



# Institute for Multidisciplinary Sciences

Yokohama National University



FACULTY  
PROFILE

# YNU

YOKOHAMA National University

## The Positioning of the Institute for Multidisciplinary Sciences (IMS)

By comparison with the Institute of Advanced Sciences (IAS), which undertakes outstanding, world-class research in cutting-edge technology research spheres, the Institute for Multidisciplinary Sciences (IMS) is a vision-driven research institute seeking to help build an ideal society through interdisciplinary collaboration across diverse research fields that aims to realize a vision for the society of the future. The IMS's Principal Investigators (PIs) include many up-and

coming younger researchers who will be playing an important role in the society of the future, and the IMS is aiming to accelerate the strengthening of diversity and interdisciplinary collaboration. The IMS is boldly undertaking work on current research topics which have been selected through back-casting from the vision of where we want to be in the future, and is realizing research activities that will lead to the generation of new academic fields and of new value for society.

## ABOUT IMS



## Framework for Collaboration with External Partners

In recent years, the competition in the university sector to secure high-level international research talent has become increasingly intense, and the movement of research talent between countries has accelerated. As with the IAS, which has made the recruitment and securing of first-rate foreign researchers a priority, and has been proceeding with the putting in place of the necessary systems, the IMS has also been forging an international collaboration network with overseas companies, overseas universities, and other

international partner organizations, aimed at realizing the YNU's vision, and has been strengthening measures to build itself into an International Network Hub that will be at the center of innovative, high-level research activities. In addition, by implementing initiatives for ongoing strengthening of collaboration with non-academic bodies, including the local community and industry, the IMS is aiming both to enhance international research capabilities and promote the social implementation of research results.

