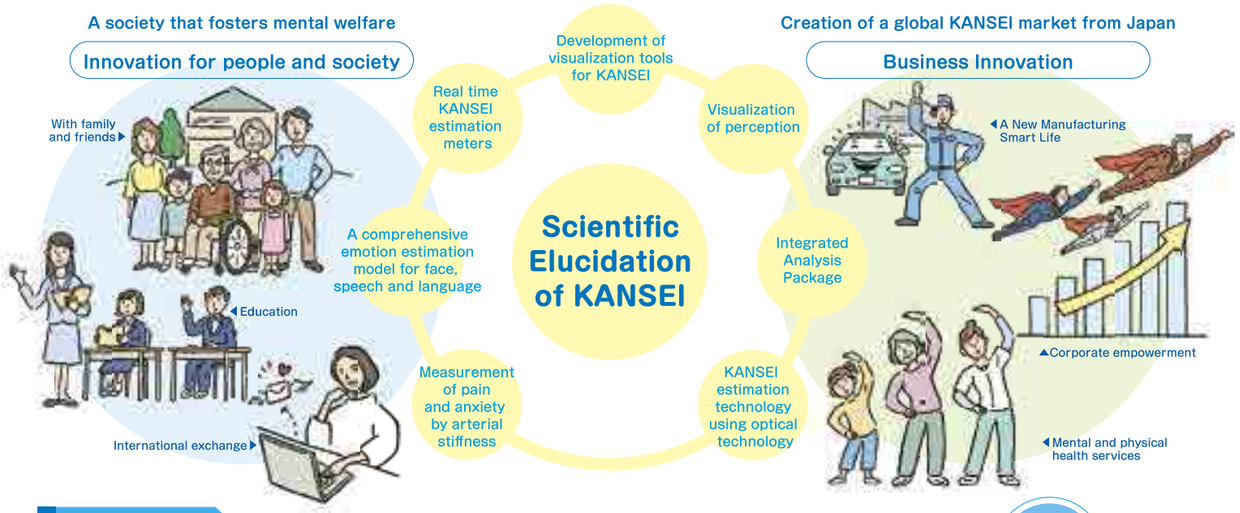
Associate Professor, Brain Mind and KANSEI Sciences Research Center, Hiroshima University

2003 Doctor of Informatics, Kyoto University
2014 Assistant Professor (Special Appointment), Graduate School of Biomedical & Health Sciences,Hiroshima University
2018 Current Position
Major in Cognitive neuroscience and Cognitive psychology

The Future

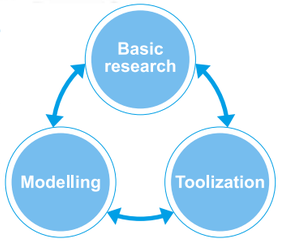
“Anytime, anywhere, with anyone.”

Social innovation through KANSEI innovation



Outline

Conventionally, the technology of manufacturing has developed with an emphasis on economy and efficiency. We rarely pay attention to the changes in our inner lives, such as the satisfaction and mental well-being of the people who use our products. This is because, at the current level of science, it is very difficult to figure out how the mind works. At the Center for KANSEI Innovation, we are approaching this challenging issue using the latest brain science. We aim to create a society where people and people, people and things, and people and society are connected and harmonized through "KANSEI". We define "KANSEI" as "the brain activity that causes some kind of 'awareness' when information obtained visually, aurally, and from other sources is compared to the individual's experience." By clarifying this mechanism, we can build an intellectual foundation for creating new value and bring innovation to manufacturing and services.



Applications & Services

- **Wearable and real-time KANSEI meters based on brain science**
  ·We will develop a tool to quantitatively measure KANSEI based on brain science.
  ·We aim to develop simple devices and tools, such as wearable, non-contact, non-constraining devices, to measure KANSEI in a variety of environments.
- **Products and services that accurately reflect the users' traits and instantaneously respond to KANSEI information in real-time**
  ·By incorporating analysis technology for sensory information into products and services, we aim to build technologies and systems that can be customized to meet the characteristics of each user and grow into products and services that are unique to them.

Organization

Project Leader : Hidetoshi Yoshida (Hiroshima Univ.) **Research Leader : Takafumi Sasaoka (Hiroshima Univ.)**

【**Core Institution**】Hiroshima University
【**Participating organizations**】Hiroshima City University, National Institute of Advanced Industrial Science and Technology, Otemon Gakuin University, Mazda Motor Corporation, Mitsubishi Chemical Corporation, MCC COMPOSITE PRODUCTS K.K., ANDERSEN Group, KOBELCO CONSTRUCTION MACHINERY CO., LTD., HIROSHIMA GAS Co., Ltd., TOTO Ltd., Sapporo Holdings Ltd., TOPPAN PRINTING Co., Ltd., Mitsui Chemicals, Inc., SHIMIZU CORPORATION, Meiji Co., Ltd., KONICA MINOLTA, INC.

Satellite institution: National Institute for Physiological Sciences(NIPS)
Satellite Project Leader: Ippei Hagiwara
(NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.)
Satellite Research Leader: Keiji Imoto (National Institutes of Natural Sciences (NINS))

【**Participating organizations**】NINS, NIPS, Yokohama National University, Kyoto University, Hokkaido University, NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc., Oki Electric Industry Co., Ltd., Tokai Optical Co., Ltd., NTT DATA Corporation, TOYOTA BOSHOKU CORPORATION, ZENSHO HOLDINGS 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)

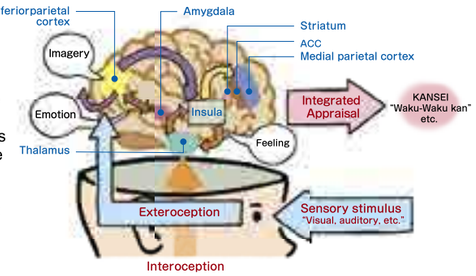
【**Participating organizations**】Shizuoka University, Hamamatsu University School of Medicine, The Graduate School for the Creation of New Photonics Industries, Chiba University, Hamamatsu Photonics K. K., HONDA ELECTRONICS CO., LTD., Brookman Technology, Inc., Pulstec Industrial Co., Ltd., Hashimoto Rashi Co., Ltd., PHOTRON Ltd.

Core Project

We aim to develop visualization technology for KANSEI and to implement this technology in society.

◆Scientific Elucidation of KANSEI

Sensory information from the five senses (exteroception) and from internal organs (interoception) are integrated in a site of the brain called the insula, and "awareness" is created in reference to past experiences. We have proposed the "KANSEI brain network hypothesis", which states that KANSEI is a system that triggers awareness and generates feelings such as "Waku-Waku” (excitement). We are also conducting research on the connections between people and people, and between people and society by elucidating the mechanism of "perception" that processes exteroceptive information and the process of communication with others. Furthermore, we are developing cutting-edge devices that will serve as the basis for visualization technologies for KANSEI and perception.



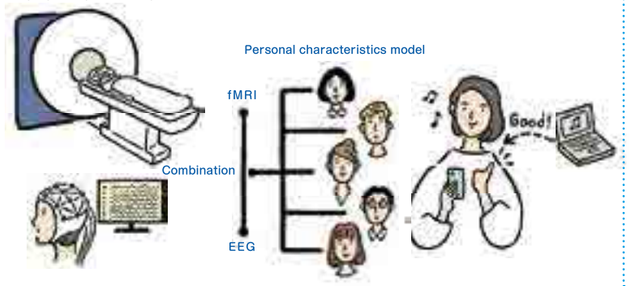
◆Main Research Interests

1. Visualization of KANSEI

We are working to model the findings of basic research to elucidate the mechanisms of "KANSEI" and to develop tools to solve social problems.

