



JSPS

# WISE Program

Doctoral Program for  
World-leading Innovative &  
Smart Education



# Message



Chair, WISE Program Committee  
HAMAGUCHI Michinari

To sustain and grow the affluence currently enjoyed in Japan, the government is expected to take the lead in creating the new key industries of the future while staying abreast of the quickly advancing global industrial structure propelled by rapid changes in the world economies and societies. (That is, to achieve Japan’s Society 5.0 vision.) To that end, university graduate schools in Japan are expected to be a wellspring of the new knowledge genres and technologies needed to spur the creation of new key industries while being an incubator of talented people attuned to the social values attending these innovations.

On the other hand, when looking at the situation currently enveloping graduate schools in Japan, we witness a variety of problems in both the qualitative and qualitative aspects of the educational environment, one being a phenomenon of excellent young people shying away from entering PhD programs. In Japan, this is called “*hakasebanare*,” roughly translated “PhD flight.”

Given this situation, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) launched the “Doctoral Program for World-leading Innovative and Smart Education” (WISE Program) in FY 2018. Taking a lead in generating and applying new knowledge, the WISE Program has as its aim the fostering of excellent doctoral students, who will be the high-level “knowledge professionals” who create the values that will inform the next generation. While taking on the challenge of solving daunting societal issues, these knowledge professionals will endow society with trailblazing innovation. In working to reform Japan’s leading graduate schools, the WISE Program expects each university to create doctoral programs that amplify their unique institutional character and strengths and to make program proposals that give expression to their own free ideas.

During the period up to FY 2020, 140 applications had been received from Japanese national, public and private universities, among which a total of 30 programs were selected. The WISE Program Committee monitors the selected graduate school programs and in their four and seventh years carries out an assessment of their progress. Through this process the Committee works to support each program and to foster the next generation of excellent professionals who will shoulder Japan’s future.

The executives of the selected universities take the initiative under the president’s lead in creating a system to implement the WISE program, through which an all-out effort is made to reform the university’s entire graduate program.

We expect that each program will foster high-level knowledge professionals who personify the WISE objective while overcoming unanticipated difficulties in confronting an increased spread of the new coronavirus. We also strongly expect that the results attained through the WISE program will be used to advance university reform throughout Japan.

## CONTENTS

Message	3
WISE Program <small>Doctoral Program for World-leading Innovative &amp; Smart Education</small>	4
List of Programs	6
Programs selected in FY 2018	12
Programs selected in FY 2019	42
Programs selected in FY 2020	64



# WISE Program

Doctoral Program for World-leading Innovative & Smart Education

At its core, what propels the WISE Program is each university leveraging its unique strengths and capabilities. Building upon their heretofore accomplishments in campus reform, these universities carry out systematic collaborations with other universities, research institutions and corporations in and outside Japan. By establishing integrated master's-doctoral programs, which over a 5-year period endow their students with a melding of top world-class educational and research prowess, these universities cultivate the kind of outstanding PhD professional who can pilot forward various sectors of society. Concurrently, the program propels the establishment of excellent academic hubs capable of sustainably advancing human resource development and exchange and of generating new joint research initiatives.

## The WISE Program's Purpose and Backdrop

### Purpose

Spearheading the generation and use of new knowledge, the WISE Program works to create the values that will bolster the next generation. Concomitantly, the program fosters the kind of high-level knowledge professionals who can enrich society with new genres of innovation while taking on the challenge of solving difficult societal issues.

### Backdrop

On one hand, Japan has increased the number of master's and PhD graduates via a quantitative expansion of its university graduate schools and has moved forward in improving the research environment of its universities and in increasing the number of research fields in which the country is globally competitive. On the other hand, Japan's international presence is wavering amidst the country's declining economic growth. Recent years have seen a situation that can be called "PhD flight," in which excellent young Japanese students are not going on to take doctoral courses. This foretells a future decline in the nation's intellectual creative capacity, which will weaken Japan's international competitiveness including its scientific and technological innovative prowess.

To sustain and grow the affluence currently enjoyed in Japan, the government is expected to take the lead in creating the new key industries of the future while staying abreast of the quickly advancing global industrial structure propelled by rapid changes in the world economies and societies. To that end, university graduate schools in Japan are expected to be a wellspring of the new knowledge and technologies need to create new key industries while being an incubator of talented people attuned with the social values attending these innovations.

### Transition

In and after 2015, the government's Council on Investments for the Future and its Central Council for Education proposed the establishment of a top-notch graduate program that could provide cutting-edge education via universities collaborating with corporations, overseas institutions, and other entities in fields in which Japan excels, after which the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Japan Society for the Promotion of Science (JSPS) began to consider a concrete system design for that graduate program.

Then, in FY 2018, the "Doctoral Program for World-leading Innovative and Smart Education" (WISE Program) was launched. It is positioned as a component within the government's innovation strategy.

### Program Outline

Through the WISE Program, national, public and private universities with established graduate schools take the lead in generating and utilizing new knowledge while creating values that will drive forward the next generation. To foster high-level knowledge professionals, the program establishes a clearly defined profile of the kind of persons to be fostered and works to build and develop a degree program for them—one that maintains a consistent level of high quality across its master's and doctoral curricula.

In endeavoring to reform Japan's leading graduate schools, the WISE Program expects each university to create programs that amplify their own unique institutional character and strengths and to make program proposals that give expression to their own free ideas.

— Targets of support: National, public and private universities with established doctoral programs

— Period of program support: 7 years (At the 4-year mark, an overall program assessment is conducted in addition to an evaluation of each individual doctoral program. On and after the eighth year, a program extension is

considered based on these evaluation results.)

— Amount of support: Up to ¥423 million

— Domains for proposal calls: For the purpose of fostering excellent PhD professionals, the following four recruitment domains are established.

(1) Research fields in which Japan has an international position of predominance or particular excellence

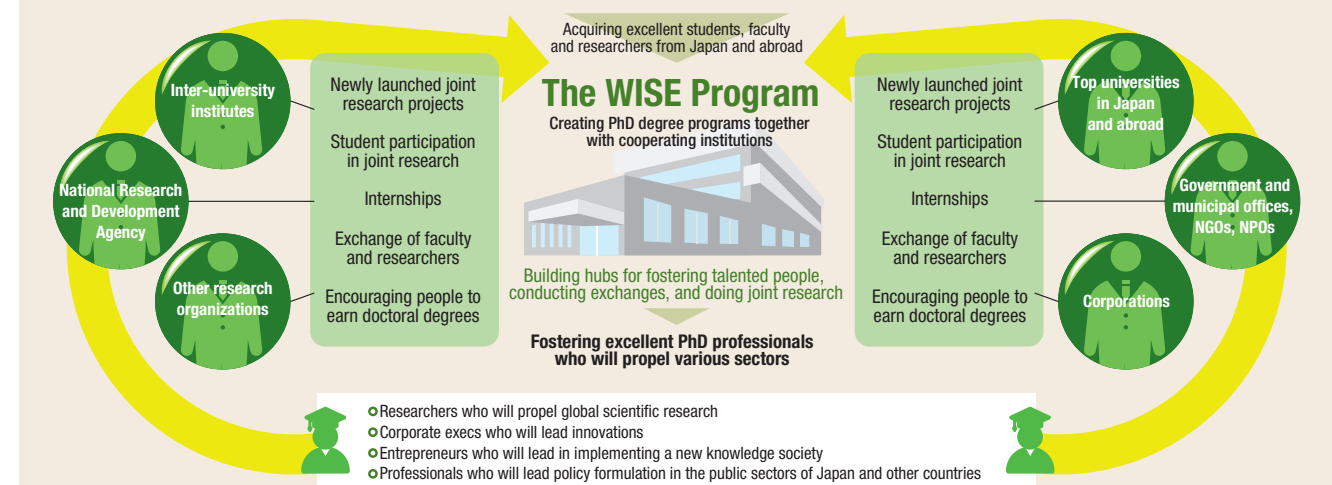
(2) Domains that fuse the sciences and humanities, that are interdisciplinary, or that are new and can create diverse values and systems within society

(3) Domains that are at the core of the industrial structure and that create new industries which contribute to economic development

(4) Domains in which Japan is expected to make contributions from a perspective of preserving academic diversity in the world

— Follow-up: Program officers (POs) are staffed within the WISE Program. They regularly examine and ascertain the state of progress of the selected programs and provide them with consultation and advice.

## Image of the Entire Program



## Q&A

### Q How can I enter the WISE Program?

**A** To enter the program, you will need to take a selection exam and carry out the entrance procedures. For details, please inquire directly to your preferred WISE program in the university. Website links and contact information are contained in the "List of Programs." For information on coming to Japan to study, please use the following links:  
Study in Japan Comprehensive Guide: <http://www.studyinJapan.go.jp/en/index.html>  
JASSO: <https://www.jasso.go.jp/en/index.html>

### Q If I belong to a university that has become a WISE cooperating institution, may I join the program?

**A** You cannot join the program just because you belong to a WISE cooperating institution. For details, please inquire directly to your preferred WISE program in the university.