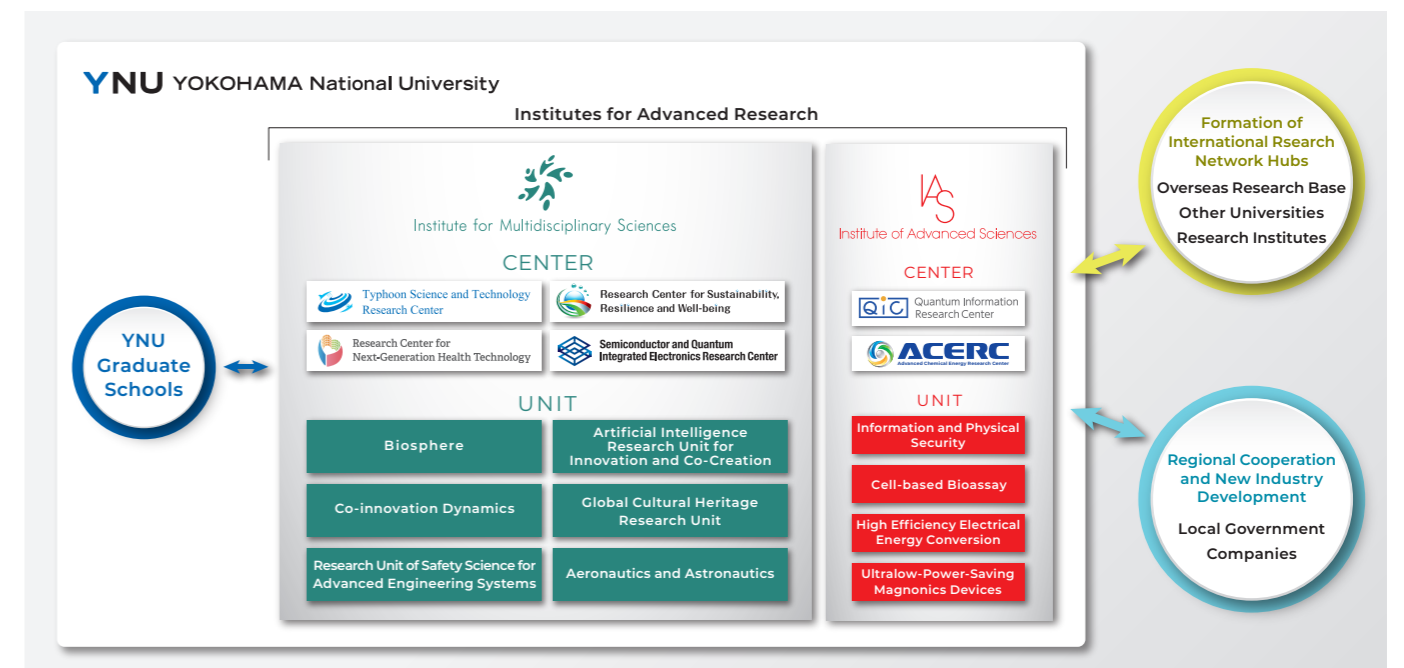
## Research Organization

The Institute for Multidisciplinary Sciences (IMS) has four academic centers of practice: the Typhoon Science and Technology Research Center, the Research Center for Sustainability, Resilience and Well-being, the Research Center for Next-Generation Health Technology, and the Semiconductor and Quantum Integrated Electronics Research Center, as well as six units: the Co-Innovation Dynamics Research Unit, the Biosphere Research Unit, the Artificial Intelligence for Innovation and Co-Creation Research Unit, the Research Unit of

Safety Science for Advanced Engineering Systems, Global Cultural Heritage Research Unit and the Research Unit of Aeronautics and Astronautics. These research centers and research units, which take on the challenges of global social issues, aim to realize their respective visions for the future and contribute to solving global-scale issues facing humanity and co-creating innovation through dialogue with society, based on the synergy of the outstanding new technologies of the Institute of Advanced Science (IAS).



## IMS Organizational Structure



## Research Support System

The IAS and the IMS bring together international researchers in a wide range of fields from both within and outside Japan to undertake high-level research projects. Dedicated research strategy planning managers and industry-university-government collaboration coordinator have been assigned to realize focused support not only for the putting in place of a leading-

edge research environment, external funding management, and research outreach activities (including research PR and science communication), but also for the building of a researcher network that links together the researchers at the IAS and the IMS across the boundaries of their respective research fields.



## Typhoon Science and Technology Research Center

**VISION**  
As Japan's first dedicated typhoon research facility, the Typhoon Science and Technology Research Center aims to contribute to the formation of a safe, active and sustainable society, by reducing typhoon disaster risk. The Center also aims to contribute to a carbon-free society by harnessing typhoon energy.

**ABOUT**  
As Japan's first dedicated typhoon research institute, the Typhoon Science and Technology Research Center aims to contribute to the formation of a safe, active and sustainable society, by reducing typhoon disaster risk. The Center also aims to contribute to a carbon-free society by harnessing typhoon energy.

**RESEARCH CONTENTS**  
The Typhoon Science and Technology Research Center contributes in four ways:

1. Contribution to the formation of a safe, active and sustainable society, by reducing typhoon disaster risk
2. Contributing to a carbon-free society by creating a new source of renewable energy
3. Contributing to the recovery of Japan as a technology superpower through typhoon innovation
4. Contribution to cultivation of personnel who can succeed on the world stage through seamless research partnership between industry and academia



Center Director  
**FUDEYASU  
Hironori**



## Research Center for Sustainability, Resilience and Well-being

**VISION**  
The Center aims to create a society that is flexible and earns public approval in the face of change, based on the study of risk symbiosis.

**ABOUT**  
The Research Center for Sustainability, Resilience and Well-being conducts comprehensive academic and practical research and education aimed at producing an "abundant society": a prosperous and fruitful society in which everyone can leverage their talents and characteristics to live dynamic lives, cherish dreams and hopes for the next generation as they harvest.

**RESEARCH CONTENTS**  
To create an abundant society, we conduct research fusing the sciences and humanities, tackling educational challenges and implementing the results of these efforts in society. In so doing we strive to implement a society resistant to disasters such as fires and earthquakes, supported by resilient infrastructure.

