

Doctoral Program  
for World-leading Innovative & Smart Education

## **The Frontier Development Program for Genome Editing**



HIROSHIMA UNIVERSITY



**Mitsuo Ochi**  
**President of Hiroshima University**  
**Director-General of the program**

In 2019, Hiroshima University (HU) launched the Frontier Development Program for Genome Editing, an integrated Master's-PhD course, with the aim of training PhD students to introduce innovations to society.

Genome editing is a new biotechnology that makes it possible to rewrite the genomic information of various living organisms at will, using an artificial DNA-cutting enzyme (genome editing tool). Basic genome editing research has advanced considerably. As it is just a matter of time before we see the industrial and medical application of genome editing in the field of biofuel, breeding, and drug discovery, the ethical aspects of genome editing should be considered when scientists conduct cutting-edge R&D in this area of biotechnology.

HU boasts one of the top genome editing research track records in the whole of Japan, with several leading researchers being core members of the Japanese Society for Genome Editing. Furthermore, under the Program of Open Innovation Platform for Industry-academia Co-creation (nicknamed *COI-NEXT*), led by the Japan Science and Technology Agency (JST), HU is promoting an industry-academia co-creation, which is based on the concept of 'Bio × Digital Transformation (BioDX).' The purpose of this collaboration is to maximize biological functions with a view to solving social issues such as new infectious diseases, food supply problems, and difficulty in achieving zero CO<sub>2</sub> emissions. In addition to promoting research and development, including human resource development and career path formation through industry-academia co-creation, HU aims to work together with local industry to realize a bioeconomy-oriented society so that it can contribute towards achieving Hiroshima's Sustainable Development Goals (SDGs).

In our efforts to develop new industries, I hope that new students will join us at HU, which provides a great environment for fostering distinguished PhD students, who will lead the world in genome editing technology.



**Hidetoshi Tahara**  
**Program Director**

**Executive and Vice President,**  
**(Industry-Academia-Government and Community Collaboration)**  
**Hiroshima University**

The Frontier Development Program for Genome Editing is based on curricula led by world-class domestic and overseas genome editing researchers. Its purpose is to train specialists who can take the lead in creating new industries in the field of biotechnology.

We have established the five-year Life Science Course to develop new industries and the four-year Medical Course to study diseases and develop genome editing-based therapies and drugs. In these two courses, students will learn the basic and applied knowledge and technology of genome editing. A wide variety of curricula are provided in advanced technologies, including training at the Center for iPS Cell Research and Application, Kyoto University, and at overseas institutes; collaborative research with Tokushima University, which has outstanding research achievements in the agricultural, fisheries, and livestock field; and education by enterprises participating in the Consortium for Industry-University Cooperation in Genome Editing Technology.

Hiroshima University has served as a driving force for advancements in the field of genome editing in Japan, and earned high acclaim. This program is designed to enable students to engage in top-level research activities, taking advantage of the university's strong track record and network among industry, academia, government and the private sector. I hope that they will play an active role and make a valuable contribution on the global stage by taking action and resolving various social issues, based on what they have learned in this program.



**Takashi Yamamoto**  
**Program Coordinator**

**Professor,**  
**Graduate School of Integrated Sciences for Life**  
**Hiroshima University**

Genome editing technology needs to be actively utilized in order for industries to solve fundamental human problems related to food, energy, and diseases. Hiroshima University has led the genome editing field over the years. In 2012, it established the Genome Editing Consortium, and in 2016, the Japanese Society for Genome Editing, centered around Hiroshima University's researchers.

The global market of genome editing is expected to rapidly grow in many fields, including life science research, the biotechnology industry, breeding of animals and plants, medical care, and drug discovery. The competition to develop these technologies is getting more intense. Thus, Hiroshima University is one of the best places in Japan to learn genome editing because it has served as the domestic base of genome editing research and can collaborate with a wide range of organizations.

Why don't you join us in advancing genome editing technology?

## Program overview

This program established the Life Science Course (5-year curriculum) and the Medical Course (4-year curriculum) in order to provide students with opportunities to acquire basic and applied knowledge and to learn techniques of genome editing. This program enables students to master genome editing technology and connect it directly to industry.