### Q What is studying like WISE doctoral programs?

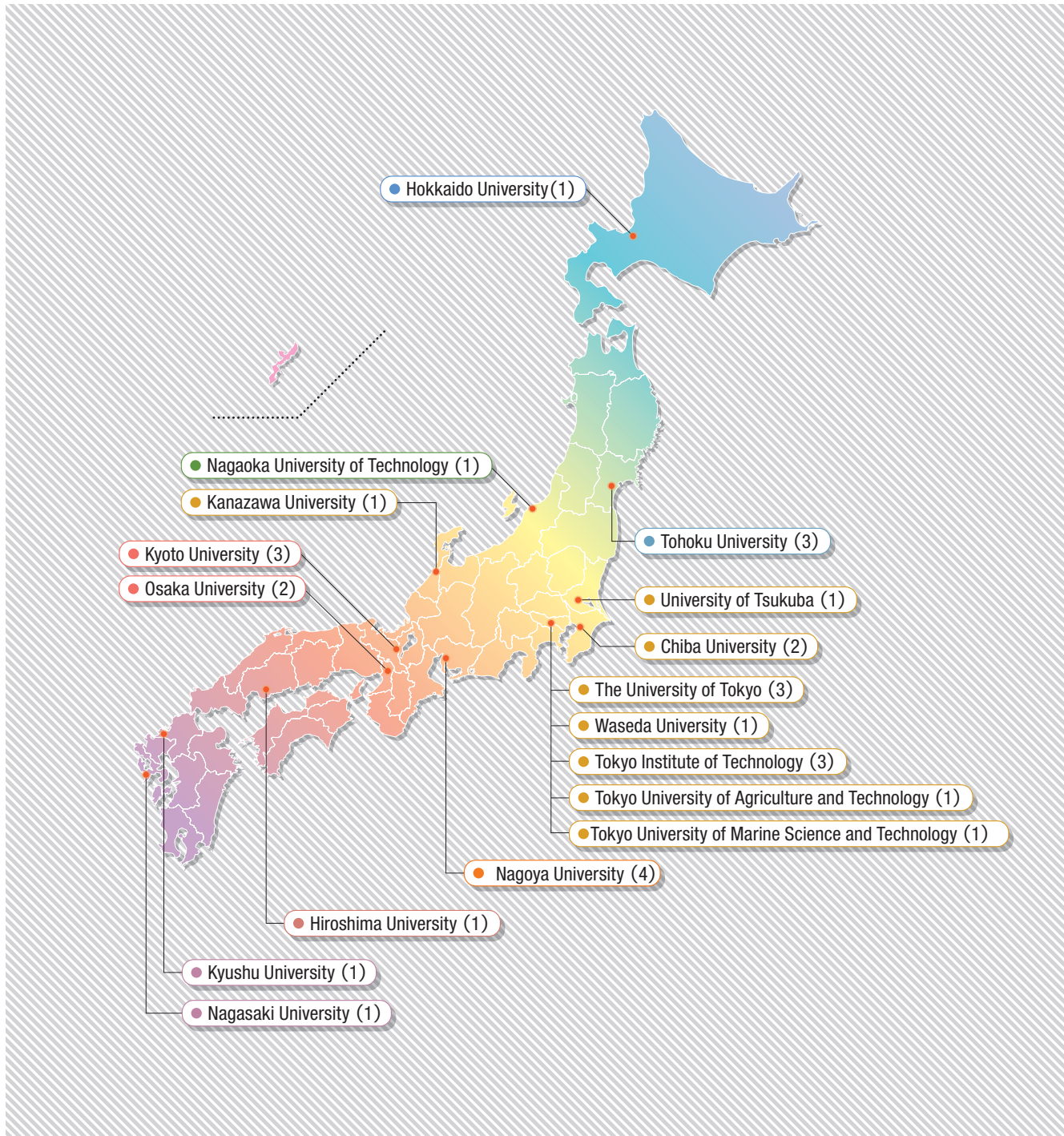
**A** To enter a WISE program, you will need to have earned a bachelor's degree. In the program, you will study for a period of five years via an integrated master's and doctoral course curricula. As to course completion, a qualification exam is carried out based on the program's own standards.

### Q Can I receive a different degree from a WISE-affiliated graduate school? Is there a joint degree program?

**A** The WISE Program does not issue PhD degrees. They are issued by your affiliated research department. However, some universities have joint degree programs. For details, please inquire directly to your preferred WISE program in the university.



# List of Programs



Applications and Selections				
Fiscal year	Number of applications		Number of selections	
	Number of universities	Number of programs	Number of universities	Number of programs
FY 2018	38	54	13	15
FY 2019	29	44	9	11
FY 2020	27	42	4	4

List of Programs Selected in FY2018					
No.	Names of programs	Names of universities	Names of Program Coordinator	WISE cooperating institutions	Page
1801	WISE Program for One Health Frontier Graduate School of Excellence	Hokkaido University	HORIUCHI Motohiro	Obihiro University of Agriculture and Veterinary Medicine Graduate School (National Research Center for Protozoan Diseases) / Rakuno Gakuen University Graduate School / Shionogi & CO., LTD. / Fuso Pharmaceutical Industries, LTD. / World Health Organization (WHO) / Office international des Epizooties (OIE-World Organisation for Animal Health) / Japan International Cooperation Agency (JICA)	12
1802	Advanced Graduate Program for Future Medicine and Health Care	Tohoku University	NAKAYAMA Keiko	Miyagi Prefectural Government / TOME CITIZEN HOSPITAL / South Miyagi Medical Center / Katta General Hospital / National Institutes of Health (USA) / National University of Singapore / University of Sydney / Tropical medicine, Philippines / Peking University / Norwegian University of Science and Technology / ONO PHARMACEUTICAL CO.,LTD / Kyowa Kirin Co., Ltd / Biogen Japan Ltd / GC Corporation / J. MORITA CORP. / Tokuyama Dental Corporation / Canon Medical Systems Corporation / Philips Japan, Ltd. / SHIMADZU Corporation / OMRON HEALTHCARE Co., Ltd. / NTT DOCOMO, INC. / Yakult Honsha Co.,Ltd. / Kagome Co., Ltd. / Care Service Co., Ltd. / TOPCON CORPORATION / Kajima Corporation Technical Research Institute / FRACTA, INC.	14
1803	WISE Program for AI Electronics	Tohoku University	KANEKO Toshiro	NEC Corporation / TOSHIBA CORPORATION / CANON MEDICAL SYSTEMS CORPORATION / Hitachi Solutions East Japan, Ltd. / Keihin Corporation / E&M Corporation / AISIN SOFTWARE Co., Ltd. / KDDI Research, Inc. / Mitsubishi Electric Corporation / SHOWA DENKO K.K. / ALPS ALPINE CO., LTD / TDK Corporation / KPIT Technologies Ltd..	16
1804	Ph.D. Program in Humanics	University of Tsukuba	YANAGISAWA Masashi	University of California, Irvine / University of Bordeaux / National Taiwan University / University of Edinburgh / Materials Science / Advanced Industrial Science and Technology / Toyota Motor / Hitachi / Shimadzu / CYBERDYNE / Astellas Pharma	18
1805	World-leading Innovative Graduate Study Program for Life Science and Technology	The University of Tokyo	KIKKAWA Masahide	Astellas Pharma Inc. / Olympus Corporation / CANON MEDICAL SYSTEMS CORPORATION / SHIONOGI & CO., LTD. / Sysmex Corporation / Janssen Pharmaceutical K.K. / DAIICHI SANKYO COMPANY, LIMITED / Takeda Pharmaceutical Company Limited / Utokyo Innovation Platform Co., Ltd.	20
1806	Excellent Leader Development for Super Smart Society by New Industry Creation and Diversity	Tokyo University of Agriculture and Technology	MIYAURA Chisato	KUBOTA Corporation / AEON AGRI CREATE CO.,LTD / SHIMADZU CORPORATION / Japan Automobile Research Institute / Japan Agricultural Corporations Association / Greate Tokyo Initiative / Leave a Nest Co., Ltd. / Recruit Career Co., Ltd. / Jissen Women's University / Cornell University / University of California, Davis / University of Oxford / The Leibniz Centre for Agricultural Landscape Research (ZALF) / University of Bonn / Vietnam National University of Forestry / Gadjah Mada University / The University of North Carolina at Chapel Hill	22
1807	Creating sustainable societies through [Material×Information] multi-talented human resource development	Tokyo Institute of Technology	YAMAGUCHI Takeo	NIMS / AIST / Leiden University / McGill University / Max Planck Institute / Imperial College London / Cornell University / Sorbonne University / Tsinghua University / TOYOTA MOTOR CORPORATION / Nissan Motor Co., Ltd. / Mazda Motor Corporation / Toshiba Corporation / JFE Steel Corporation / JX Nippon Mining & Metals Corporation / ASAHI KASEI CORPORATION / Mitsubishi Chemical Corporation / SUMITOMO CHEMICAL Co., Ltd. / TOSOH CORPORATION / MITSUBISHI GAS CHEMICAL COMPANY, INC. / Sumitomo Electric Industries, Ltd. / SHOWA DENKO K.K. / TDK Corporation / LG Japan Lab Inc. / Panasonic Corporation / FUJIFILM Corporation / AGC Inc. / ZEON CORPORATION / Showa Denko Materials Co., Ltd. / KANEKA CORPORATION / Toyo Seikan Group Holdings, Ltd. / NAGASE & CO., LTD. / Hamamatsu Photonics K.K. / ENEOS Corporation	24
1808	Global Pro-Active Root Technology Program	Nagaoka University of Technology	OHISHI Kiyoshi	Aalto University / Mondragon University / University of York / Bristol University / University of Sheffield / University of Leeds / University of Deusto / Indian Institute of Technology Madras / University of Antwerp / University of Bordeaux / TH Köln-Technology,Arts,Sciences / Friedrich-Alexander Universität Erlangen-Nürnberg, FAU / Universität Bielefeld / Sankyo Tateyama,Inc / Sumitomo Electric Industries, Ltd / Nagaoka Power Electronics Co., Ltd / Unipulse Corporation / Fuji Electric Co., Ltd / SANKI ENGINEERING CO., LTD / Japan Business Create Co.,Ltd / IBSYSTEM Co., Ltd / Japan Fine Ceramics Association / Niigata Industrial Creation Organization / The Institute of Applied Energy / National Institute of Advanced Industrial Science and Technology / Niigata City / Nagaoka City	26