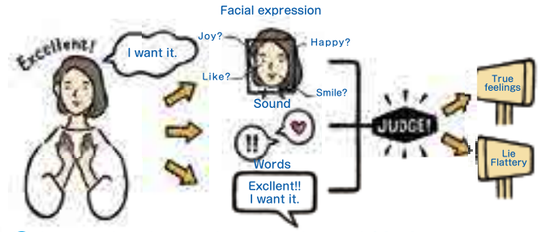
Real time KANSEI estimation meters

We built a tool for estimating "Waku-Waku" (excitement) using an electroencephalograph. By administering a simple questionnaire to the user, it is now possible to measure Waku-Waku based on the person's personality traits. With a wearable EEG meter and one laptop computer, it is possible to measure this in real time.



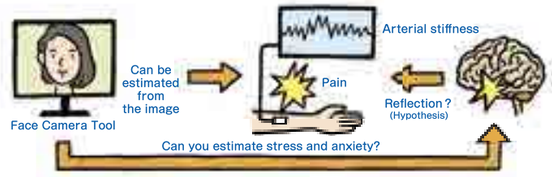
A comprehensive emotion estimation model for face, speech and language

By using three parallel methods ((1) emotion estimation from still images of facial expressions, (2) emotion estimation from the acoustic features of speech, and (3) emotion estimation from emotional words and expressions contained in the speech), it is possible to evaluate whether or not the speech is a "lie or flattery" that differs from the real intention. We are working to improve and lighten the weight of the system for social implementation.



Measurement of pain and anxiety by arterial stiffness

We have shown that measurements of arterial stiffness can be used to quantify "pain", an autonomic response. The experiments using fMRI confirmed that pain stimulation activates areas of the brain that are involved in KANSEI. By hypothesizing that measurements of arterial stiffness reflect autonomic responses such as anxiety and stress, we are developing a tool to measure these negative feelings in real-time under ever-changing conditions.



2. Visualization of perception

Our goal is to conduct basic research to elucidate the brain mechanisms of perception and to model and implement them in society. We also aim to conduct basic research that takes a scientific approach to human and complex information that is socially relevant, and to apply it to the real world.

Activities of the KANSEI Consortium

A case study of cooperation between KONICA MINOLTA, INC. and a local food manufacturer (Yoshino Miso Co., Ltd.)
In order to achieve a design that better conveys the intended message of the product, we developed a product package design based on three elements that apply the perception research of the National Institute for Physiological Sciences (NIPS) Group.

(1) An eye-catching design with a "Hiroshima" feel to it

The words "Hiroshima", "Lemon flavored", and "Oyster" stand out in the design (micro evaluation)

(2) Design to attract the eye on the sales floor

Yoshino Miso's new product has a yellow design that stands out compared to other products (macro evaluation)

(3) Pursuing the essence of "Yoshino Miso"

Quantitative evaluation using image statistics
Analysis from visual features that are considered important for texture perception

Evaluation of visual salience ("prominence") by computational model
Application of human perceptual characteristics to analysis

3. KANSEI estimation technology using optical technology

Using optical technology, we are developing a technology to measure changes in physiological indices that can serve as an indicator of sensory visualization. For example, the facial KANSEI camera, which quantifies stress by estimating heart rate variability and blood pressure from images taken of the face, can acquire high-resolution images even in dark environments where it is difficult to read facial expressions with the human eye, and obtain effective measurement results.

Topic

◆Towards social implementation

The KANSEI COI project consists of three sites. They aim to visualize perception, visualize KANSEI, and develop sensing devices, respectively. This includes basic research, applied research, device development, and implementation testing by KANSEI Consortium members. In addition, various other activities are being developed to support the research. The purpose of this project is to use the results of such research and activities to contribute to the resolution of social issues. For this purpose, we are preparing to build an "Integrated Analysis Package". We collect a variety of research that has a high potential for application to social implementation as "tools" and combine them into one package, allowing us for more accurate and objective evaluation. The visualization of "KANSEI" by the "Integrated Analysis Package" is useful in every genre from basic research to product planning and social system design by companies. This could be a game-changing innovation, allowing for research, design, and development based on subjective assessment to be complemented by objective assessment based on brain science.

Inquiry

KANSEI Innovation Research Promotion Organization, Hiroshima University
Tel: +81-82-257-1737 Fax: +81-82-257-1723
E-mail: info@coikansei.hiroshima-u.ac.jp

1-2-3, Kasumi, Minami-ku, Hiroshima City, Hiroshima 734-8551, JAPAN
[Access] 20 minutes by bus from Hiroshima Station

Project Period : FY2013～FY2021

https://yucoi.yz.yamagata-u.ac.jp/en/

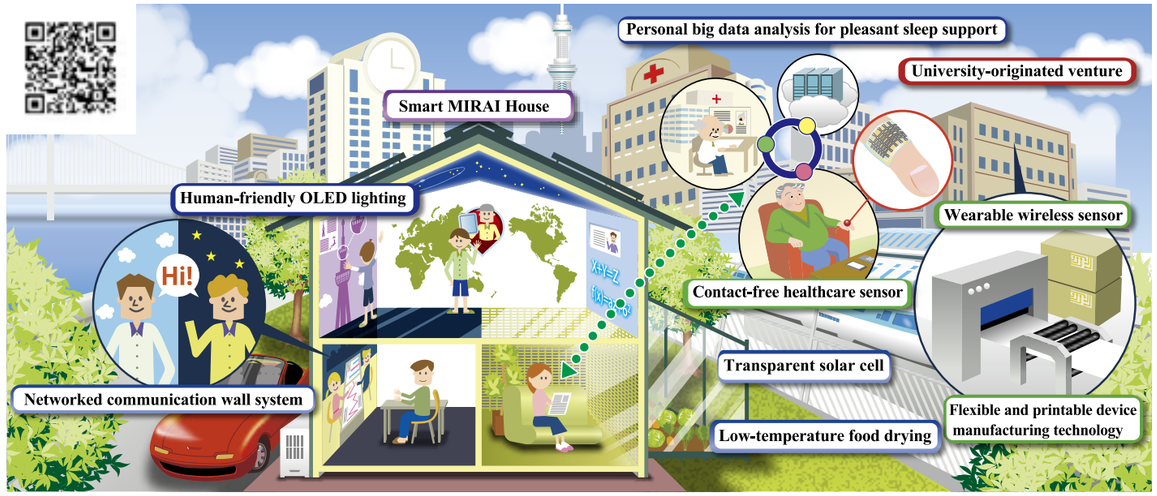
Frontier Center for Organic System Innovations

Promoting lifestyle innovation for elderly person and for the people living in local region towards smart future society through organic material based technology

Project Leader
Toru Miyake
Senior Corporate Officer, and General Manager of Purchasing Division, Dai Nippon Printing Co., Ltd.

Research Leader
Yoshihiro Ohba
Specially appointed professor of Yamagata University

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,” “Ultra-thin organic LED lightings” to enrich communications style and living environments
- “Data acquisition system and original analysis know-how for good sleep,” “Circadian rhythm lighting system”
- “Smart organic system chip,” “Vital sensor sheet” for applications in the field of health care
- “Low-temperature dehumidification drying system” for food processing, “Organic LED cultivation system” for creating healthy food
- “Functional organic materials” for printable electronics, organic LEDs and solar cells

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.,
KONICA MINOLTA, INC., ZEON CORPORATION, KANEKA CORPORATION,
Mitsubishi Heavy Industries, Ltd., Lumiotec Inc., KEN OKUYAMA DESIGN Co., Ltd.,
ITO ELECTRONIC CO., LTD., Toray Engineering Co., Ltd.,
JSR Corporation, FUJIBO HOLDINGS, INC., ND Software Co., Ltd.,
NEC Networks & System Integration Corporation, PARAMOUNT BED CO., LTD.,
Chikaku Inc., HOSHI Co., Ltd., KIMURAYA, MIKI SHOKO CO., LTD.,
Organic Lighting Corporation, Yoyogi Sleep Disorder Center,
Tohoku University of Art and Design, 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, KONICA MINOLTA, ZEON, KANEKA, Mitsubishi Heavy Industries, Lumiotec, KEN OKUYAMA DESIGN, ITO ELECTRONIC, PARAMOUNT BED, NEC Networks & System Integration, Chikaku, Organic Lighting, HOSHI, MIKI SHOKO, KIMURAYA, 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-thin, ultra-lightweight, and flexible displays which is wall-mountable and which can make our life more comfortable.