Acquire basic and advanced knowledge and learn the techniques of genome editing

Specialized courses in genome editing

Learn the process for social implementation of research achievements

Collaborative research with the Council of the Frontier Development for Genome Editing, internship, etc.

From case studies, learn the skills required to start a business

Courses in career development, data literacy, etc.

Learn the research ethics required for genome editing

Course on ethics in genome editing research

### Life Science Course (5-year curriculum)

In the first and second years, students will learn basic and advanced genome editing techniques. From the third year, they will conduct research utilizing the knowledge they have acquired. Through basic courses on social implementation of technologies and internships, they will be trained to become experts able to work at the cutting edge of genome editing technology.

### Medical Course (4-year curriculum)

After systematically learning the basic and advanced genome editing technologies in the first and second years, students will conduct research for their doctoral thesis, utilizing knowledge that they have acquired. In addition, through internships at domestic and overseas partner institutes, they will be trained to be able to work at the cutting edge of genome editing in the medical field.

## Admission

This program has been accepting students since April 2019, and has been implemented as a degree program across several graduate schools. Visit our website or check the Applicant Guidelines for details.

## Financial support

- (1) 50,000 yen per month (600,000 yen per year) will be provided for up to three students per year starting the year after entering the school. Those who are recognized as having excellent academic performance and making outstanding achievements in academic activities after entering the school will be eligible for this program. (Details of the application, including timing, will be announced after admission.)
- (2) Free tuition will be provided for third and later years of the Life Science Course and all years of the Medical Course (some students may be ineligible due to their academic performance).
- (3) Ikenoue Student Dormitory is exclusively available for program students for 2 years for a charge (monthly boarding fee is 4,700 to 15,000 yen; in addition, students must pay common expenses and utility expenses).

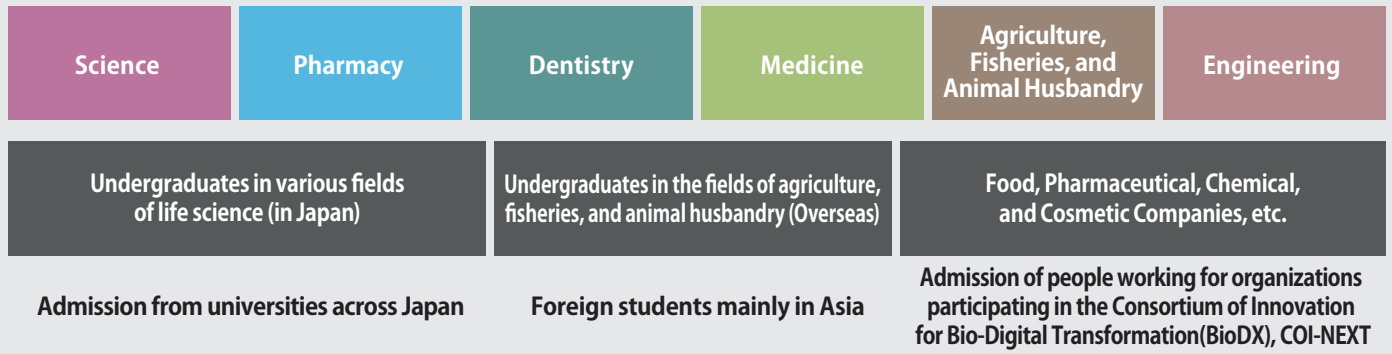
\*The forms for financial support described in (1), (2), and (3) are up to date as of April 1, 2021, but may be changed in the future. The support is provided only within the standard course term.