List of Programs

List of Programs

No.	Names of programs	Names of universities	Names of Program Coordinator	WISE cooperating institutions	Page
1809	Graduate Program of Transformative Chem-Bio Research	Nagoya University	YAMAGUCHI Shigehiro	Institute for Molecular Science, National Institutes of Natural Science / National Institute for Basic Biology, National Institutes of Natural Science / the Graduate University for Advanced Studies / Institute of Physical and Chemical Research / Kaneka Co. / Konica Minolta, Inc. / Japan Tobacco Inc., Plant Innovation Center / ITbM-GTR consortium	28
1810	DII (Deployer-Innovator-Investigator) Collaborative Graduate Program for Accelerating Innovation in Future Electronics	Nagoya University	AMANO Hiroshi	Innovation for High Performance Micro-electronics / Interuniversity Microelectronics Center / Office ATOQS / Japan Aerospace Exploration Agency / National Institute for Materials Science / National Institute of Advanced Industrial Science and Technology / KAPION Inc. / SCIOCS COMPANY LIMITED / DENSO CORPORATION / TOSHIBA CORPORATION / TOYOTA CENTRAL R&D LABS., INC. / Hitachi, Ltd. Central Research Laboratory / FUJITSU LABORATORIES LTD. / Miraiproject Corporation / Sumitomo Electric Industries, Ltd. / National University of Singapore / TAIYO NIPPON SANSO CORPORATION / Tokyo Electron Ltd. / TOYODA GOSEI CO., LTD. / TOYOTA MOTOR CORPORATION / Nissan Motor Co., Ltd. / Furukawa Electric Co., Ltd. / Mitsubishi Electric Corporation / Nanjing University / Japan Venture Capital Association / NC State University / Forschungszentrum Jülich	30
1811	Innovation of Advanced Photonic and Electronic Devices	Kyoto University	KIMOTO Tsunenobu	University of Cambridge / Humboldt University of Berlin / ETH Zurich / Dresden University of Technology / Nanjing University / Sungkyunkwan University / National Institute for Materials Science / National Institutes for Quantum and Radiological Science and Technology / Central Research Institute of Electric Power Industry / National Institute of Advanced Industrial Science and Technology / Nidec Corporation / Mitsubishi Electric Corporation / Shimadzu Corporation / Sumitomo Electric Industries, Ltd.	32
1812	Transdisciplinary Program for Biomedical Entrepreneurship and Innovation	Osaka University	KANAI Yoshikatsu	Pfizer Inc. / Novartis Pharma K.K. / Johnson & Johnson Innovation / IQVIA Solutions Japan K.K. / Bayer Yakuhin, Ltd / Eli Lilly Japan K.K. / Chugai Pharmaceutical Co., Ltd. / Otsuka Pharmaceutical Co., Ltd. / Shionogi & Co., Ltd. / Daiichi Sankyo Company, Limited / Mitsubishi Tanabe Pharma Corporation / Cytiva / SYSMEX CORPORATION / Takara Bio Inc. / Quantum Operation, Inc. / Osaka Prefectural Government, Department of Commerce, Industry and Labor / Pharmaceuticals and Medical Devices Agency / National Institute of Health Sciences / National Institutes of Biomedical Innovation, Health and Nutrition / Japan Patent Office	34
1813	The Frontier Development Program for Genome Editing	Hiroshima University	YAMAMOTO Takashi	Center for iPS Cell Research and Application, Kyoto University / Graduate School of Technology, Industrial and Social Sciences, Tokushima University / Department of Molecular and Cellular Biology, Harvard University / Technical Research Center, Mazda Motor Corporation	36
1814	Global Health Elite Programme for Building a Healthier World	Nagasaki University	ARIYOSHI Koya	London School of Hygiene and Tropical Medicine / Hokkaido University Research Center for Zoonosis Control / National Research Center for Protozoan Diseases, Obihiro University of Agriculture and Veterinary Medicine / School of International Health, Graduate School of Medicine, The University of Tokyo / National Center for Global Health and Medicine / JICA / Sysmex Corporation	38
1815	Graduate Program for Power Energy Professionals	Waseda University	HAYASHI Yasuhiro	Hokkaido University / Tohoku University / University of Fukui / University of Yamanashi / Tokyo Metropolitan University / Yokohama National University / Nagoya University / Osaka University / Hiroshima University / Tokushima University / Kyushu University / University of the Ryukyus / The University of Tennessee / University of Chicago / University of Washington / Tsinghua University / Chulalongkorn University / Technical University of Munich / ENEOS Corporation / Tokyo Gas Co., Ltd. / Central Research Institute of Electric Power Industry / National Institute of Advanced Industrial Science and Technology / Power Academy	40

List of Programs Selected in FY2019

No.	Names of programs	Names of universities	Names of Program Coordinator	WISE cooperating institutions	Page
1901	WISE program for Sustainability in the Dynamic Earth	Tohoku University	NAKAMURA Michihiko	Stanford University / Harvard University / University of Washington / University College of London / University of Indonesia / Sorbonne University / University of Hawaii at Manoa / JICA / Tokio Marine & Nichido Fire Insurance Co., Ltd / Nippon Koei Co., Ltd / Penta-Ocean Construction Co., Ltd / NTT DATA, Inc	42
1902	Applied Humanities Program for Cultivating Global Leaders	Chiba University	YONEMURA Chiyo	Okayama University / Nagasaki University / Kumamoto University / The Graduate University for Advanced Studies / Zhejiang Gongshang University / Institute for Oriental and Classical Studies, National Research University "Higher School of Economics"(Russia) / National Museum of Japanese History / Aeon Environmental Foundation / AEON CO.,LTD / JTB Tourism Research & Consulting Co. / Chiba Bank	44
1903	Innovative Medicine CHIBA Doctoral WISE Program	Chiba University	NAKAYAMA Toshinori	University of California San Diego / University of Southern California / Charité – Universitätsmedizin / University of Toronto / Institute of Physical and Chemical Research / National Institute of Advanced Industrial Science and Technology / National Institute of Radiological Sciences / Takeda Pharmaceutical Co., Ltd / Microsoft Japan Co., Ltd / Sysmex Corporation / Eli Lilly Japan K.K. / Olympus Corporation / DNA Chip Research Inc. / H.U. Group Research Institute G.K. / Genefrontier	46
1904	Forefront Physics and Mathematics Program to Drive Transformation	The University of Tokyo	MURAYAMA Hitoshi	Nippon Steel Corp. / NTT Corp. / Macromill, Inc. / École Polytechnique / California Institute of Technology / UC Berkeley / Korea Institute for Advanced Study / National Taiwan University / ETH Zurich / Tsinghua University / Seoul National University / Harvard University / Princeton University / Peking University / ENS de Lyon / HSE University / CERN / Mathematical Sciences Research Institute / IHES / Paul Scherrer Institute	48
1905	World-leading Innovative Graduate Study: Advanced Business Law Program	The University of Tokyo	TAMURA Yoshiyuki	Harvard Law School / Peking University / Seoul National University / National Taiwan University / Hitachi, Ltd. / FUJIFILM Corp. / SoftBank Corp. / Yahoo Japan Corp. / Nippon Life Insurance Co. / Intellectual Property Department, Takeda Pharmaceutical Co., Ltd., / Institute for Monetary and Economic Studies, Bank of Japan	50
1906	Engineering Education Program for Super Smart Society based on Advanced Quantum Science	Tokyo Institute of Technology	SAKAGUCHI Kei	National Agriculture and Food Research Organization / National Institutes for Quantum and Radiological Science and Technology / RIKEN Center for Advanced Intelligence Project / Japan Agency for Marine-Earth Science and Technology / NICT Wireless Networks Research Center / AIST Information Technology and Human Factors / JTEKT Corporation / NEC Corporation / NSK Ltd. / Yaskawa Electric Corporation / Azbil Corporation / Hitachi Industrial Equipment Systems Co., Ltd. / Yokogawa Electric Corporation / Koden Electronics Co., Ltd. / KDDI Corporation / SoftBank Corp. / Huawei Japan / SHO-BOND Corporation / DENSO Corporation / Kawasaki City / Ota City / Google LLC / SOLiD Gear Inc. / CEA Leti / Georgia Institute of Technology / National Taiwan University of Science and Technology / University of Twente / University of Rome Tor Vergata / The Ohio State University / Thammasat University Thailand / Univ. Glasgow / Technical University of Munich / Fraunhofer Heinrich-Hertz-Institute / University of Sydney / Institute for Infocomm Research / Cornell University / Yonsei University / Asurion LLC / RWTH Aachen University	52