1-3. ICT System for Pleasant Sleep
Advanced ICT system for big-data analysis of enriching quality of sleep with daily individual biosignals and environmental data acquisition.

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

1-5. Eating and health
Creating “foods” utilized OLED plant cultivation and low-temperature drying technology that is able to retain foods' color, aroma and nutritional ingredients.

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

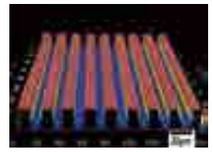
Prof. Shizuo Tokito (Yamagata Univ.), Toray Engineering, JSR, FUJIBO HOLDINGS, ND Software, Yoyogi Sleep Disorder Center, National Institute of Advanced Industrial Science and Technology

2-1. Organic Biosensors
Sweat sensor for real time or periodical monitoring of human physiological conditions such as heat stroke and exercise stress.

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
Development of device fabrication technologies using precision processing technologies such as micro and nanoimprint.



(AIST) Stress Sensor
Highly sensitive salivary sensor for stress monitoring using nitrate ion-selective field-effect transistor.

Topics

■Smart Mirai House built for demonstration experiment of advanced technology for enriching and pleasant lifestyle

- Advanced organic devices, such as OLED and organic vital sensor, are being tested for practical applications.
- The bedroom is designed for comfort and good sleep, aiming to control circadian rhythm.
- Translucent organic solar panel is installed on window face to demonstrate year-round use.

■Proving tests in society (hospital, medical care, agriculture,etc)

- OLED communication wall system, which is being tested in a hospital, brings distant family in the same room.
- OLED Medica Light makes skin color and blood vessel easy to see and enhances accuracy of medical diagnosis/treatment.
- OLED lighting is used to verify plant cultivation, aiming to improve agricultural operation in winter.


Medica Light


OLED Communication Wall System


Vital Sensor Sheet


Vital Information Analysis

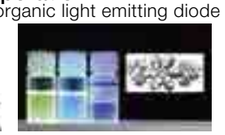
■Commercialization of bed sensors for nursing facilities and homes

New sheet-type bed sensor used for care watching system is able to detect human vital information (pulse, respiration, body movement, etc.) while sleeping. It is also prospected to be used at home care to ensure health and safety during bedtime.

■Establishment of YU COI-originated venture companies

Future Ink Corporation
Printed vital sensor, silver nanoparticle ink

FLASK Corporation
Materials for organic light emitting diode



Vegea Corporation
Drying technology for food processing

Inquiry
COI Project Office, Yamagata University
Tel : +81-238-26-3585 Fax : +81-238-26-3240
E-mail : coi@jm.kj.yamagata-u.ac.jp
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/

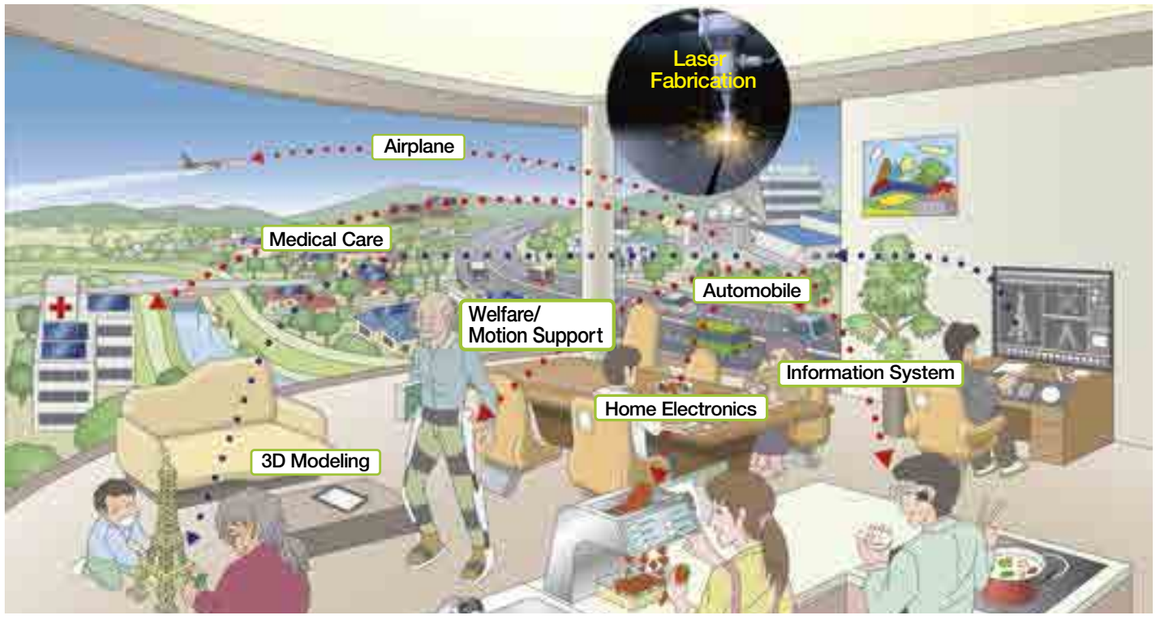
Innovative Center for Coherent Photon Technology (ICCPT)

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

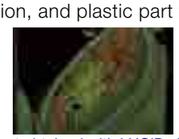
Our goal is to build a personalized, sustainable society by actively employing ideas arising from individuals and optimizing resource usage. With the photon as the basis of our organization and a solid scientific foundation that ensures the reliability of new technologies, we strive toward initiating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

Applications & Services

●High-precision laser fabrication techniques
Non-thermal laser 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), which are currently key materials in the aircraft and automobile industries. In addition, the basic construction of cyber physical systems (CPSs) for laser processing, which is indispensable for the Internet of Things, will be established.

●3D printer; RECILS
RECILS is a new 3D printer that has realized both high-speed and high-resolution molding for the first time. RECILS can be applied in many fields including microfluidics, optical communication devices, honeycomb structure fabrication, and plastic part fabrication.

● Internal-organ observation system
A unique microscope will be developed for observing lesions, such as tumors, inside organs using a tissue-clarification method called “LUCID,” which has been developed by us. Using this microscope technique, the cost and time spent on diagnostic techniques in pathology will be reduced.



Small intestinal tomogram of rat obtained with LUCID clearing solution

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. , PhotonTech Innovations, Co., Ltd.

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 conventional laser.

2. Advanced laser molding and modifying techniques
[Norikatsu Mio (Univ. of Tokyo), Toray Industries, Inc.]
Using improved stereolithographic techniques, high-performance 3D printers (product prototypes) and their applications will 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 the ultraviolet (UV)–THz regions, will be developed as the core coherent technology and coherent light source for testing extreme UV lithography (EUV) optics.

High-intensity laser source : Photon Ring

4. Exploration of individual needs
[Hiroshi Onodera (Univ. of Tokyo)]
Lightweight walking support systems without power supply will be developed using the above-mentioned laser fabrication and 3D printing techniques. Additionally, internal organ observation systems that reliably detect interior lesions will be developed in conjunction with a clearing reagent.

