Institute of Advanced Sciences

Yokohama National University

FACULTY PROFILE

YNU

YOKOHAMA National University

The Positioning of the Institute of Advanced Sciences (IAS)

The Institute of Advanced Sciences (IAS) was established in October 2014 after YNU received a University Reform and Strengthening Grant from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) to undertake research in fields relating to safety engineering and risk, which are areas where YNU is particularly strong. Based on an approach that emphasizes “risk symbiosis,” the IAS is an organization that aims to be an international research center that will contribute toward the development of appropriate ways to respond to risk in 21st century society and the realization of a vigorous, sustainable global society where people can enjoy safety and peace of mind. The IAS also has a role to play in further enhancing the research capabilities of YNS, by promoting focused research within an advanced framework, and by creating international research hubs in relevant fields. In April 2023, an additional institute – the Institute for Multidisciplinary Sciences (IMS) – was established alongside the IAS to create a university-wide research framework that will accelerate and develop the initiatives referred to above, and will promote research which aims to strengthen diversity and which embodies a strong awareness of the importance of contributing to society and of co-creation with society.

ABOUT IAS

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. Faced with this environment, the IAS 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. It has 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 IAS is aiming both to enhance international research capabilities and promote the social implementation of research results.

Research Organization Structure

The establishment of the Institute for Multidisciplinary Sciences (IMS) in April 2023 also represented a new start for the IAS. To drive world-class research in cutting-edge research fields, the IAS has adopteda structure that comprises two academic research centers – the Quantum Information Research Center and the Advanced Chemical Energy Research Center – and four research units led by outstanding researchers: Information and Physical Security, Cell-based Bioassay, High Efficiency Electrical Energy Conversion, and Unconventional Magnonics. The aim is for the research results generated by these research units and research centers, together with those generated by the IMS, to contribute toward the building of new social and economic systems, toward the fostering of innovation, and toward the development of science and technology.