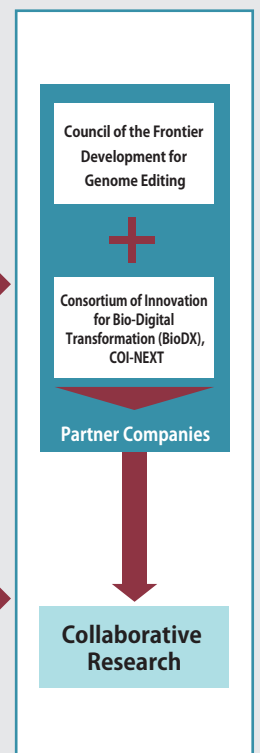
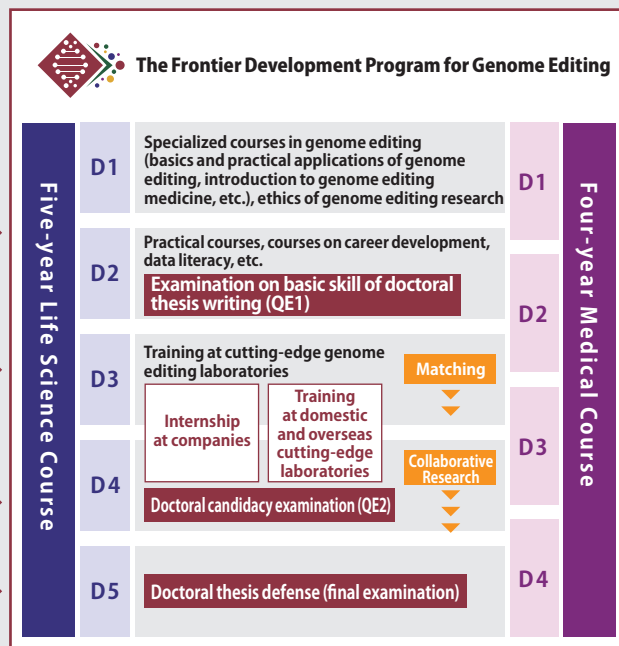
# Opening up the Future with Genome Editing

Genome editing is the fundamental technology of life science, and this program is open to students from a wide range of backgrounds.



## Doctoral Program for World-leading Innovative & Smart Education

### Program provider



Students acquire the ability to apply technologies to society (ability for social implementation) under an organization that enables them to experience the speed of advanced research.

Produce genome editing researchers who **develop new industries**.

Developers of industrial genome editing technologies

Researchers of genome editing-based therapies and drug discovery

Food and Chemical Companies

Pharmaceutical and Bio-venture Companies

University Researchers, Venture Companies

Entrepreneurs of venture businesses related to genome editing

Developers of basic genome editing technology

Council of the Frontier Development for Genome Editing + Consortium of Innovation for Bio-Digital Transformation (BioDX), COI-NEXT

One of the features of this program is that fostering students' cutting-edge and practical R&D capability through collaborative research with private companies in the Council of the Frontier Development for Genome Editing and/or organizations participating in the Consortium of Innovation for Bio-Digital Transformation (BioDX), COI-NEXT.



As of April, 2021

## Akihide Takami

**Supreme Principal Engineer, Technical Research Center  
Mazda Motor Corporation**

In collaboration with Hiroshima University and Tokyo Institute of Technology, Mazda is making efforts to research bio-based liquid fuels produced from renewable biomass as an alternative for fossil fuels, such as gasoline and diesel oil. The goal is to considerably reduce Well-to-Wheel CO<sub>2</sub>\* emissions in order to achieve a carbon neutral automobile society. We believe that genome editing technology will drive innovation in dramatically improving the productivity of biomass-derived liquid fuel, and we eagerly anticipate its further development.

\* Well-to-Wheel CO<sub>2</sub>: Cumulative CO<sub>2</sub> emissions generated from to dig the oil well to consumption by cars.



## Ichiro Nazuka

**General Manager, Business Development Dept, Information and Communication Division**  
**TOPPAN PRINTING CO., LTD.**

TOPPAN PRINTING has cultivated information processing technology based on our own printing technology. Because a large amount of genetic information must be processed in genome editing, technologies for correctly and safely managing large amounts of data, as well as for data analysis using AI, are useful in this field. Therefore, we are currently conducting collaborative research with Hiroshima University on genome editing databases using AI. We hope that this research will contribute to the application of genome editing to a wide range of industries, creating innovative products and services, and solving various social problems.



## **The Frontier Development Program for Genome Editing**

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### **Contact**

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Issued in October 2021