5. Development of new non-equilibrium photo processes
[Shinji Tsuneyuki (Univ.of Tokyo)]
We will develop methods, such as sophisticated computer simulations based on first principles, mathematical modeling of multiple scales, and photoelectron spectroscopy experiments, to build a foundation for CPSs. Then, we will elucidate the theory of non-equilibrium light processes by analyzing light propagation, electronic excitation, and the resulting structural material changes.

Topics

● Long-term, Multi-port operation of Photon Ring

We have been developing MHz repetition rate coherent XUV source, named Photon Ring, in which XUV high-order harmonics are generated inside the cavity of a high-energy mode-locked ring laser oscillator. We have already succeeded in multi-port operation with a repetition rate of 3 MHz. Here, we report a stable long-term operation of more than two hours with different gas targets. Figure 1 shows high harmonic (HH) spectra obtained under the double ports operation. In Fig.1(a), HH spectrum generated from Ne gas target injected in the port 1 is depicted as a blue curve, and that generated from Ar gas target injected in the port 2 is depicted as a red curve. While in Fig.1 (b), HH spectrum generated from Ar in the port 1 and that generated from Xe in the port 2 are depicted. The results open a novel way to perform an XUV-pump & XUV probe experiment with different photon energies.

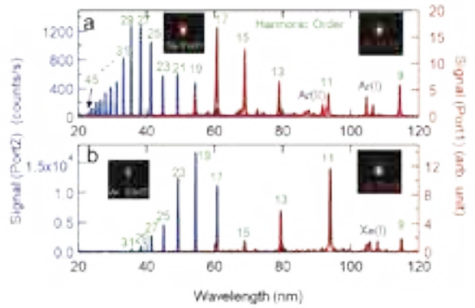


Fig.1. High harmonic spectra in double ports operation with different gas targets: (a) Ne in the port1 and Ar in the port 2, (b) Ar in the port 1 and Xe in the port 2.

● Performance improvement of tissue clearing reagent LUCID

LUCID (JST international patent) has the highest clearing ability among the existing organ clearing reagents and is used in cancer research and drug discovery in a pharmaceutical company. We have succeeded in developing a new clearing reagent, LUCID-DX, which greatly improved the tissue clearing ability and clearing speed of LUCID. With LUCID-DX, specimen staining is possible at the same time as clearing. Staining and clearing of biopsy specimens by endoscopy can be completed in 12 hours. In the case of other organ clearing techniques, tissue clearing requires more than 10 days and cannot be used for the treatment of clinicopathological specimens due to the disadvantage that the cleared sample disintegrates in a short time. LUCID-DX, which solves these problems, contributes to man-power reduction in pathological specimen processing and reduction of waste liquid volume.

LUCID: il**LU**mination of **C**leared organs to **ID**entify target molecules

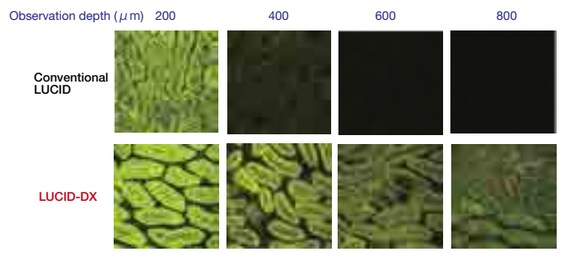


Fig. 2. Comparison of deep observation performance of transparent colon (excitation light intensity and sensor sensitivity are the same) LUCID-DX enables deep observation without increasing the excitation light intensity. Deep observation of conventional LUCID is also possible by increasing the excitation light intensity.

Inquiry
The University of Tokyo,
Institute for Photon Science and Technology
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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

https://coi.sfc.keio.ac.jp

Center of Kansei-oriented Digital Fabrication

Realizing societies promoting designs for individuals

Project Leader
Kenji Matsubara
President and CEO of Longfellow Inc.

Research Leader
Jun Murai
Distinguished Professor of Keio University
Member of the IT Strategic Headquarters
Member of the Cybersecurity Strategic Headquarters, NISC

The Future

Outline

We strive towards a common goal of creating a “society with designs that cater to individuals”, in which making things to match individual needs and challenges are a part of everyday life. To achieve that goal requires mechanisms for things defined by individual kansei to be made individually with digital fabrication technologies - i.e. mass-customization systems. We thus engage in R&D in kansei-indexing technologies, digital fabrication, and mechanisms to connect the two.

Application & Service

1) Fields of fashion, apparel, interior design, and materials
April 2020, Sumika Chemical Analysis Service started Kansei Analysis Service. The analytic technology, based on kansei engineering, psychology, statistics and other sciences, is capable of developing objective measurement of values to assess products and services based on people’s vaguely-held feelings and senses (kansei), quantifying and visualizing kanseis, and further add kansei-related values to products and services. This service will respond to society’s potential needs for kansei value creation and thereby contribute to “designs for individuals”

2) Digital orthosis fabrication assist service
Using 3D printers and other digital fabrication technologies, this service assist designing and making of orthoses. With this new service for designing and making, orthopedics can now execute the process of designing and making orthoses in a streamlined digital workflow. It is expected that this will improve both the satisfaction and productivity of the orthopedic simultaneously.

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 Keio University)

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

Assistant organization leader :
Fumio Kishino (Visiting Professor of Kwansei Gakuin Institute of Kansei Value Creation)

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

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

Assistant deputy organization leader :
Noriko Nagata (Professor of School of Science and Technology, Kwansei Gakuin University)

【Core institution】 Keio University
【Satellite institutions】 Kwansei Gakuin University, Meiji University and Yamagata University
【Participating institutions】 Kanazawa College of Art, Institute of Advanced Media Arts and Sciences, Chukyo University, Tottori University, National Institute of Advanced Industrial Science and Technology,
Amoeba Energy Co., Ltd., APOLLO GIKEN Co., Ltd., CENTURY-YELL CO.,LTD., Daihatsu Motor Co., Ltd., Digital Fashion Ltd., Fuji Prix Group Co., Ltd., Fuji Xerox Co., Ltd., Honda R&D Co., Ltd., Hyogo Prefectural Institute of Technology, iCareLab.Co.Ltd, JSR Corporation, Kanagawa Prefecture, LIXIL Corporation, Mitsubishi Chemical Corporation, Mitsubishi Electric Corporation, Naris Cosmetics Co., Ltd., Nikon Corporation, NIPPON PAINT HOLDINGS CO., LTD., NIPPON STEEL CORPORATION, Okamura Corporation, Panasonic Corporation, Rapithela Corporation, RICOH JAPAN Corporation, SHIMA SEIKI MFG., LTD., Studio Midas, Sumika Chemical Analysis Service, Ltd., SUMITOMO CHEMICAL COMPANY, LIMITED, Sunarrow Co., Ltd., Toppan Printing Co., Ltd

The Takeda Wahei Center, Social Fabrication Laboratory (NU Kannai Building 2F)

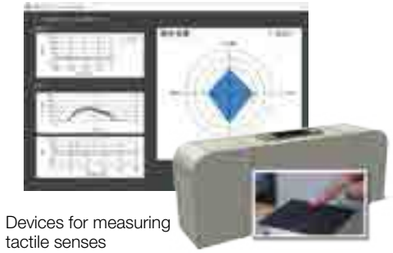
Key R&D Themes

1. Service Development for Kansei Value Indexing Technologies

[Leader :Noriko Nagata (Kwansei Gakuin University)]
Participating institutions : Kwansei Gakuin University, Kanazawa College of Art, Chukyo University, Tottori University, APOLLO GIKEN Co., Ltd., CENTURY-YELL CO.,LTD., Daihatsu Motor Co., Ltd., Digital Fashion Ltd., Fuji Prix Group Co., Ltd., Honda R&D Co., Ltd., Hyogo Prefectural Institute of Technology, iCareLab.Co.Ltd, LIXIL Corporation, Mitsubishi Electric Corporation, Naris Cosmetics Co., Ltd., Nikon Corporation, NIPPON PAINT HOLDINGS CO., LTD., NIPPON STEEL CORPORATION, Panasonic Corporation, RICOH JAPAN Corporation, SHIMA SEIKI MFG., LTD., Sumika Chemical Analysis Service, Ltd., SUMITOMO CHEMICAL COMPANY, LIMITED

Development of Kansei Digital Bespoke, a framework for supporting individuals' design work to give shape to their own values, and Kansei AI Engine, that efficiently learns relations between individuals’s kansei and physical properties invoking it, search and recommend design fit to individuals. Some of the technologies developed are now in use as a “Kansei AI Pattern Sommelier” which provides best matching fabric suggestions to users upon their input of desired images or relevant words on a screen. Providing support for Kansei value creation activities and creation of business environments in Japan and abroad.