List of Programs



List of Programs

List of Programs

No.	Names of programs	Names of universities	Names of Program Coordinator	WISE cooperating institutions	Page
1907	Development of WISE (World-leading Innovative & Smart Education) Program to foster AI (Artificial Intelligence) Professionals for Marine Industries	Tokyo University of Marine Science and Technology	SHOJI Ruri	National Institute of Maritime, Port and Aviation Technology / Japan Agency for Marine-Earth Science and Technology / Japan Fisheries Research and Education Agency / Technical University of Denmark / IDEA Consultants,inc. / BEMAC Corporation / NPO Marine Technologist	54
1908	WISE Program for Nano-Precision Medicine, Science and Technology	Kanazawa University	HANAYAMA Rikinari	Imperial College London / University of British Columbia / Nikon Solutions Co., Ltd. / Pfizer R&D Japan G.K. / Ricoh Co., Ltd. / FUJIFILM Wako Pure Chemical Corporation / Olympus Corporation / Daicel Corporation / Hamamatsu Photonics K.K.	56
1909	Convolution of Informatics and Biomedical Sciences On Glocal Alliances	Nagoya University	KATSUNO Masahisa	Gifu University / National Institute for Physiological Sciences / Aichi Cancer Center / National Center for Geriatrics and Gerontology / Aichi Developmental Disability Center Institute for Developmental Research / Institute of Statistical Mathematics / Shimadzu Corporation / Novartis Pharma / NVIDIA Corporation / Eisai Co., Ltd. / Olympus Corporation / RaQualia Pharma / Sumitomo Dainippon Pharma Co., Ltd. / Mitsubishi Tanabe Pharma Corporation / Takeda Pharmaceutical Co., Ltd. / University of Adelaide / Lund University / Albert-Ludwigs-Universität Freiburg / University of Nottingham / University of Hong Kong / University of Bologna / University of Alberta / LMU Munchen / Korea University / Erasmus Medical Centre Rotterdam / Monash University / CBmed / Hitachi Co., Ltd.	58
1910	Graduate Program for Medical Innovation	Kyoto University	WATANABE Dai	University of California, San Diego / University of Toronto / National Taiwan University / The FIRC Institute of Molecular Oncology / National Institutes of Health / Max-Planck Institute / NeuroSpin / RIKEN / Institute of Biomedical Research and Innovation, Foundation for Biomedical Research and Innovation at Kobe / Tazuke Kofukai Medical Research Institute Kitano Hospital / Bioorganic Research Institute, Suntory Foundation for Life Sciences / NTT DATA Corporation / Deloitte Tohmatsu Consulting LLC. / mixi, Inc. / KBBM, Inc. / MICIN, Inc. / Eisai Co., Ltd. / Daiichi Sankyo Co., Ltd. / Chugai Pharmaceutical Co., Ltd. / Asahi Kasei Pharma Corporation / Taisho Pharmaceutical Co., Ltd. / Sumitomo Dainippon Pharma Co., Ltd. / ONO PHARMACEUTICAL CO., LTD. / Mitsubishi Tanabe Pharma Corporation / KYORIN Pharmaceutical Co.,Ltd. / Chordia Therapeutics, Inc.	60
1911	Multidisciplinary PhD Program for Pioneering Quantum Beam Application	Osaka University	NAKANO Takashi	High Energy Accelerator Research Organization Institute of Materials Structure Science / High Energy Accelerator Research Organization Institute of Particles and Nuclear Studies / National Institutes for Quantum and Radiological Science and Technology / Cyclotron and Radioisotope Center, Tohoku University / Research Center for Electron Photon Science, Tohoku University / J-PARC / Kyoto Institute of Technology / Isotope Science Center, The University of Tokyo / Kalvi Institute for the Physics and Mathematics of the Universe, The University of Tokyo / RIKEN / TRIUMF / The University of Queensland / Heidelberg University Hospital / National Institute of Health Science / ATOX / Telix Pharmaceuticals Japan / SOCIONEXT / Hitachi, Ltd. / Nihon Medi-Physics Co, Ltd. / Sumitomo Heavy Industries, Ltd. / FUJIFILM Toyama Chemicals Co., Ltd. / Kyoto Medical Technology / EPS Corporation / Metal Technology Co. Ltd. / Toshiba Electronic Devices & Storage Corporation / Yamato Scientific Co., Ltd. / Japan Radioisotope Association / Anderson Mōri & Tomotsune	62

List of Programs Selected in FY2020					
No.	Names of programs	Names of universities	Names of Program Coordinator	WISE cooperating institutions	Page
2001	Multi-Scope・Energy WISE Professionals	Tokyo Institute of Technology	IHARA Manabu	Hitotsubashi University / AIST / JICA / Kawasaki City / Kawasaki Heavy Industries, Ltd. / Chiyoda Corporation / Toshiba Corporation・Toshiba Energy Systems & Solutions Corporation / Showa Denko K.K. / BROTHER INDUSTRIES, LTD. / Tokyo Electric Power Company Holdings, Inc. / Iwatani Corporation / ENEOS / JFE Engineering Corporation / IHI Corporation / SEKISUI CHEMICAL CO., LTD. / Panasonic Corporation / Sony Corporation / NTT FACILITIES, INC. / NTTDATA CUSTOMER SERVICE Corporation / NTT DATA BUSINESS SYSTEMS CORPORATION / Deloitte Tohmatsu Consulting LLC / Azbil Corporation / SUMITOMO CORPORATION / Mitsubishi Corporation / Tokuyama Corporation / KAJIMA CORPORATION / Mizuho Information & Research Institute, Inc. / Mitsubishi Electric Corporation / Massachusetts Institute of Technology / Princeton University / Georgia Institute of Technology / University of California, Santa Barbara / University of Cambridge Judge Business School / Imperial College London / INSA Lyon / RWTH Aachen University / University of Stuttgart / Uppsala University / Swiss Federal Institute of Technology in Lausanne / University of New South Wales / Nanyang Technological University / Tsinghua University / Korea Advanced Institute of Science and Technology / Thailand National Science and Technology Development Agency / CEA-Liten	64
2002	Graduate Program for Lifestyle Revolution based on Transdisciplinary Mobility Innovation	Nagoya University	KAWAGUCHI Nobuo	Gifu University / University of Michigan / Virginia Institute of Technology / The Ohio State University / Chalmers Institute of Technology / National University of Singapore / Chulalongkorn University / Hanoi University of Science and Technology / WHILL Inc. / MTG Ventures / KDDI Research, Inc. / 01Booster, Inc. / Sohgo Security Services Co., Ltd. / Sompō Japan Insurance Inc. / Central Japan International Airport Co., Ltd. / Tier IV, Inc. / Denso Corporation / Toyota Motor Corporation / Toyota Technical Development Corporation / Sumitomo Mitsui Banking Corporation / Yahoo Japan Corporation / Yamaha Motor Co., Ltd.	66
2003	Distinguished Doctoral Program of Platform Studies for Activating Society	Kyoto University	HARADA Hiroshi	Jichi Medical University / The Institute of Statistical Mathematics / Toyota Motor Corporation / NTT Communication Science Laboratories / Meteorological Engineering Center / Agricultural and Rural Development Information Center / The Research Institute for Humanity and Nature / Mitsubishi UFJ Research and Consulting / RIKEN / Yahoo! JAPAN Research / System Platform Research Laboratories / Advanced Telecommunications Research Institute International / Nippon Telegraph and Telephone West Corporation / KDDI Research, Inc. / KADOKAWA ASCII Research Laboratories, Inc. / Ruby Association / Tripadvisor LLC / Anritsu Corporation / Institute for Health Economics and Policy / National Institute of Information and Communications Technology / National Fisheries University / Japan Agency for Marine-Earth Science and Technology / The National Agriculture and Food Research Organization / wenovator LLC / Mitsubishi Electric Corporation Information Technology R&D Center / Sony R&D Center / University of Chicago / University of Illinois / Vienna University of Technology / University of Potsdam / Delft University of Technology / Technical University of Berlin / Aalborg University / Huazhong Agricultural University / National Chung Hsing University / National Taiwan University / University of Florida / Technical University of Munich / Sorbonne University / The French National Centre for Scientific Research / Institute for Infocomm Research, Agency for Science, Technology and Research (A*STAR)	68
2004	Graduate Program of Mathematics for Innovation	Kyushu University	SAEKI Osamu	The Institute of Statistical Mathematics / RIKEN (Center for Advanced Intelligence Project / Interdisciplinary Theoretical and Mathematical Sciences Program) / FUJITSU LABORATORIES LTD. / Beautiful Mind / Mazda Motor Corporation / Sumitomo Electric Industries, Ltd. / The National Institute of Advanced Industrial Science and Technology / Itoshima City (A planning department, Regional Promotion Division) / NIPPON TELEGRAPH AND TELEPHONE CORPORATION / Department of Mathematics, University of Illinois at Urbana-Champaign / Department of Mathematics, University of California, San Diego / Department of Mathematics and Statistics, La Trobe University / Department of Mathematics, National University of Singapore / Department of Mathematics, National Taiwan Normal University / Mathematical Institute, Leiden University / Zuse Institute Berlin	70

List of Programs



## WISE Program for One Health Frontier Graduate School of Excellence

[Program Coordinator] HORIUCHI Motohiro (Dean · Professor, Faculty of Veterinary Medicine, Hokkaido University)

### Message from the President



HOUKIN Kiyohiro  
President, Hokkaido University

Strive to nurture professionals with knowledge and skills to address challenges of One Health approach with an objective view of human and animal health and ecological soundness on earth

The WISE Program for One Health Frontier Graduate School of Excellence offers highly effective educational courses through active cooperation with other universities, business and international organizations. The WISE Program welcomed its second class last academic year, and while being faced with various hardships due to the new infectious disease, we have once again recognized the need for One Health and the importance of "One Health approach" through transdisciplinary, multisectoral and interinstitutional collaboration. In this program, we strive to accumulate knowledge from all sources and nurture highly qualified professionals who offer solutions to challenges for One Health and contribute globally. We aspire to be a model of good practice at Hokkaido University and a pioneer of innovation in graduate education.

### Aim for One Health

Zoonosis and emerging and re-emerging infectious diseases, such as influenza, Ebola hemorrhagic fever, tuberculosis, and antimicrobial-resistant bacterial infections appear one after another and threaten public health. In the past 30 years, more than 30 new pathogens have emerged and a million people die each year from mosquito- and tick-borne infections. Transboundary animal infectious diseases, such as foot-and-mouth disease and classical swine fever, cause severe economic damage once they enter.

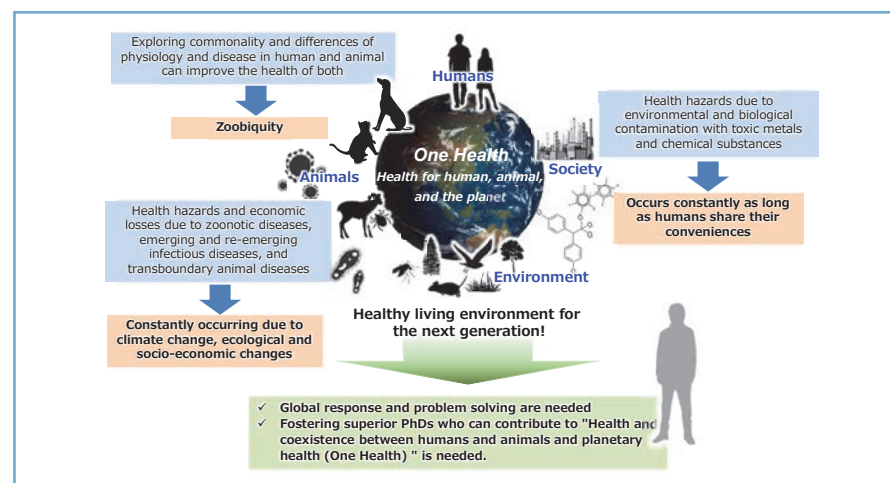
Hazards chemicals discharged into environment that include poisonous metals, pollutants such as dioxin, and persistent organic pollutants, are known to have caused global-scale contamination and threaten the health of humans and animals. Environmental pollution, rather than disease, is the leading

cause of death in developing countries, with one-sixth people estimated to die.

