



### Ishikawa High-tech Sensing Cluster

# Kanazawa

## Development of a system to diagnose early-stage dementia and establishment towards preventive medicine-based society

### Cluster Vision

Using research "seeds" from Kanazawa University, Kanazawa Institute of Technology, Japan Advanced Institute of Science and Technology(JAIST),etc and Industrial Research institute of Ishikawa such as superconducting quantum interference devices (SQUIDs), biosensors, and biomeasurement systems, we developed a system to help diagnose early-stage dementia and other support systems for the elderly and promoted technological developments in the field of high-tech measurement. By continuously utilizing these research results, we aim to create new industry and business, inaugurate a system for brain checkups in response to the aging of society, innovate in order to construct systems for a prevention-oriented society, and finally form Knowledge Clusters to produce technological "seeds."

### Project Overview

Technologies to measure brain function are highly promising; using these, the Kanazawa area worked to develop technological elements that would effectively allow diagnosis of early-stage dementia, which is an issue for a rapidly aging society. We developed diagnostic and measuring systems used in both hospitals and daily life, of which the medical evaluations were to be performed.

Exploiting the characteristics of the Kanazawa area, we aim to construct systems ranging from those for preventive medicine and health checkups, e.g. the development of a system to aid in the early diagnosis and prevention of dementia, to those to help the healing/recovery and for environmental conservation and food safety. We established a foundation of industrial clusters in order to create a prevention-oriented society of the future.

- Developmental research on a system to aid in the diagnosis of early-stage dementia and protocols to prevent dementia
- Development of ultra-sensitive magnetic-field measurement and control technologies for brain checkups and applied research into new fields of applications
- Development of highly functional biosensors for brain checkups, and applied research into new fields of applications
- Development of information-integration technologies within network environments for brain checkups, and applied research into new fields of applications
- Health care protocols based on advanced biomedical measurement technologies
  - Development of health care systems using non-invasive monitoring techniques
  - Development of protocols to measure evidence of mental health care and to aid in recovery
- Developmental research on "aware" technologies in order to create "aware" homes
- Development of biomagnetic field measurement equipment for small animals

Project Director  
**Shuichi Nakagawa**



Former Director of Technical Development and Director of the Central Research Facility at Yokogawa Electric Corp., and former President of Yokogawa Research Institute Co., Ltd.

### Incorporating project results with the prefecture's industry and health/welfare strategies and promoting cluster creation

Our project worked to mainly develop diagnostic systems of early-stage dementia and to shift the emphasis from validation of medical utility and verification tests to practical use.

Creating a framework to use development results to somehow continue creating clusters in future and linking them to regional policies is also crucial.

The results from the sensing cluster have been utilized by Ishikawa Prefecture's "Industrial Innovation Strategy" and "Health Frontier Strategy."

Fortunately, in November 2005, we succeeded in inviting the headquarters and research laboratory of the life-science division of a key corporation that had participated in joint research here in Kanazawa, where the business and development base took root.

Exploiting such experience, in the 2nd stage of the Knowledge Cluster (the Hokuriku Innovation Cluster for Health Science), we developed further research and development with Toyama Prefecture. We aim to form a global Knowledge Cluster in the field of health/medical care.

### Cluster Headquarters

- President.....Masanori Tanimoto (Governor, Ishikawa Prefecture)
- Vice President.....Hirotohi Shibuya (Chairman, Ishikawa Machinery and Electronics Association)
- Project Director.....Shuichi Nakagawa
- Chief Scientist.....Ryoji Suzuki (Professor, Kanazawa Institute of Technology)
- Science and Technology Coordinator...Osamu Ishihara, Kazuo Tsukabayashi, Mutsumi Usui, Isao Hashimoto

### Core Organization

Ishikawa Sunrise Industries Creation Organization (ISICO)

### Participating Research Organizations (Bold: Core Research Organization)

- Industry:Shibuya Kogyo Co., Ltd., Yokogawa Electric Co., Ltd., Eagle Technology Inc., Ishikawa Seisakusho, Ltd., COM-ONE Ltd., Three.Arrows Co., Ltd., Noritz Co., Fujitsu Hokuriku Systems, Ltd., Progress Ltd., TAK MEDICA Inst. of Tech. Corp., Suzuko Co., Ltd.
- Academia:Kanazawa University, Kanazawa Institute of Technology, Japan Advanced Institute of Science and Technology (JAIST), Kanazawa Medical University, Osaka University, Tokyo Medical and Dental University
- Government:Industrial Research Institute of Ishikawa, RIKEN

### Main Results

#### 1. Applications of SQUID sensors

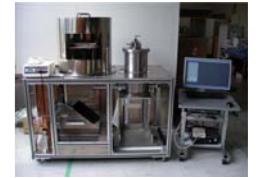
We developed a MEG using newly-designed SQUID sensors, Dewar, etc. and proceeded with clinical trials to measure higher brain function / diagnose dementia. We hence discovered the potential to diagnose early-stage dementia. We also developed a device to measure magnetic fields around the spinal cord as part of measurement of magnetic fields accompanying neural transmissions of the human cervical spine, which is used to diagnose spinal damage. A clinical study on the device is underway at the Tokyo Medical and Dental University. Furthermore, we developed a biomagnetic field measurement device for small animals consisting of SQUID sensors, which are used to measure their MCGs and MEGs. Clinical studies have been conducted with its potential use in pathological analysis and as assistance in new drug development.

#### 2. Non-invasive biomeasurement system

We developed systems capable of measuring information such as body weight, blood pressure, and ECG at home in a non-invasive manner. One is a system to measure body weight, excretion, and blood pressure using a bathroom toilet seat, while two is a system to measure ECGs and respiration in the bathtub. And another is system to measure pulse and respiration rate during sleep using a pillow. These systems have been placed in a laboratory and two hospitals, then subjected to medical evaluation.

#### 3. Commercialization of biosensors

We developed a Metal Immunoassay method, enabling high sensitive and electrical measurement of small volume samples compare with ELISA method. By applying this technique to biosensors and targeting productizations, various versions of electrodes were produced. Part of them were commercialized as a "DEP Chip" high quality disposable screen printed electrodes. In addition, we developed a high-sensitivity fluorescence detector for biosensors, which has been shrunk to A4 size.



Biomagnetic field measurement device for small animals



Non-invasive biomeasurement system



Biosensors