Fashion design app reflecting individual preferences



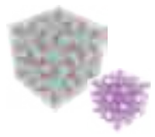
Devices for measuring tactile senses

Kansei AI Engine

2. Standardization and Package Development of Digital Fabrication Technologies

[Leader : Hiroya Tanaka (Keio University)]
Participating institutions : Keio University, Yamagata University, Institute of Advanced Media Arts and Sciences, National Institute of Advanced Industrial Science and Technology
Amoeba Energy Co., Ltd., Fuji Xerox Co., Ltd., JSR Corporation,Kanagawa Prefecture, Mitsubishi Chemical Corporation, Okamura Corporation, Rapithela Corporation, Studio Midas Sunarrow Co., Ltd. Toppan Printing Co., Ltd

Super Fit Lab will be used as the field for experimentation. It is located within Wahei Takeda Center, Social Fabrication Laboratory, Keio SFC Research Institute, Keio University. It engages in development of a new design system for efficiently making and providing things that are catered to needs of individuals, extracted at a deeper level of understanding and reinforcing a higher value to the end user.
It also engages in the development of a system for monitoring and sensing processes spanning from fabrication to use of things made. Yet another research under way is on the printing of structural objects using multiple materials for broadening the scope of 3D printable things.



Technologies to design complex internal structure

Fabble.cc, a service assisting making projects

Workshops to train FabNurses

Super Fit Lab Studio

3. Topics

“Digital orthosis fabrication assist service”

JSR Corporation and Tomei Brace Corporation Limited jointly established Rapithela Corporation. Rapithela Corporation will provide inno-vative digital service customized to each individual users of orthoses using cutting edge 3D printing technologies along with Keio University SFC Research Institute.

“Takashimaya STYLE ORDER SALON Kansei AI Sommelier”

In September 2019, Takashimaya, the department store, introduced the Sommelier as a customer facing tool at its 5 stores. It was developed jointly with Digital Fashion Ltd, and CENTURY-YELL CO.,LTD.. The tool is also deployed to Aeon Malls and Tokiwa Department Store.

“Just-fit Factory”

Exhibition on the research outcomes of digital fabrication and kansei measurement technologies at the Media Lab, Miraikan, The National Museum for Emerging Science and Innovation.

May 16, 2019~Sep 1, 2019

Inquiry

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Tel : +81-466-49-3436 Fax : +81-466-49-3594
E-mail : coi@sfc.keio.ac.jp

Office of Center of Innovation Program, The Takeda Wahei Center, Social Fabrication Lab, SFC Research Institute, Keio University
NU Kannai Bld.2F, Yamashitacho, 223-1, Naka-ku, Yokohama-shi, Kanagawa 231-0023, Japan
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E-mail:coi@sfc.keio.ac.jp

Project Period : FY2013～FY2021

https://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
Deputy Director, Daiwa House Industry Co., Ltd.
1976 Joined Daiwa House Industry and started working at their manufacturing plant
2003 Group Leader, Parts Production Design Group
2012 Assistant Director, Central Research Laboratory
2015 Manager, Frontier technology Laboratory
2018 Deputy Director (current post)

Research Leader
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

What is an "innovative material"?

Utilization of biotechnology and nanotechnology

◎ Highly functional materials ⇒ Heat resistance, incombustibility, fireproof, lightweight fiber, etc.

◎ Biomass-derived materials ⇒ Reduction in environmental burden and cost

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
⇒ Continuous forming of long and large members
⇒ 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 utilising 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
  Cities will be restored and built by new environment with being consisted of materials superior in environment performance and highly functional materials.
- 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

【Core institution】Kanazawa Institute of Technology
【Participating institution】Kanazawa University, Japan Advanced Institute of Science and Technology, Gifu University, National Institute for Materials Science, Kyoto University, Public Works Research Institute, Industrial Research Institute of Ishikawa, Gifu Prefectural Industrial Technology Center, Daiwa House Industry Co., Ltd., Toray Industries, Inc., Suncorona Oda Co., Ltd., Tsudakoma Corp., Shibuya Corporation, KOMATSU MATERE Co., Ltd., Daido Kogyo Co., Ltd., MORIN Chemical Industries Co., Ltd., Nippon Paper Industries Co., Ltd., IPCO K.K.

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

Key R&D

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

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 themes: impregnation process technology, press molding and secondary process, and we will achieve high productivity at low cost.

Development of quick heat-up process of Double Belt Press

Heating test by internal quick heating method

World's first random sheet by continuous molding

Sequential Press Molding

Continuous Forming

Development of Sequential process and Continuous forming process

Laser welding Ultrasonic welding

Development of Continuous welding technology by laser, ultrasonic, electromagnetic induction and plasma.

Development of ultrafast pultrusion technology using thermoplastic resin.

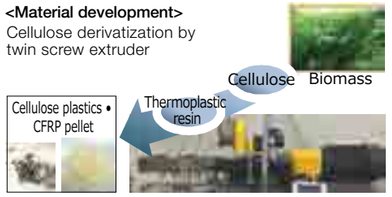
GF/PP Strand rod

BF/PP Strand rod

◆ Fundamental technology (Material technology, evaluation technology)

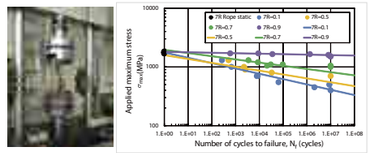
We will work on the development of materials with high functionality and environmental performance, as well as evaluation technology for practical implementation.

<Material development>
Cellulose derivatization by twin screw extruder

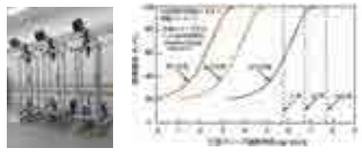


Continuous production system for thermoplastics made from biomass

<Evaluation Technology>
Acquisition of various test data for reliability assurance and standardization.
Establishment of new material evaluation method and life prediction technology.



Fatigue test of tension rod.



Creep test and tensile creep life prediction of tension rod.

Efforts towards the Social Implementation

◆ Social implementation to the field of civil engineering and construction by Application (Task Team).

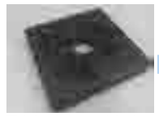
<Application of tension rods into aseismic reinforcement, etc.>
We developed CF/TP-EP Strand Rod and applied to seismic reinforcement and other fields.

Commercialized as CABKOMA strand rod (KOMATSU MATERE Co., Ltd.)

"Weaving" seismic retrofit (Tomioka warehouse number 3)

Seismic reinforcement of building walls

<Application to ground anchor bearing plate >
Development of CFRP bearing plate combining CF/TP-EP thick plate and axial force monitoring system using optical fiber sensor.



Thick plate molded from CF tow chips impregnated with thermoplastic Epoxy (TP-EP).

Ground anchor with CFRP bearing plate

Verification trial has started since 2018. (Takatsuki-city)

<Application of FRP panel to construction field>
For the development of FRP members that meet the fire resistance standards necessary for the application in the construction industry, we will develop fireproof coatings and high heat-resistance resins, establish evaluation and testing methods for fire resistive performance, and develop and install a suitable testing system.

