

# Institute of Advanced Sciences

先端科学高等研究院

## Establishment of a research hub rooted in the field of sustainable living with risk management which contributes to sustainable global development

Yokohama National University (YNU) has started creating a global hub for leading-edge research which responds to various risks and other issues faced directly by today's global society. Research is being conducted in the fields of safety engineering and sustainable living with risks management, both strong fields of the university, through collaboration with some of the best researchers in the world.

In addition to issues surrounding human activity which are related to resources, energy, the environment, and safety, there is a strong demand in 21st century society for the realization of a safe and secure society capable of sustainable development, the creation of new scientific fields and technologies, the assessment of newly developed technologies that contribute toward this effort, and the adequate implementation of these in society. At the same time, the various issues mentioned above will be solved with limited cost and burden on society as it matures with diverse values.

Leveraging the strengths of this university, the Institute of Advanced Sciences aims to promote leading-edge research for the realization of technological innovation and creation of resilient social systems based on the development and assessment of leading technological systems, risk analysis, establishment of optimal control methods, and similar efforts in order to respond quickly to the needs of the society we have described. The creation of the field of sustainable living with risk management was realized through the integration of individually

conducted risk research in various fields as a systematic area of study. While concentrating on research fields where the university's strengths lie, the field of sustainable living with risk management has a synergy effect created through the presence of world-leading researchers and collaboration with them.

The Institute of Advanced Sciences consists of the following research fields: 1) Industrial disaster and natural disaster risk research and management and safety innovation research related to urban planning and political measures; 2) Creation and innovation of smart cities and research related to social spaces and value creation through clean energy, eco materials and clean cities; and 3) Life innovation research related to the creation of technologies that respond to the aging society and networks using body area networks, etc. that serve as their foundation.

With a focus on research for planning of cities and industrial areas designed to deal with risks posed by natural and industrial disasters, smart cities utilizing clean energy and eco materials, and the creation of safe and secure communities which contribute to new value creation that responds to the aging society, we plan to expand into new academic disciplines which will also reach into economics and management. This institute, which serves as an integrated hub for the field of sustainable living with risk management, is the first of its kind in the world.

## Organizational structure

This institute will establish research units involved in both international collaboration and industry-academic partnerships which aim to create highly practical research seeds that respond to global standards.

Each research unit is mainly comprised of three Principal Investigators(PI). The most distinctive characteristic of the units is the cooperation of the domestically-based PI, a YNU(Associate) Professor with outstanding research seeds and a research field unique to Japan and the world, the overseas PI, who is popular internationally in his or her field, and a PI from the world of industry who has the know-how to bring research seeds into industry and society. Research units which include researchers from the university create highly practical research seeds in the field of sustainable living with risk management by paying attention to various perspectives.



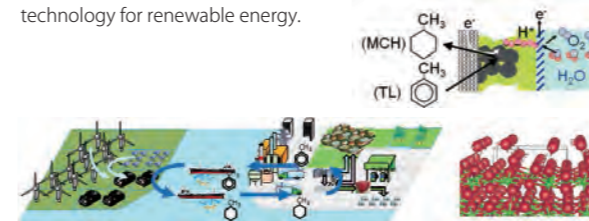
## 11 Research Units

### Safety and Resilience of Infrastructure and Infrastructure Systems

A large number of the civil infrastructures in Japan are aging. The safety and resilience of infrastructures and infrastructure systems are extremely important. This research unit aims at developing efficient infrastructure management systems, making use of advanced technologies such as sensing technology, information technology, and robotics together with advanced civil engineering.

### Chemistry of Hydrogen Energy Conversion

We develop systems and materials for direct electrocatalysis of energy carriers and non-precious metal oxide electrocatalysts for oxygen reduction reaction for polymer electrolyte fuel cells toward the development of hydrogen energy technology for renewable energy.



### Extremely Energy-Efficient Processors

Our research goal is to realize extremely energy-efficient integrated circuits beyond the thermodynamic limit by using adiabatic and reversible circuits. In this research unit, we investigate the minimum energy limit in computation and develop extremely energy-efficient processors.



### Medical Information and Communication Technology (Medical ICT)

The Medical ICT unit promotes research and development of reliable and safe, i.e. dependable wireless body area networks (BAN) in the field of healthcare and medicine based on advanced information and communication technologies. International standards and regulations in this field also are coordinated with collaborating ministries, institutes and companies throughout the world.

### Safety of Marine Structures and Environmental Protection

The unit carries out collaborative researches on the safety and operability of floating liquefied natural gas units with the University of São Paulo. It also conducts collaborative research together with Shanghai Jiao Tong University on future-generation ships with highly improved energy-saving and safety performance.



### Safety and Risk Management of Process Industry & Energy Systems

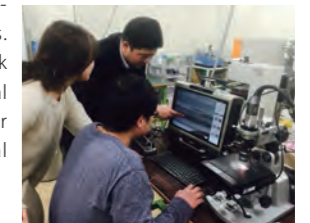
This unit investigates loss prevention, hazard identification, risk management and safety promotion of technological systems such as process industries and energy systems for a safer, more secure and sustainable society.

### Information and Physical Security

This research unit conducts research on one-step-ahead information and physical security techniques, developing and implementing cutting-edge malware countermeasures, cryptography, software and hardware technologies, system technologies, security economics, etc.

### Self-Healing Materials

This research unit is organized for R&D of self-healing materials, which are attractive candidates as next-generation structural materials. Research topics include risk assessment and design of global standards for these materials for actualizing self-healing material applications.



### Next-Generation Urban Habitats

Research on habitats correlated with issues confronting cities throughout the world will be undertaken in collaboration with overseas think tanks and universities in order to arrive at models for how future cities and communities might be organized and new social systems in response to social crises in an age of transformation of capitalism.

### Risks and Uncertainties in the Economy

This research unit conducts theoretical and empirical research on a wide range of topics of risks and uncertainties in the economy (i.e. fluctuations of the financial market, population, and the problem of unemployment), collaborating with leading researchers abroad in economics and related areas.

### Policy Development in Latin America

This research unit conducts urban and rural development policy research focusing on sustainable living with risk management and based on academic agreements between YNU and universities in Latin America, and in addition organically combines development anthropology, civil engineering, and gender and development studies to disseminate innovative field-based research integrating art and science.