There are many diseases such as cancer, urological and neurological disorders, which

are commonly observed in humans and animals, other than infectious diseases.

Based on the concept that researches on physiological difference and similarity of



The human resources that we aim to foster is superior PhDs who will be able to contribute to the achievement of "One Health" to pass soundness and integrity of living environments to the next generations.

### DATA

[Number of scheduled student recruitments] 19-20  
[Number of anticipated program graduates] 19-20  
[Number of people engaged in the program] 51  
[Students' affiliated schools and departments]  
2 graduate schools, 2 departments  
<Graduate School of Infectious Diseases> Infectious Diseases  
<Graduate School of Veterinary Medicine> Veterinary Medicine  
[WISE Cooperating Institutions]  
2 universities, 2 companies, 3 international organizations  
Obihiro University of Agriculture and Veterinary

Medicine Graduate School (National Research Center for Protozoan Diseases) / Rakuno Gakuen University Graduate School / Shionogi & CO., LTD. / Fuso Pharmaceutical Industries, LTD. / World Health Organization (WHO) / Office international des Epizooties (OIE-World Organisation for Animal Health) / Japan International Cooperation Agency (JICA)

### [Fields of diplomas]

Ph.D. (Infectious Diseases), Ph.D. (Veterinary Medicine)  
Name of the program to be noted: One Health Frontier Graduate School of Excellence



HOKKAIDO UNIVERSITY  
WISE Program for  
**One Health Frontier**  
Graduate School of Excellence

[Office and section in charge] Educational Planning and Graduate Schools Unit, Academic Affairs Department, Academic Affairs Planning Division.  
[Inquiries] 011-706-5252  
[URL] <https://onehealth.vetmed.hokudai.ac.jp/en/>

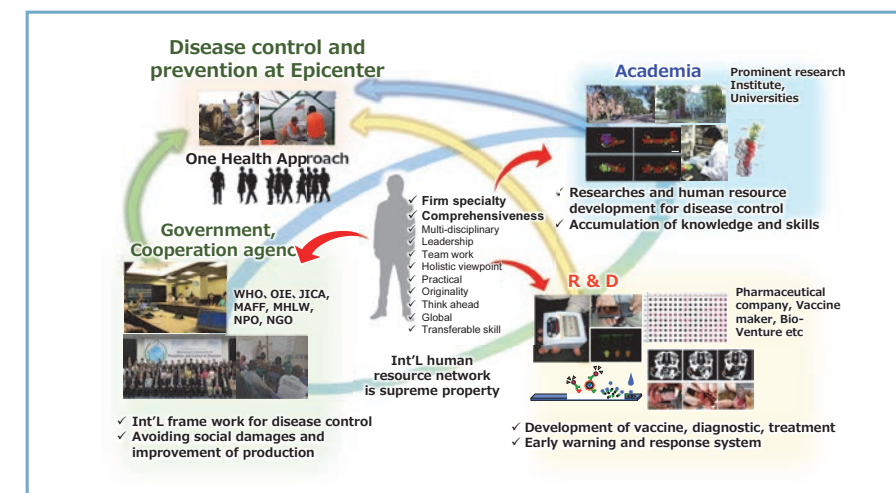
diseases greatly contributes to both human and animal health, "Zoobiquity", which proposes the reinforcement of collaboration between medicine and veterinary medicine, is recently drawing international attention.

Health and socio-economic problems by infectious diseases and hazardous chemicals are continuously occurring. Contemporary humans, who have been receiving lives of convenience, are obliged to pass soundness and integrity of living environments on to the next generations. Zoobiquity also aims to further improve the health of people and animals.

"Health and coexistence between humans and animals and planetary health" is the critical concept of this program "One Health" with the aim of fostering experts who can contribute to its achievement.

### The Human Resources Network fostered by PhDs is a supreme property of world society.

To ensure "One Health", multi-disciplinary collaboration such as medicine, veterinary medicine, and environmental science, and trans-sectoral cooperation with human and animal health sectors, education, research and development institutions, and risk management authorities, in other words, "One Health Approach", is essential. In this program, we promote advanced researches using excellent research and human resources and outstanding experiences on



The abilities of PhDs fostered by this program, a wide range of fields in which they play active roles, and social contributions.

infectious diseases, chemical hazard, and animal and life sciences for contributing One Health. Additionally, PhDs will gain a variety of experiences of international collaborative research with reliable counterparts, cooperative activity with international organization such as WHO, OIE, and JICA, and/or development research in collaboration with public institution and company. This program aims at fostering superior PhD who will be able to tackle and resolve problems related to One Health, with a definite idea for disease control and prevention, a holistic viewpoint, a well-balanced international sense, and a comprehensive competence for decision-making and problem-solving. They show their great expertise in the field of administrative and international cooperation to help to prevent

disease spread. In the R&D fields, they contribute to innovations essential for disease prevention, such as the development of new vaccines, diagnostic and treatment methods, and early detection systems of anomalies. They also play a key role in fostering human resources and the accumulation of scientific knowledge in universities and institutes, through education to help prevent and overcome diseases as well as basic and applied research to bring about novel innovations. The network fostered by PhDs who share the philosophy of One Health is a supreme property in a global society. With them, this program, and related organizations with the shared aim of One Health, we hope to accelerate the creation of One Health, a social benefit that should be shared by human society.

### Message from WISE Cooperating Institution



MINATO Yuki  
World Health Organization (WHO) · Department of Food Safety and Zoonoses (FOS) · Project Officer

### One Health issues need to be tackled on a global scale

Health issues related to One Health, such as antimicrobial-resistant bacteria and zoonosis, are very diverse and need to be addressed on a global scale. From both macro and micro viewpoints, the expertise to discuss. In order to solve problems, the desire to encourage collaboration transcends the barriers between different fields. And in collective decision making, communication skills. I realized that students are having a strong base of the fundamentals for these attributes through the lecture I held in the summer of 2019.

### Student's Voice



WANG Zu-Jyun  
Graduate School of Infectious Diseases DC1

### Aiming to be an expert who can contribute to the international society

When I worked as a poultry veterinarian in my home country of Taiwan, I was involved in the training of my current lab. The experience of studying in Japan was invaluable and made me feel to acquire my knowledge and skills in the Ph.D. course, so I applied myself to the program. My ambition is to contribute to the achievement of One Health and to solve the problems through joint research with international organizations and on-site experience in internship opportunities abroad, not just in the fields of research but also across Asia.



## Advanced Graduate Program for Future Medicine and Health Care

[Program Coordinator] NAKAYAMA Keiko (Professor, Graduate School of Medicine, Tohoku University)

### Message from the President



OHNO Hideo  
President, Tohoku University

### Fostering leaders of social progress in anticipation of the New Normal Producing leaders who will drive futuristic medical care through data / technology

The COVID-19 crisis demands a "New Normal," which our university is addressing by advancing education, research, and social synergy as we "strive for creativity and innovation" while leading social progress from a global outlook. Now, as in the past, our university implements diverse degree programs as part of a positive cycle of education, research, and social synergy aimed at developing highly specialized human resources.

For three years the Advanced Graduate Program for Future Medicine and Health Care has steadily fostered human resources to drive futuristic medical care (which promotes health, prevention, and treatment through data, technology, and social infrastructure), making this degree program central to our graduate school innovations.

### Towards the New Normal

Our goal is to provide medical care that is lead by data and technology and to contribute expeditiously to the resolution of social problems. Through this program, we are fostering motivated human resources who can contribute to this goal. The Tohoku region is becoming a super-aging society ahead of the rest of the world. We would like to create futuristic medicine and health care in this region, and to expand rapidly it to the rest of the world. In a super-aging society,

medical needs are rapidly shifting from acute diseases to chronic care, requiring lifelong prevention and treatment. With limited resources, efficient support is required for living independently with these diseases. In order for the super-elderly to live as members of a prosperous society, it will be necessary

to build organic collaborative society with the fields of psychology, sociology, and economics as well as medical and welfare services. The recent pandemic of a new type of corona virus infection has strengthened and concretized our desire for futuristic medicine, which we have been striving for. We will continue to



Students visit university hospitals, regional hospitals, and biobanks for backcasting training to see first-hand what is going on in the field, to embody social needs, and to cultivate the ability to find solutions.

### DATA

[Number of scheduled student recruitments] 15

[Number of anticipated program graduates] 15

[Number of people engaged in the program] 94

[Students' affiliated schools and departments]

9 graduate schools, 20 departments

<Graduate School of Medicine> Medical Sciences, Disability Sciences, Health Sciences, Public Health

<Graduate School of Dentistry> Dental Sciences

<Graduate School of Pharmaceutical Sciences> Molecular Pharmaceutical Science, Life and Pharmaceutical Science, Pharmacy

<Graduate School of Life Sciences> Integrative Life Sciences, Ecological Developmental Adaptability Life Sciences, Molecular

and Chemical Life Sciences

<Graduate School of Information Sciences> Applied Information Sciences, Computer and Mathematical Sciences, Human-Social Information Sciences

<Graduate School of Economics and Management> Economics and Management

<Graduate School of Arts and Letters> Japanese Studies, Global Humanities, Integrated Human Sciences

<Graduate School of Education> Educational Sciences

<Graduate School of Biomedical Engineering> Biomedical Engineering

[WISE Cooperating Institutions]

4 universities, 19 companies, 4 local public bodies

Miyagi Prefectural Government / TOME CITIZEN HOSPITAL / South Miyagi Medical Center / Katta General Hospital / National Institutes of Health (USA) / National University of Singapore / University of Sydney / Tropical medicine, Philippines / Peking University / Norwegian University of Science and Technology / ONO PHARMACEUTICAL CO., LTD / Kyowa Kirin Co., Ltd / Biogen Japan Ltd / GC Corporation / J. MORITA CORP. / Tokuyama Dental Corporation / Canon Medical Systems Corporation / Philips Japan, Ltd. / SHIMADZU Corporation / OMRON HEALTHCARE Co., Ltd. / NTT DOCOMO, INC. / Yakult Honsha Co., Ltd. / Kagome Co., Ltd. / Care Service Co., Ltd. / TOPCON CORPORATION / Kajima Corporation Technical Research Institute / FRACTA, INC.