**Establishment of three research centers**

1. **Resilient Infrastructure Research Center:** Contributing to the longevity of infrastructure
2. **Possibility and Visualization Research Center:** Improving the prevention and reduction of disasters by using digital twins, etc.
3. **Ways of Connection Research Center:** Contributing to a happier society through the science of human relations



Center Director  
**HOSODA  
Akira**



## Research Center for Next-Generation Health Technology

**VISION**  
The Center builds health innovation ecosystems based on research evidence from general knowledge, linking development of medical and healthcare technology to technology development and practical research. In this way the Center creates innovative spaces where people can enjoy health and happiness through movement, work and residential living.

**ABOUT**  
By gathering the Center's "seeds" related to general health technology, including health, medicine and social services, the Center becomes a hub that links industry, academia and citizens, advancing world-leading academic research. We aim to be an organization that shoulders the responsibility of organically and effectively advancing regional liaison, industry-academic-public liaison and medical-industrial liaison.

**RESEARCH CONTENTS**  
**Establishment of five laboratories**

1. **Revolutionary Medical Device Creation Laboratory:** Conducts R&D in medical devices to support new medical technologies
2. **Healthcare MaaS Laboratory:** Development of high-value-added service technologies linking movement with medicine, such as transport for hospital admissions, emergency care and critical care.
3. **Medical Data Science Laboratory:** Research on use of Big Data linked to early diagnosis of presymptomatic and latent disease in the healthcare and medical fields
4. **Femtech/Assistive Tech Research Laboratory:** Research on femtech to achieve divergence and inclusion and support technologies considering disabilities and other differences in abilities
5. **Health Innovation Ecosystem Co-creation Laboratory:** Advancement of research fusing social science and urban science as needed to form ecosystems centered on health technologies



Center Director  
**SHIMONO  
Tomoyuki**



## Semiconductor and Quantum Integrated Electronics Research Center

**VISION**  
The Centre will contribute to solving issues and improving the convenience of our increasingly diverse societies by promoting the realisation of smart cities, for example, through the research and development, and diffusion of cutting-edge electronics technologies.

**ABOUT**  
As a specialized organization for semiconductor and quantum technology located in Yokohama, we will foster innovation by connecting research institutions and companies worldwide and by connecting university and society.

**RESEARCH CONTENTS**

1. **Semiconducting heterogeneous integration laboratory:** focuses on the true value, deepening, and evolution of chiplet technology, and promote research on "heterogeneous integration" that can "connect" various devices in an "energy-saving" and high-speed manner with enabling parallel operation.
2. **Advanced integrated device laboratory:** promotes researches on new devices that transcend the limitations of conventional semiconductor devices, as well as on their integration technologies.
3. **Quantum Internet laboratory:** promote research and development for the realization of the quantum Internet as the foundation for global connectivity of quantum devices.
4. **Photonics laboratory:** contribute to the pioneering of next-generation optical communication technologies and non-destructive and accurate diagnostic technologies for social infrastructure.
5. **Social value innovation laboratory:** practical and theoretical research on methods of innovation (especially social implementation) is conducted to realize value by disseminating SQIE research results to society.



Center Director  
**MANABE  
Seiji**

# UNIT 1 Biosphere

## VISION

To address various problems such as climate change and biodiversity loss, we will provide scientific evidence to leverage the value of nature to maximum effect and present new ways of interacting with nature and society that consider humans as a part of the biosphere.

## RESEARCH CONTENTS

This research unit will provide the scientific evidence needed to utilize the boundless value of nature, in applications such as climate stabilization, disaster risk reduction, pandemic control, food and water security, and cultural diversity. Through collaboration among science, society, and policy, this research unit aims to build sustainable development for the biosphere, including humanity.



Principal Investigator  
**KAGAMI Maiko**

# UNIT 2 Artificial Intelligence Research Unit for Innovation and Co-Creation

## VISION

We contribute to a prosperous future society by pursuing original artificial intelligence (AI) technologies and promoting the beneficial application of AI in various fields.

## RESEARCH CONTENTS

This research unit conducts innovative and co-creative research through the development of original techniques related to automated machine learning, evolutionary machine learning, and AI design with known unknowns. This research is based on AI, including machine learning, deep learning, and evolutionary computation. This research also promotes the application of AI technologies to other fields, such as biotechnology, biomedical engineering, security, and industry-academia-government collaborative research activities.