Fire resistance with carbonized foam layer

Fire resistance testing furnace

Apply to floor slabs of high-rise buildings, etc.

<Application of FRP reinforcing bars to concrete structures>
As a countermeasure to prevent the deterioration of concrete due to salt damage, etc., we will develop ultrafast pultrusion technology of thermoplastic FRP bars and achieve long-life and laborsaving construction of concrete structures such as bridges.

Deterioration of concrete due to rebar corrosion

Photo by JR Central

Loading test of Concrete slab using FRP rebar

Topics

The Innovative Composite Materials Research and Development Center (ICC), the main site of this project, has been selected as one of the first nine successful hubs of the "J-Innovation Hub Initiative" conducted by Ministry of Economy, Trade and Industry Japan (METI).

J-Innovation HUB

In this newly established initiative, METI targets regional open-innovation hubs, mainly universities, and assesses and selects outstanding bases playing a leading role as a hub of companies' networks, and, thereby, it will aim to: enhance the trust of selected hubs in society, concentrate support measures to them, enhance the potential of top-ranking innovation hubs and encourage such bases to cooperate and compete with one another.
As a platform for innovation by innovative materials, ICC aims to further promote industry-academia collaboration in Japan and overseas.

Inquiry

Organization for Advancement of COI Research, Kanazawa Institute of Technology
TEL:076-276-3175 FAX:076-276-3101
Email: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

https://www.shinshu-u.ac.jp/coi/english/

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

Creation of a water recycling society that supports safe and hygienic livelihoods

Project Leader
Makoto Onishi
Chief Technology Officer, Water & Environment Business Unit, Hitachi, Ltd.
2018 Chief Technology Officer, Water Solutions Division,Water Business Unit, Hitachi, Ltd.
2019 Current position

Research Leader
Morinobu Endo
Special Emeritus Professor, Shinshu University
1990 Professor, Faculty of Engineering
2005 Director of Institute of Carbon Science and Technology
2012 Distinguished Professor
2020 Current position

The Future

Outline

Securing safe water supply is becoming a worldwide issue due to the limited amount of usable water and the continuously growing global population. Facing this challenge, the Global Aqua Innovation Center of Shinshu University has been developing and deploying innovative desalination and water reclamation systems based on robust reverse osmosis (RO) membranes composed of nanocarbons. With this innovative desalination and hydrologic cycle system, we can achieve a society where people throughout the world can consume as much water as needed.

Application & Service

- Seawater desalination plants can be operated anywhere and are expected to contribute to ridding the world of areas with inadequate supplies of water for agricultural use.
- Ultrapure water production and the wastewater treatment systems will be improved, contributing to secure water supplies for industrial use and the hydrologic cycle.
- The widespread use of desalination plants as well as adsorbents and separation membranes that remove heavy metals and other harmful substances will enable us to contribute to Goal 6 of the Sustainable Development Goals (SDGs), “Ensure availability and sustainable management of water.”

Implementation Structure

Project Leader : Makoto ONISHI (CTO, Technology Adviser, Water & Environment Business Unit, Hitachi, Ltd.)
Research Leader : Morinobu ENDO (Special Emeritus Professor, Shinshu University)
【Core institution】Shinshu University
【Core companies】Hitachi, Ltd., Toray Industries, Inc., Showa Denko K.K.
【Participating institutions】RIKEN, Research Organization for Information Science and Technology(RIST), Kitagawa Industries co., Ltd., Toclas Corporation, Kurita Water Industries Ltd., LIXIL Corporation, Nagano Prefectural Government

Satellite institution(COI-S)
Project Leader Mario TOKORO
(Founder and CEO, Institute for Open Systems Science, Ltd.)
【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,Kenji TAKEUCHI (Shinshu University),：Toray Industries, Inc., Showa Denko K.K., Kitagawa Industries co., Ltd., LIXIL Corporation]

Current desalination polymer membranes face problems such as the large consumption of energy due to high-pressure pumps and their low resistance to chemicals. We are working to solve these issues by using nanocarbons to develop a membrane that features robust antifouling and chlorine resistance in addition to superior desalination and permeation properties.

2. Research & Development of Nanocarbon RO Membrane Modules

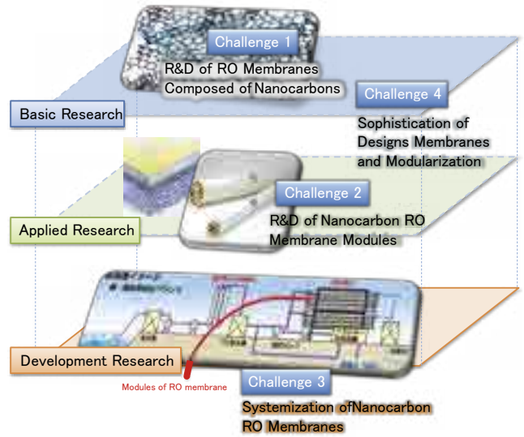
[Toray Industries, Inc.]

We are aiming at a wide range of applications, from seawater desalination to wastewater treatment. We conducted studies on adequate layers and spacers in the nanocarbon membrane we have developed, and we are establishing a module production technology.

3. Systemization of Nanocarbon RO Membranes

[Hitachi, Ltd., Kurita Water Industries Ltd.]

In cooperation with the membrane development and modularization teams, we are developing seawater desalination and wastewater treatment systems that take advantage of the developed robust membrane, and we are performing verification tests to connect them to social implementation.



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

4. Sophistication of Designs for Membranes and Modularization

[Takuya HAYASHI（Shinshu Univ.）：RIKEN, RIST]

We support the development of carbon membrane from the aspects of computational science, structural analysis, and pore analysis. We are also increasing the sophistication of module design through procedures including fluid simulation.

5. Development of New Materials and Processes with Science

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

We are developing and systemizing inorganic crystal materials that remove the hazardous ions such as heavy metals and anions, and also surface polymerized parylene membranes that allow the selective permeation of specific substances. We are also developing new materials with rapidly increasing durability and heat resistance by creating composites of nanomaterials with rubber and resin.

6. Water Environment Engineering

[COI-S Keiko TAKAHASHI（JAMSTEC）：Chuo Univ.][Shinshu Univ.]

We have completed the world's first water circulation model that couples the atmosphere, marine environments, and land areas; and we are carrying out predictions for the water environment in the subject area. Also, so as to contribute to achieving a supply of water that is free from contaminants such as excessive fluoride in the target region of Tanzania, we are making progress with the dynamic analysis of water and fluoride circulation, verifying tests for fluoride removal systems, and making proposals for a water resource management policy.

Topics

◆Development and Modularization of Carbon Nanotubes (CNT) and Polyamide (PA) Composite Membranes

We have installed large-size membrane production equipment for CNT and PA composite membranes within our Center. We are carrying out the roll-to-roll production of membranes with 50 cm wide and several tens of meters long, conducting trials of module manufacture with a diameter of 4 inches (10 cm) by using the membranes that we produce, as well as verifying tests for seawater desalination. Also, we developed 2-inch modules in our laboratories for point of use applications, in addition to improving the performance of the modules, we are also presenting evaluation tests for applications in several kinds of industries.

Large-size membrane production equipment

Small module production equipment

◆Seawater Desalination Verification Test with Four-inch Module

We have installed container loading verification test equipment in a test site located at Water Plaza Kitakyushu. We are performing a comparative study between commercially available modules and the COI-developed 4-inch trial modules. We are evaluating the performance of the membranes that we have developed in terms of anti-fouling properties, permeation, chlorine resistance and other properties, as well as its effect in reducing the costs for desalination. As we move forward, we plan to begin the verification tests on the reclamation of treated sewage.