### [Fields of diplomas]

Doctor of Philosophy (Medical Sciences) / (Disability Sciences) / (Nursing) / (Health Sciences) / (Dental Science) / (Pharmacy) / (Pharmaceutical Sciences) / (Life Sciences) / (Information Sciences) / (Economics) / (Management) / (Letters) / (Education) / (Biomedical Engineering), Doctor of Philosophy

Name of the program to be noted: Advanced Graduate Program for Future Medicine and Health Care

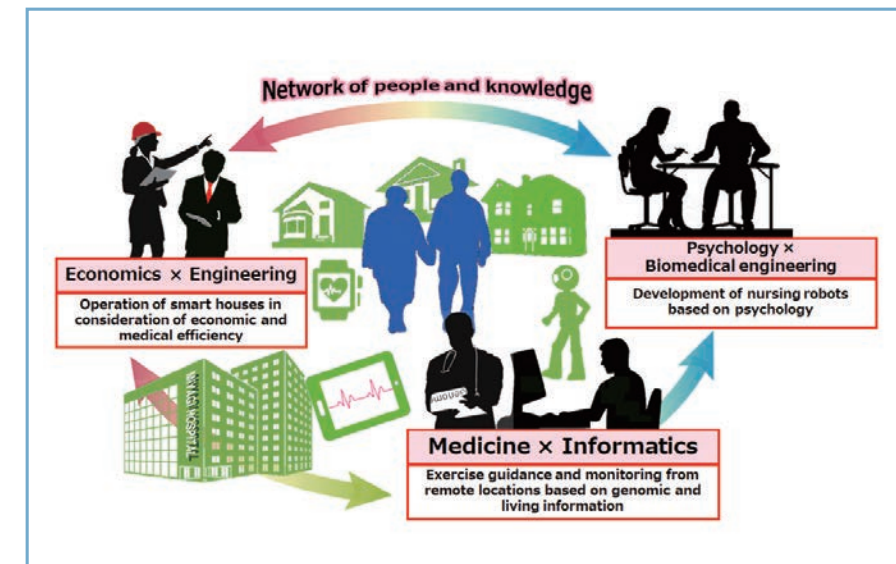
strive to build the medical care required in the new normal society.

### Students look to the future.

Our program offers a variety of on-the-job training opportunities to help students discover the challenges of today from their own perspectives and develop the ability to solve those challenges. Students who have studied in completely different fields, such as the Graduate School of Arts and Letters and the Graduate School of Education, form groups and participate in the training, resulting in the sharing of knowledge and skills across the boundaries of the humanities and sciences, and fosters the ability to interact with multiple professions on the basis of deep mutual understanding. They will perform as leaders with the ability to think and develop beyond existing frameworks and with the ability to communicate across disciplines in order to achieve the medical care required in the future.

Specifically, we want to foster students' ability to identify and solve the needs of society. For this purpose, we provide three opportunities.

Firstly, we provide opportunities where students can interact with people who are innovating in society today. We invite people who are working at the forefront of various companies to the university and ask them for one-on-one mentoring with students. The



Graduates of this program play an active role as professionals with broad knowledge and deep expertise, who are able to draw synergy among expertise, and to quickly and accurately identify and solve the needs of various fields in society.

questions and comments on the students' presentations are very stimulating. It's an experience students can't get in a ordinary college life.

Secondly, students get to visit the field. They visit university hospitals, community hospitals, and biobanks for training, so they can see with their own eyes what is going on in the field. Students are also trained to discuss with medical professionals working on the front lines of medicine and welfare and to identify the issues in the field.

Third, students are supported by a multi-

supervisory faculty system. A facilitator faculty member trained in coaching accompanies students to mentoring and training sessions, encouraging awareness and supporting activities in a challenging way.

We are convinced that students with diverse backgrounds will continue to gather together in a stimulating environment, take a bird's-eye view of society, and tackle issues more quickly and accurately, so as to contribute to building a society in which everyone can lead an independent and prosperous life.

### Message from WISE Cooperating Institution



KATO Takashi  
CEO, Fracta

### From agenda-setting to implementation: Expectation for Program for FMHC

I have extensive knowledge and experience in AI (data science and machine learning). I am entrepreneur who has been creating new value (innovation) to solve social issues as well. As the CEO of Fracta, an AI venture company, I plan to develop cross-cutting and practical classes that are appropriate for training people with the leadership skills required by this program.

### Student's Voice



SHIMOKAWA Daiki  
2nd year of Master's  
Program in Health Sciences,  
Graduate School of Medicine

### Aiming to be a expert who can create future medicine

I decided to participate in the Advanced Graduate Program for Future Medicine and Health Care to broaden my career opportunities, and contribute to my personal growth through real-world experiences. Through this program, I am constantly inspired by my fellow students from a variety of backgrounds, who have given me a multidisciplinary perspective. The opportunities that I have been given to collaborate with medical professionals, as well as corporate executives and entrepreneurs, have shaped my own career path and research.



## WISE Program for AI Electronics

[Program Coordinator] KANEKO Toshiro (Professor, Graduate School of Engineering, Tohoku University)

## Message from the President

OHNO Hideo  
President, Tohoku UniversityFostering leaders of social progress in anticipation of the New Normal  
Producing leaders with executive abilities and big-picture thinking to create ultra-smart communities

The COVID-19 crisis demands a "New Normal," which our university is addressing by advancing education, research, and social synergy as we "strive for creativity and innovation" while leading social progress. Now, as in the past, our university implements diverse degree programs as part of a positive cycle of education, research, and social synergy aimed at developing highly specialized human resources.

For three years the WISE Program for AI Electronics has provided students with the executive abilities and big-picture thinking needed to create ultra-smart communities. Incorporating interdisciplinary techniques, it fosters exceptional doctoral students capable of "continuous innovation," making this degree program central to our graduate school innovations.

## Fostering outstanding human resources to create innovations

For realizing the fourth industrial revolution and an ultra-smart society (Society 5.0), it is essential to fuse real and cyber space in every aspect of society to create new value and bring it to society, our life and industries.

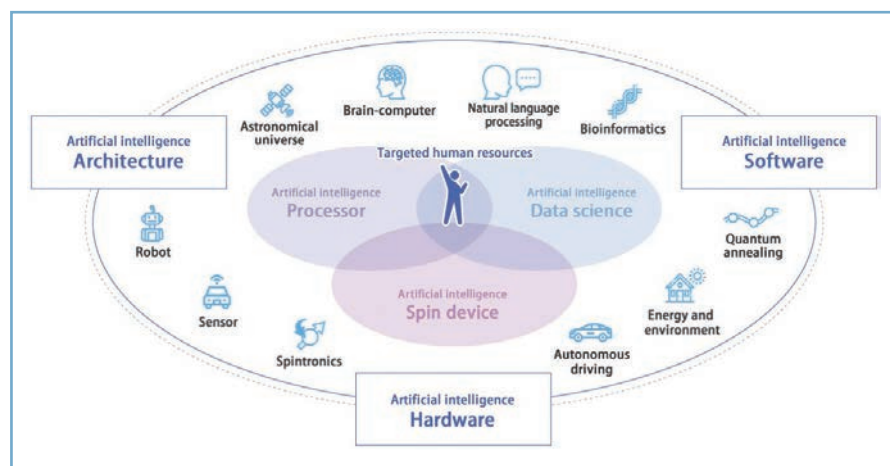
Research and development are required not only in algorithms and computer programs to process big data, but also in spintronics and electronics to develop devices and in computer architecture for designing processors that realize low-power consumption and high-performance computation.

The WISE program for AI Electronics aims to develop outstanding human resources for continuous innovation by providing educational courses to learn algorithms and computer

programs for the AI and architecture, centering on spintronics and research on spin devices, ultra-sensitive sensors, and other high-speed/low-power devices.

## Education with industry-academia and social collaboration

The WISE program for AI and Electronics (AIE) places the highest priority on areas



Fostering outstanding human resources who have a bird's-eye view and practical ability in the new field of AI electronics and create continuous innovations involving technologies from different fields

## DATA

[Number of scheduled student recruitments] 25  
[Number of anticipated program graduates] 20  
[Number of people engaged in the program] 68  
[Students' affiliated schools and departments] 68  
6 graduate schools, 15 departments  
<Graduate School of Engineering> Electronic Engineering, Electrical Engineering, Communications Engineering, Applied Physics, Management Science and Technology  
<Graduate School of Information Sciences> Computer and Mathematical Sciences, System Information Sciences, Applied Information Sciences

<Graduate School of Biomedical Engineering> Biomedical Engineering  
<Graduate School of Science> Physics, Mathematics  
<Graduate School of Arts and Letters> Japanese Studies, Global Humanities, Integrated Human Sciences  
<Graduate School of Economics and Management> Economics and Management  
[WISE Cooperating Institutions]  
13 companies  
NEC Corporation / TOSHIBA CORPORATION / CANON MEDICAL SYSTEMS CORPORATION / Hitachi Solutions East Japan, Ltd. / Keihin Corporation / E&M Corporation

/ AISIN SOFTWARE Co., Ltd. / KDDI Research, Inc. / Mitsubishi Electric Corporation / SHOWA DENKO K.K. / ALPS ALPINE CO., LTD / TDK Corporation / KPIT Technologies Ltd..