Principal Investigator  
**SHIRAKAWA Shinichi**

# UNIT 3 Co-innovation Dynamics

## VISION

To achieve new social value by socially implementing advanced knowledge and technology, the Lab clarifies mechanisms for transfer and sharing of knowledge and technology both within and among organizations. The Lab also conducts practical research on the dynamics of strategy, management and innovation in partnership with industry, academia and government, to achieve co-innovation.

## RESEARCH CONTENTS

We are asked to aim to promote innovation and achieve new social value by deploying advanced technologies and knowledge discovered by universities and the like in society (social implementation). This objective requires understanding the methods and dynamics of co-innovation among a variety of players in society. This Research Unit is primarily devoted to investigating the mechanisms and process of transfer /sharing of knowledge and technologies within and among organizations. This Unit also conducts practical research on the dynamics of innovation to realize social value, including the strategy and management of industry-academia-government collaboration for co-innovation.



Principal Investigator  
**MANABE Seiji**



Principal Investigator  
**YASUMOTO Masanori**

Institute for Multidisciplinary Sciences INTRODUCTION OF THE UNIT

# UNIT 4 Global Cultural Heritage

## VISION

Aiming to realize a peaceful world free from war, by using the cultural assets that humanity has continued to create since prehistoric times, and which are shared across national and ethnic boundaries, to develop a bird's-eye view of human history across space and time.

## RESEARCH CONTENTS

Both the fine arts and technology are 'art' that is continually being created by human beings. Our research includes the development of advanced measurement techniques that are useful in research on and conservation of works of art, and the application of informatics to accumulated cultural heritage data to discover new insights into the history of mankind.



Principal Investigator  
**FUKUNAGA Kaori**

# UNIT 5 Safety Science for Advanced Engineering Systems

## VISION

By building a new kind of safety science that goes beyond the boundaries of the existing safety engineering, and by realizing the appropriate adoption of next-generation engineering systems in society, the aim is to realize an advanced, safe society.

## RESEARCH CONTENTS

Having a framework in place for the appropriate evaluation of new technology is vitally important for realizing an enriched society that implements next-generation engineering systems making effective use of cutting-edge science and technology. Our unit is building on the foundations established by forward-looking activities in the field of safety engineering in the past to contribute toward the realization of an enriched future by developing technology for safety evaluation targeting leading-edge engineering systems, focusing on areas such as next-generation energy systems and the space sector that would be difficult to address using only existing frameworks.

- **Energy system safety assessment (hydrogen energy, next-generation nuclear power, and the space sector)**
- **Safety engineering for complex, large-scale systems (cloud computing, and information security)**



Principal Investigator  
**SHIBUTANI Tadahiro**

# UNIT 6 Aeronautics and Astronautics

## VISION

We aim to realize a sustainable aerospace society in harmony with the global environment by integrating aerodynamic design technologies for high-speed flight, materials for extreme environments, optimal guidance and control, and innovative propulsion systems to advance eVTOL aircraft, reusable space transportation vehicles, and deep-space explorers.

## RESEARCH CONTENTS

We integrate aerodynamic analysis of aircraft and spacecraft using CFD; materials design of superalloys and refractory high-entropy alloys (RHEA); rover design based on terramechanics; guidance, navigation, and control driven by trajectory optimization; and research on detonation and ion engines to develop next-generation aerospace systems, ranging from eVTOL aircraft to lunar and deep-space explorers.



Principal Investigator  
**ISHII Kazuhiro**



Institute for Multidisciplinary Sciences  
Yokohama National University



## CONTACT

Institutes for Advanced Research, Yokohama National University  
Main Office, #103, Building of Institutes for Advanced Research (S7-4)  
79-5, Tokiwadai, Hodogaya, Yokohama 240-8501, Japan  
Phone: +81-45-339-4454  
E-mail: [sentan.kenkyu@ynu.ac.jp](mailto:sentan.kenkyu@ynu.ac.jp)

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