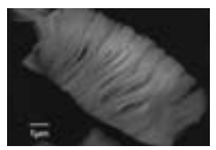
4-inch module

Verification test equipment

◆Co-project with the Tanzanian University for Safe Water

In several areas in Tanzania, the high fluoride concentration in ground water causes diseases. We have launched a joint project with Tanzanian universities to solve this problem by using our COI developed technologies, such as adsorbents for heavy metal removal. We continue performing field surveys and analyses, and proposing projects for clean water supply systems, including fluoride removal.

Survey of the well water quality



Inorganic crystal material for fluorine removal

Inquiry

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[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
Industry&academia
Collaboration Strategy Dept.
Frontier Research Center

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**
  Autonomous Driving Intelligence, Supervisory Driver Assistance System, Slocal (slow and local) Self-driving System, 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**
  Mobility Blend®, Healthy Long-life Integrated Program, Model community building, Social science assessments

Implementation Organization

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, Aichi Prefectural University, National Graduate Institute for Policy Studies, Tokyo Institute of Technology, Aichi Prefecture, Toyota City, Nagoya City, Kasugai City, Kota Town, National Institute of Advanced Industrial Science and Technology, AGC Inc., Toyota Motor Corporation, Toyota Central R&D Labs., Inc., Panasonic Corporation
【Satellite institution】 Tokyo University of Agriculture and Technology, Nagoya City University

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 (predicting vehicle position, proactive planning, supervisory driver modeling, and agent systems), (3) human characteristics research based on a senior drivers 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) Self-driving System, etc.)} on next - generation traffic systems.

Environment Recognition

Supervisory Driver Assistance System

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. By combining these advances, we aim to create attentive support systems that give individuals their daily health status and other information.

Next-generation traffic systems

Database of Senior Drivers

ICT Infrastructure Research

Proposals are being made for mobile data usage and the status of information and communication foundations related to implementation of automatic driving in the community.

Cooperative Research, Innovation Acceptance Research

We are using ① dynamic mapping (traffic social information database establishment), ② social psychological and legal analysis of public response to COI technology, and ③ research to verify model community formation in remote mountain areas, newly developed suburbs and regional cities with the goal of improving the quality of life for seniors.

Topics

▶Slocal (slow and local) Self-driving System

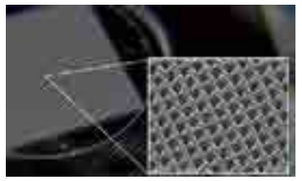
This driverless transport service operates at low speeds of 20 km per hour or less and is restricted to local areas. It can be applied to everything from ultra-compact cars to buses and other large vehicles, making it a great solution for last-mile delivery and local circular routes, for example. Thanks to support from local governments, we' ve been testing the technology on public roads—working to verify both the technology and social receptivity to automated driving.

▶Driver Agent

We're encouraging safer driving behaviors for elderly drivers by the driving supports and the review supports via a compact communication robot. We found that the supports by robot have high acceptability for drivers and less distraction than other agent forms, and the driving behaviors are most improved by using both supports together. To prove greater applicability, we are advancing actual verification tests on public roads with the vehicles.

▶Bioaerosol Measurement Device

We're developing a glass filter that traps and separates out bioaerosol substances like cells and exosomes. Thanks to device prototypes that allow for faster, more accurate testing, we've been able to successfully run clinical trials verifying patients' reactions to anticancer medications. We've also developed highly - sensitive microbe measurement devices to aid in sanitation inspections, which have allowed us to successfully identify indigenous bacteria.



▶Walking Assistance Robot

We've develop a walking assistance robot that lets seniors develop their walking skills in a safe, fun way. The robot identifies and visually outputs user walking conditions and ability so that it can provide optimized walking motion for every individual. Walking maintains and improves the body's functioning. Supporting the ability to get out and enjoy an active lifestyle. With expected operation of services (loaning to facilities), we will move ahead with verification at multiple hospitals and nursing facilities.

Inquiry
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Project Period : FY2013～FY2021

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

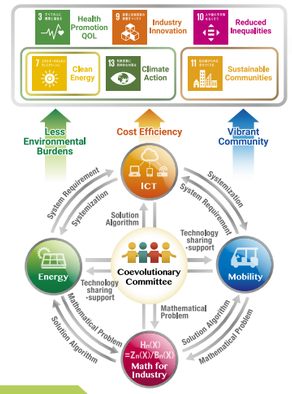
Center of Coevolutionary Research for Sustainable Communities

The Coevolutionary Committee solves issues of local communities through promoting coevolution of technologies in different fields.

Project Leader
Yuichi Nakamura
Executive Professional, NEC Corp.
1998 Joining NEC
2013 General Manger Green Platform Research Labs.
2018 Vice President Central Research Labs.
2020 Executive Professional, NEC Corp.

Research Leader
Yasuhide Fukumoto
Professor, Institute of Mathematics for Industry, Kyushu University
1987 Doctor of Science, The University of Tokyo
1987 JSPS Postdoctoral Fellow, The University of Tokyo
2002 Professor of Faculty of Mathematics, Kyushu University
2011 Professor of Institute of Mathematics for Industry, Kyushu University
2014 Director of Institute of Mathematics for Industry, Kyushu University
2018 Professor of Institute of Mathematics for Industry, Kyushu University

The Future



Outline

The “Center of Coevolutionary Research for Sustainable Communities” aims to create a safe, active, and sustainable community by revitalizing the local economy (cities and surrounding suburbs), creating jobs and providing transportation choices for those who are mobility disadvantaged, while utilizing clean energy to the fullest, in order to minimize environmental burdens (SDGs7&13). Also, through these measures, it will now be possible to show further consideration for the health of our local residents (SDG3), and offer affordable and accessible local services for those who are socially disadvantaged(SDG10). In order to successfully create such a community, we will utilize an approach that we refer to as the “coevolution of community and the technology/system.” Ideally, a specific regional problem will promote the development of a certain technology/system, which then will introduce a solution for the problem and the community will thus improve. Or, certain technological/systematical developments will cause a chain reaction and encourage other developments in technology/system, which will then eventually promote solutions for regional problems. Currently, it is mainly Kyushu University/ The University of Tokyo / Yokohama National University forming a coevolutionary committee through an approach that incorporates participating companies/local governments. By pro-actively working toward attaining a coevolution of various technical fields such as Energy/ Mobility/ ICT/ Mathematics for Industry under the management of PL/RL, we build an innovation platform that continues to bring forth social implementation solutions to counteract regional problems(SDG9).

Applications & Services

- Spread of new energy services, and major expansion of renewable energy (SDG7, SDG13)
  The establishment and social implementation of an energy policy that considers stability of a power grid and economical/environmental factors; a hydrogen system that utilizes renewable energy; a radical and highly efficient fuel cell system; the achievement of high durability/power in a fuel cell for a mobility system
- Offering access to a sustainable transportation system that is safe, affordable and easily available (SDG11.2)
  Guidance for people and vehicles using a multi-modal information sharing system; building a multi-functional community center out of redesign of vehicles ; a co-operating/sharing mobility system that assists citizens to break free from an overdependence on personal vehicles; road maintenance management system that maintains safe road infrastructure
- Safe, secure and sustainable society (SDG11.7)
  A monitoring service in urban areas; information transmission based on life-sensing which facilitates daily life routines

Implementation Structure

Project Leader : Yuichi Nakamura (NEC Corp.)
Research Leader : Yasuhide Fukumoto (Kyushu University)
Research Sub-leader: Rin-ichiro Taniguchi (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, YEAAH Inc., Hitachi Ltd., NEC Corporation, Tokyo Gas Co., Ltd., Institute of Systems, Information Technologies and Nanotechnologies (ISIT), JXTG Nippon Oil & Energy Corporation, Nissan Motor Co., Ltd. EV System Laboratory, OLM Digital, Inc., Nippon Telegraph and Telephone Corporation, Team AIBOD Co., Ltd., Miyama Smart Energy Co., Ltd., Kyulux, Inc.,Showa Motors Inc.