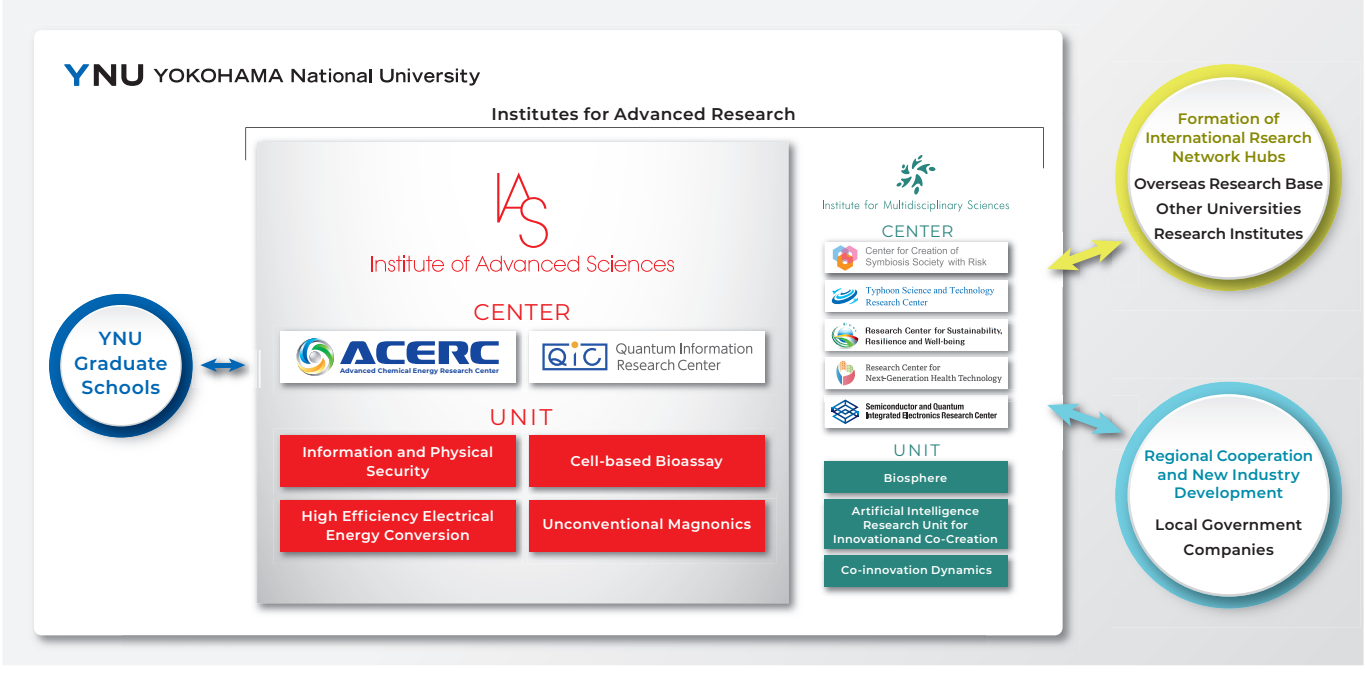
YNU President,
Director of
IAS and IMS

UMEHARA
Izuru

Vice Director of
IAS and IMS

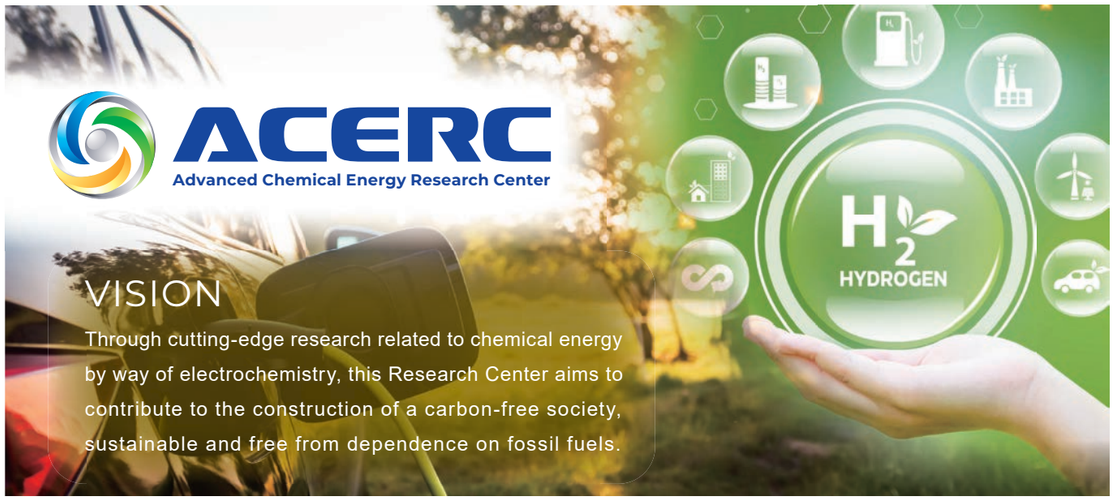
YOSHIKAWA
Nobuyuki

IAS 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 have been assigned to realize focusedsupport 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.



ABOUT Putting Chemical Energy to Effective Green Use in Pursuit of the SDGs

The aim of the Advanced Chemical Energy Research Center is to achieve a sustainable society by contributing to the construction of a carbon-free society that is no longer dependent on fossil fuels. Leveraging its strength in electrochemistry, the Advanced Chemical Energy Research Center is establishing itself as a new research hub related to chemical energy. The Center is a research hub that is building a network to bring academia, industry and government agencies together while conducting academic study and technological research related to new forms of chemical energy. By implementing the fruits of its research in society, the Center contributes to the efficient use of renewable energy and achievement of a carbon-neutral society.

RESEARCH CONTENTS Two Laboratories

The Advanced Chemical Energy Research Center is established within the Institute of Advanced Sciences. The Center incorporates two laboratories, a green hydrogen research laboratory and an advanced energy storage research laboratory. The Center liaises with researchers inside and outside the Institute of Advanced Sciences to pursue research activities.