## Message from WISE Cooperating Institution

SUGIYAMA Keizo  
Executive Director of Security Division, KDDI Research, Inc.

## Expectations to the WISE Program for AI Electronics

KDDI Research Inc. has set "Challenge to a prosperous future" as its business vision and is working to create next-generation technologies necessary for the future society. AI is indispensable as a next-generation technology, but in order to actively promote implementation of AI in society, research and development aimed at solving issues such as security is required. We hope that excellent human resources in AI will be cultivated through practical research and development through industry-academia collaboration in this program.

## Student's Voice

SUMI Takuma  
1st year of Doctoral Program in Biomedical Engineering, Graduate School of Biomedical Engineering

## Learning Artificial Intelligence deeply and extensively

Taking Project-Based Learning subjects and leader seminars held with industry-academia collaboration, I would like to learn practical AI technologies in this program, which are used at the forefront of industry. I decided to participate in this program to learn AI deeply and extensively and to integrate it with my research on biological neural networks. The experience gaining through this program with industry-academia collaboration will be useful in academic research, and the connections with other researchers will be a great asset.

## [Fields of diplomas]

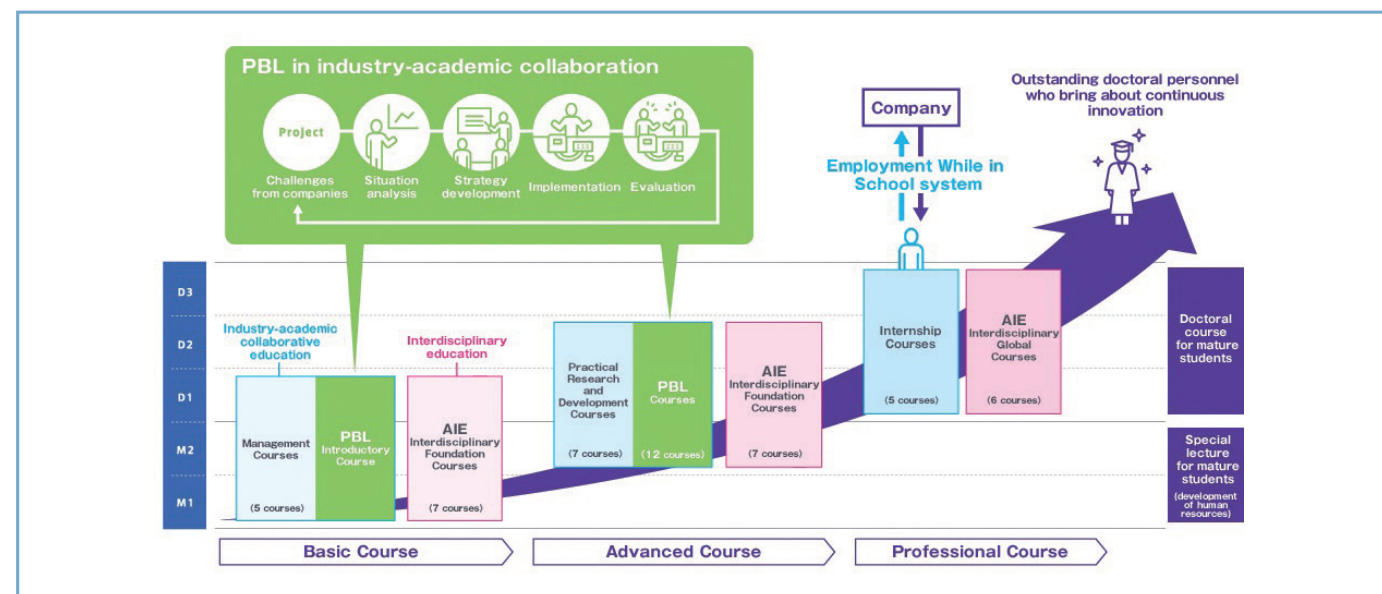
Doctor of Philosophy (Engineering) / (Information Sciences) / (Biomedical Engineering) / (Science) / (Letters) / (Economics) / (Management),  
Doctor of Philosophy

Name of the program to be noted: WISE Program for AI Electronics

[Office and section in charge] AI Electronics Education and Research Center

[Inquiries] 022-795-5667

[URL] <https://www.aie.tohoku.ac.jp/english/>



An education system consisting of "interdisciplinary education" constructed by highly specialized researchers in diverse academic fields and "industry-academic collaborative education" by researchers in industry and faculty members

that contribute toward new value creation. The program builds a five-year integrated graduate school education system consisting of "interdisciplinary education" and "industry-academic collaborative education". The interdisciplinary education is constructed by highly specialized researchers in diverse academic fields to develop student's abilities to take a bird's eye view to penetrate real and cyber space, and a multidimensional interconnection in Society 5.0. The industry-academic collaborative education is for students to develop practical skills to resolve social

issues cooperating with industries and society.

The five-year integrated education is divided in three courses: basic course, advanced course, and professional course. In the basic course, leader seminars are held with industry-academia collaboration. PBL (Project Based Learning) subjects are built up in the advanced course with collaborations between researchers from partner companies and faculty members. The students in the program can take up to four PBL subjects. They are expected to acquire the ability to solve problems and to become leaders who

can play an active role in the industrial world. In the professional course, the AIE program prepares an international internship program to foster outstanding doctoral students who will play a central role on the international stage, and a long-term corporate internship program aiming for further development of practical skills necessary in industry.

In addition, "Employment System in School" is formed, which allows students to get a job at a company even while they are still in school. This system will pave a new path to build diverse career paths.



## Ph.D. Program in Humanics

[Program Coordinator] YANAGISAWA Masashi (Professor, Director of International Institute for Integrative Sleep Medicine, University of Tsukuba)

[Office and section in charge] Office of School of Integrative and Global Majors  
 [Inquiries] 029-853-7076  
 [URL] <https://www.phd-humanics.tsukuba.ac.jp/en/>

Message from  
the President

NAGATA Kyosuke  
President of the University of  
Tsukuba

## Creating a new paradigm ~ Developing outstanding talents who can challenge “ZERO to ONE” ~

The Humanics program is a Ph.D. program that ensures interdisciplinary, leading-edge, world-class standards of education by combining top-tier national and international instructors and students with academic, industry, and governmental circles across disciplines.

As student-led new initiatives, the “double-mentor system” and “reverse mentor system” are adopted. Basic study of biomedical sciences is given to students having studied in physical sciences/ engineering/ informatics fields, and vice versa. Until now, an educational course, where students having graduated from a 6th-year medical course can learn physical sciences/ engineering/ informatics such like the Humanics program, was hard to be established in Japan, so that this is a true educational course for MD-Ph.D. students.

Under these new initiatives, we develop outstanding talents who can challenge “ZERO to ONE”.

## Anticipated Ph.D. talents

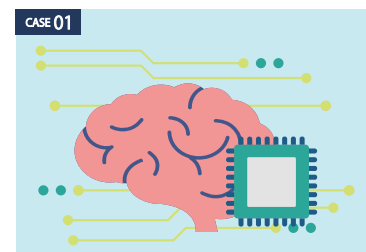
To create a new paradigm by integrating different disciplines of biomedical sciences and physical sciences / engineering / informatics, it is necessary to develop leaders who can talk with each other using the languages of both fields, understand both deeply, and integrate them in order to make it a reality. For example, da Vinci, a surgical support robot, was developed from the idea of a surgeon entrepreneur with an engineering background, and the robot suit HAL was inspired and implemented in the real world by an engineer who had studied human physiology. Optogenetics, a leading candidate for the Nobel Prize, that manipulates neuronal activity with light was founded by a psychiatrist who was well versed in

optical technologies and genetic engineering. However, the educational system to develop such talents did not exist in our country.

This graduate program sheds light on the fundamental principles of physiology and pathology of the human, defines “Humanics”

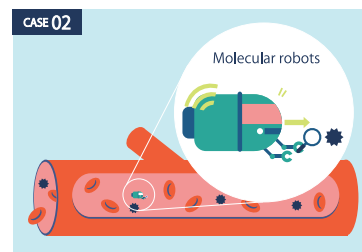
## Humanics Aims for Fusion Research

Humanics aims at integrated research that creates a new qualitatively different paradigm that goes far beyond the common sense of biomedical science and science, engineering and informatics.



Development of artificial neural network devices that can be linked to the brain, and understanding of sensibility, motivation, and thoughts, etc.

Improvement of cognitive function and mental health



Development of molecular robots to intervene in cell functions based on the understanding of molecular pathogenesis and to control infectious diseases and cancer.