Research Facilities for Co-Evolutional Social Systems

Satellite institution (TMS)

Yokohama National University (YNU) 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., Park24 Co., Ltd., Hitachi Ltd., City of Yokohama, NEC Corporation, DENSO Corporation, Toyota Motor Corporation, ZENRIN DataCom CO., LTD., Hakone Town, MIYAGAWA Co., Ltd., Keikyu Corporation
JMA Research Institute Inc., IHI Corporation, LocaliST Corporation

Satellite institution (EMS)

The University of Tokyo Leader : Ryuji Matsuhashi

【Participating institutions】Shizuoka GAS Company, Ltd., Miyama Smart Energy Co., Ltd., Team AIBOD Co., Ltd., E-Konzal Co., Ltd., IHI Corporation

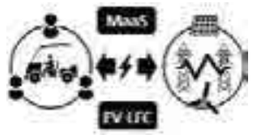
Key R&D Themes

1. Energy Leader : Kazunari Sasaki (Kyushu Univ.) , Sub-Leader : Ryuji Matsuhashi (Univ. of Tokyo)

Based on the concept of the center, we will realize “consumption of energy generated in the region of the residents” in the following meaning. Namely the frequency fluctuations and the imbalances due to introduction of renewable energies will be compensated with the innovative technologies such as hydrogen-related ones. Also the concept of the future social system will be developed, so that the de-carbonization of energy and the vibrant local economy can coexist. This will lead to the paradigm shift of the technology, industry and society.Specifically Kyushu University handles the creation of innovative technologies such as hydrogen infrastructure, a high- efficient power generation system, and zero emission mobility, as well as methods for their social implementation. The University of Tokyo Satellite conducts energy/ICT related technology innovations along with reforms in economic and social institutions, and they have been advancing toward energy conservation and low carbonization to benefit the consumer sector.

2. Mobility Leader : Fumihiko Nakamura (YNU)

From the standpoint of SDGs, the aim is to realize a city where anyone can have mobility without relying upon private cars. We are carrying out a research and development for an easily accessible mobility system that is cost-effective and minimizes environmental burdens. The goal is to maintain the liveliness of an environmentally focused society that faces a decreasing and aging population. The research topic consists of three subtopics: a co-operating/sharing mobility system that gives other options replacing private cars, a multi-modal information provision compatible with MaaS that helps people in smart selection of mobility, and a road maintenance management system that supports to maintain the functionality of road infrastructure which is essential to mobility.

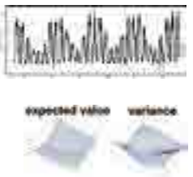


3. ICT Leader : Yutaka Arakawa (Kyushu Univ.)

With an aim to build a social environment that maintains a lively society and allows for various types of people, to live in security, we offer monitoring services at the traffic nodes such as stations and bus stops to ensure the safety and security of our citizens and the elderly who needs supports, as well as carrying out research and development to encourage people to go out for creating a vibrant society. In addition to this, to improve the performance of these individual services developed at this Center, we also put our efforts into promoting the coevolution of Energy/ Mobility/ Mathematics for Industry. Moreover, we assist the advancement of an information infrastructure that supports data circulation, anomaly detection using machine learning, image/ video analysis using deep learning.

4. Math for Industry Leader : Yasuhide Fukumoto (Kyushu Univ.)

In association with the recent progress of measurement and telecommunication technologies, promptly analyzing vast amount of various data and using it to make highly accurate predictions has become a vital step in creating a sustainable and vibrant society. Mathematics for Industry develops data utilization technologies by using the ideas of modern mathematics to support research and development/social implementation of Energy, Mobility and ICT. We are conducting researches such as estimations of the energy supply /demand by combining statistics for analyzing big data with machine learning, statistical analyses of large-scale questionnaires of residents for designing a comfortable town and topological analyses and modeling of pedestrian streams for creating a vibrant society by nudging people.



Topics

Creating a Sustainable Community

Our goal is to activate local economies through realization of a locally generated and consumed energy that contributes to stabilize the power grid, and by circulating cash produced with clean energy within the community. Various technologies and systems for clean energy will be used such as highly accurate supply and demand estimation of power, “Pay-As-You-Save” (PAYS) payment scheme for electric utility expenses, and imbalance compensation utilizing electric vehicles (EV) or hydrogen. By utilizing the capital funds, we will be able to provide transportation options to those who are mobility disadvantaged, offer ICT monitoring services to promote "safety and security" to those who are socially disadvantaged, and take measures to revitalize the activities of local residents that have a stay-at-home tendency. Through these approaches, we can create a lively town, and we continue to further revitalize the local economy. The self-sufficient and sustainable community approach, with clean energy and an activated local economy, will be introduced throughout the whole of Japan. Ideally, it will contribute to regenerate itself from results of a decreasing and aging population and attain a de-carbonized society.

Building an Independent Innovation Platform

With the base of the Coevolutionary Committee, in which researchers from various fields collaborate, such as Energy, Mobility, ICT, and Mathematics for Industry, to drive incessant "coevolution," we are constructing an R&D platform to activate continuous innovation by promoting the following features:

- Industry participating in the Coevolutionary Committee for social implementation
- Collaboration with an advanced research unit within the campus, especially those with young researchers
- Offer industry the campus equipped with state-of-the-art infrastructure for experiment
- Invite an adequate project leader from industry in response to the advancement of the project researches
- Nominate the most suitable person within the campus as a research leader, who is able to advance the academic aspects supporting the project
- Establishing a management system for the research and development for comprehensive collaboration, including project management, intellectual property strategy/management,contracts with companies, etc.

Inquiry

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744 Motooka, Nishi-ku, Fukuoka City, 819-0395, Japan
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E-mail : office@coi.kyushu-u.ac.jp

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

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 Conference

- This conference is organized by volunteers from next generation researchers at each site as a place where researchers from different fields can introduce their research and interact and discuss each other.
  (Presentation type)
  ① Keynote Speech：Presentations by famous researchers
  ② Oral Session：Researchers give presentations about their research. General Lecture by COI site researchers or Invited Lecture by researchers outside the COI site
  ③ Poster Sessions：Posting research posters

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.

COI Next Generation Researchers Collaborative Research Fund

- A new support menu "COI Next Generation Researchers Collaborative Research Fund (Digital field collaboration research)" which focuses on the digital field has been launched from FY2018.

Outline

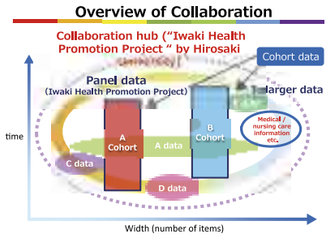
Comprised of collaborative research themes* involving two or more COI sites, it promotes collaborative research by soliciting and selecting proposals from research teams headed by next generation researchers in charge of collaborative research themes.
*Digital field collaboration research can be proposed by young researchers alone. It also requires proposals to collaborate with overseas institutions (universities, companies, etc.).

	COI Next Generation Researchers Collaborative Research Fund	COI Next Generation Researchers Collaborative Research Fund (Digital field collaboration research
FY2017	12 research projects (7 collaborative research themes, 5 FSs)	—
FY2018	21 research projects (15 collaborative research themes, 6 FSs)	57 FSs
FY2019	23 research projects (18 collaborative research themes, 5 FSs)	19 collaborative research themes
FY2020	16 research projects (14 collaborative research themes, 2 FSs)	7 research projects (6 collaborative research themes, 1 FS)

"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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Tel：0172-39-5537 E-mail：coi@hirosaki-u.ac.jp

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