Green Hydrogen Research Laboratory

Advanced Energy-Storage Research Laboratory

Center Director, Green hydrogen research laboratory Director

MITUSHIMA Shigenori

Advanced energy storage research laboratory Director

YABUUCHI Naoaki

ABOUT World First

Success in Generating Geometrical Quantum Entanglement of Electrons and Photons in a Diamond

Success in proof-of-principle of optical random-access quantum memory

Outstanding researchers in quantum information both in and outside Yokohama International University are gathered in the Center. The Center fosters an environment in which these researchers can routinely exchange information and create ideas, continuously launching joint research with high research value in a timely manner. The Center accepts national projects and participates as a nexus for international joint projects, earning the trust of outside parties as a suitable organization for tackling global top-level, large-scale research projects. As such, it was launched as a global research hub for advancing practical research in this field.

RESEARCH CONTENTS Two Large-Scale Projects

The Quantum Information Research Center is established within the Institute of Advanced Sciences. The Center incorporates three laboratories, a quantum information physics laboratory, a quantum-controlled-electron integrated- circuit laboratory and an integrated photonics laboratory.

1 MOONSHOT RESEARCH & DEVELOPMENT PROGRAM

Research and Development for Building a Global Quantum Cryptography Communication Network

QuINT Quantum INTerfaces — Development of Quantum Interfaces for Building Quantum Computer Networks

2 Ministry of Internal Affairs and Communications (MIC)

QuREP QUANTUM REPEATER TECHNOLOGY — Quantum Repeater Technology

Center Director, Quantum information physics laboratory Director

KOSAKA Hideo

Quantum-controlled-electron integrated-circuit laboratory Director

YOSHIKAWA Nobuyuki

Integrated photonics laboratory Director

BABA Toshihiko

UNIT 1

Information and Physical Security

VISION

We envision realizing “Society 5.0,” in which cyberspace and physical space are tightly integrated. We aim to achieve this goal by developing security solutions that are resilient against future threats, based on accurate understanding of current threat mechanisms.

RESEARCH CONTENTS

We research technology for observation and analysis of cyberattacks and malware, for detection and analysis of vulnerabilities, the human factor in security, cyber-threat ecosystems, and the possibilities for use and misuse of AI. Through these efforts, we obtain a deep understanding of the current state of threats and identify future security issues on that basis, thereby achieving early solutions.

Principal Investigator

YOSHIOKA Katsunari

UNIT 2

Cell-based Bioassay

VISION

The goal of this unit is to develop cellular assay technologies to evaluate the safety of chemicals and drugs for humans. By so doing, this unit seeks to realize a safe and secure society in which people can live long and healthy lives while reducing the sacrifice of animals in scientific research.

RESEARCH CONTENTS

This unit develops cellular assays to evaluate various toxicities of chemicals, such as promotion of oncogenesis, developmental toxicity, neurotoxicity, and skin irritation and sensitivity. Furthermore, by combining these assays with AI-based image analysis technology, we study methodologies to develop international testing methods using these assays.

Principal Investigator

FUKUDA Junji

UNIT 3

High Efficiency Electrical Energy Conversion

VISION

We contribute to reducing CO2 emissions by applying electricity conversion technologies and electrical-mechanical energy conversion, made possible using power electronics.

RESEARCH CONTENTS

This unit researches elemental technologies that will form the heart of next-generation electricity conversion technologies. These include high-efficiency operation of EV power trains, wireless power transmission and noise-free inverters, made possible by high-efficiency electricity conversion technologies that use wide-bad-gap semiconductors.

Principal Investigator

AKATSU Kan

UNIT 4

Ultralow-Power-Saving Magnonic Devices

VISION

For the realization of a “trillion-sensor universe” fusing cyberspace and physical space, the research unit achieves the development of revolutionary devices for information processing, using the ubiquitous magnon in magnetic materials.

RESEARCH CONTENTS

This research unit controls spin flow and magnon flow in nanoscale structures not associated with electrical Joule heating. The purpose of this effort is to pioneer next-generation information-processing technologies, including ultra-energy-saving information processors required for sensor network terminals, neuromorphic processors, and Q-bits that can work at room temperature.

Principal Investigator

SEKIGUCHI Koji

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