Overcoming intractable diseases by molecular robots

Creating the “Humanics” by integrating biomedical sciences and physical sciences/engineering/informatics, and cultivating outstanding talents who can overcome intractable challenges to life and health

## DATA

[Number of scheduled student recruitments] 15  
 [Number of anticipated program graduates] 15  
 [Number of people engaged in the program] 132  
 [Students' affiliated schools and departments]

4 graduate schools, 10 departments  
 (After restructuring of schools and programs in April, 2020 : 2graduate schools, 4degree programs, 9programs)  
 <Graduate School of Comprehensive Human Sciences>  
 Biomedical Sciences, Clinical Sciences, Kansei, Behavioral and Brain Sciences  
 (After restructuring of schools and programs in April, 2020 : <Graduate School of Comprehensive Human Sciences> Medical Sciences, Neuroscience)  
 <Graduate School of Life and Environmental Sciences>

Life Sciences and Bioengineering, Biological Sciences  
 (After restructuring of schools and programs in April, 2020 : <Graduate School of Science and Technology>  
 Life and Agricultural Sciences, Biology)  
 <Graduate School of Systems and Information Engineering> Computer Science, Intelligent Interaction Technologies  
 (After restructuring of schools and programs in April, 2020 : <Graduate School of Science and Technology>  
 Computer Science, Intelligent and Mechanical Interaction Systems)  
 <Graduate School of Pure and Applied Sciences>  
 Chemistry, Physics, Materials Science and Engineering  
 (After restructuring of schools and programs in April,

2020 : <Graduate School of Science and Technology>  
 Chemistry, Physics, Engineering Sciences)  
 [WISE Cooperating Institutions]  
 4 universities, 2 national institutes, 5 companies  
 University of California, Irvine / University of Bordeaux  
 / National Taiwan University / University of Edinburgh  
 / Materials Science / Advanced Industrial Science and Technology / Toyota Motor / Hitachi / Shimadzu / CYBERDYNE / Astellas Pharma

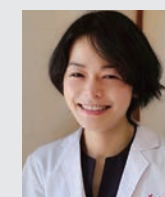
Message from WISE  
Cooperating Institution

SANKAI Yoshiyuki  
President and CEO, CYBERDYNE Inc.,  
Executive Research Director, Center  
for Cybernetics Research  
Director, F-MIRAI / Professor,  
University of Tsukuba

## Changing society with “Humanics” x “Cybernetics”

CYBERDYNE, a publicly listed venture company originating from the University of Tsukuba, is a research institute designated by MEXT whose researchers all have their own government-issued Researcher Number. Our business involves the research and development, production, and sales of medical devices and technology, and our simultaneous investment in basic research and societal implementation allows for the promotion of a positive Medical Innovation Cycle. Join us in our challenge to shape the future with Medical Cybernetics + Humanics!

## Student's Voice



EZAKI Seioh  
2nd year, Ph.D. Program in  
Humanics

## Beyond Engineering and Medical Sciences

I graduated from College of Engineering Systems of the University of Tsukuba and obtained medical licenses in both China and Japan after graduation. In my undergraduate years, I was involved in the research of gait sensation presenting devices for hemiplegic patients. Now I am working on the research supervised by Prof. Yamazaki in Orthopedics and Prof. Suzuki in Intelligent Informatics under the double-mentor system.

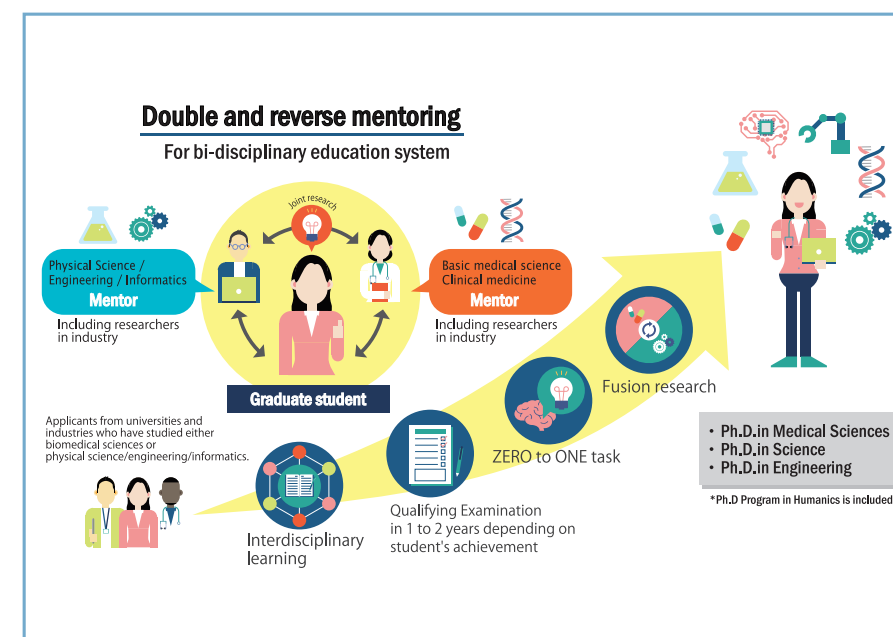
I think this program is best for challengers who are willing to integrate the different research fields.

as a discipline that generates new science and technology to achieve a healthy and comfortable life of human beings in the society, and is designed to nurture the Humanics talents. The Humanics talents should be doctoral-level professionals with knowledge and skills in the fields of both biomedical sciences and physical sciences / engineering / informatics, and have the expertise to combine these bi-disciplinary knowledge and skills. They should also have flexible, multifaceted creativity which can be applied to the unpredictable future, based on the expertise. Through the development of expertise and applied skills, this Ph.D. program cultivates individuals capable of independently uncovering basic principles of human life, creating systems to reconstitute and assess the validity of discovered principles, and building new theories of life.

The program aims to develop outstanding talents who can challenge to create a qualitatively different paradigm that goes far beyond the common sense of biomedical sciences – that is, ZERO to ONE – by always incorporating the knowledge and technology from different fields.

## Outstanding features

This program 1) has a remarkable characteristic of creating a new dimension of study, termed “Humanics,” under the cross-sectoral collaboration among internationally



Under the bi-disciplinary education system with a pre-admission program toward a graduate school, cultivating a comprehensive view of individuals with professional knowledge and skills in multiple fields and capability of integrating them

competitive, outstanding research institutions which are specialized in biomedical sciences and physical sciences/engineering/informatics, respectively, both inside and outside of the University of Tsukuba. In addition, the program 2) cultivates individuals' bi-disciplinary expertise with doctoral-level knowledge and skills by a full “double mentor system” in which each student is guided by two faculty members, one from the field of biomedical sciences and the other from physical sciences / engineering / informatics,

in their respective laboratories in the course of pursuing joint research projects, and 3) offers prospective students an opportunity to have an interdisciplinary background of the program before enrollment as a pre-admission program in their undergraduate years, which creates a seamlessly integrated system for transition to graduate education. Furthermore, the program 4) aims at a self-sustainable operation in collaboration with enterprises after the period of governmental funding.



## World-leading Innovative Graduate Study Program for Life Science and Technology

[Program Coordinator] KIKKAWA Masahide (Professor, Graduate School of Medicine, The University of Tokyo)

### Message from the President



GONOKAMI Makoto  
President, The University of Tokyo

### Enthusiastically supporting the development of The University of Tokyo World-leading INnovative Graduate Study Program for Life Science and Technology

The University of Tokyo(UTokyo) aims to nurture "knowledge professionals" who contribute to solving common problems in human society and create new knowledge. To achieve this goal, UTokyo has been developing the World-leading INnovative Graduate Study (WINGS), an integrated master's and doctoral degree program. The WINGS for Life Science and Technology (WINGS-LST Program) will lead the reform in graduate studies in collaboration with other WINGS Programs, and foster outstanding international leaders of scientific excellence at the forefront of global development in Life Science and Technology. We are confident that the efforts of WINGS' students will culminate in the creation of new academic disciplines and in technological breakthroughs, all of which will contribute to accelerating and disseminating paradigm shifts across humanity.

### Human talents who can create new academic fields and contribute to human health

The World-leading INnovative Graduate Study Program for Life Science and Technology (hereinafter "this program") aims to develop talents who will significantly contribute to human health from a long-term perspective. For this reason, it covers a wide range of life science and technology research fields, from elucidation of basic principles to applied technologies that lead to clinical practice.

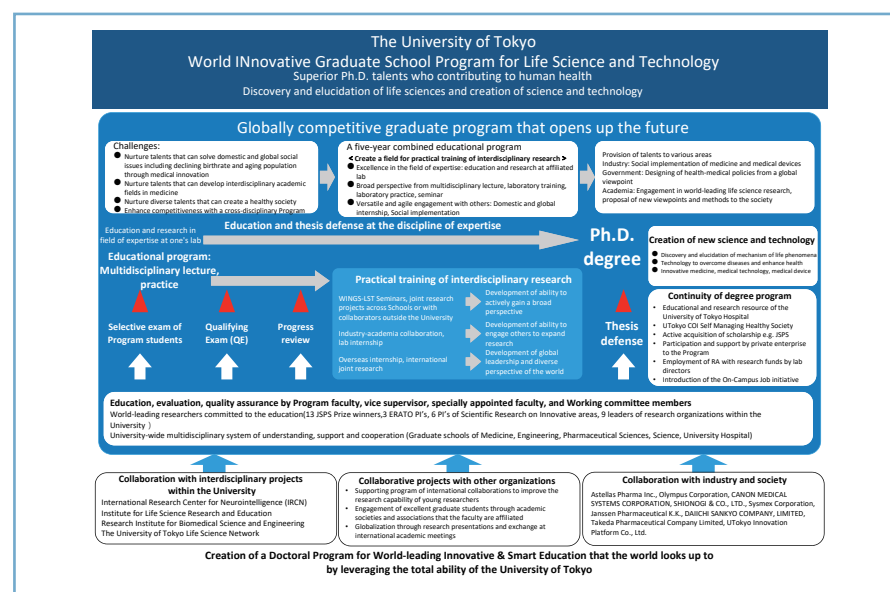
In this program, we aim to foster human talents who can create new academic fields in the future by co-developing excellence in three assets: expertise in specialized disciplines, broadness of scientific perspective, and agile engagement with others to develop new opportunities.

Development of human talents at the frontiers of life science and technology

In this program, we aim to foster human

talents at the cutting edge of life science and technology disciplines: we promote discoveries and elucidation of mechanistic

insights in all phenomena of life using new technologies, while we also develop novel and advanced technologies based on scientific



We provide a globally competitive graduate school education program that will open up the future. It will nurture Ph.D. talents who can create new academic fields and technologies, through practical interdisciplinary training.

### [Fields of diplomas]

Doctor of Medical Science, Doctor of Engineering, Doctor of Philosophy  
Name of the program to be noted: The World-leading Innovative Graduate Study Program for Life Science and Technology

[Office and section in charge] WINGS-LST office  
[Inquiries] 03-5841-0246  
[URL] <http://square.umin.ac.jp/wings-lf/>

principles and theories of life. Innovative areas in academic disciplines and technologies do not arise spontaneously. We believe that they are created by enhancing expertise, broadening perspectives through development of big picture thinking skills and meeting with experts in a variety of fields, and developing interdisciplinary research by engaging others.

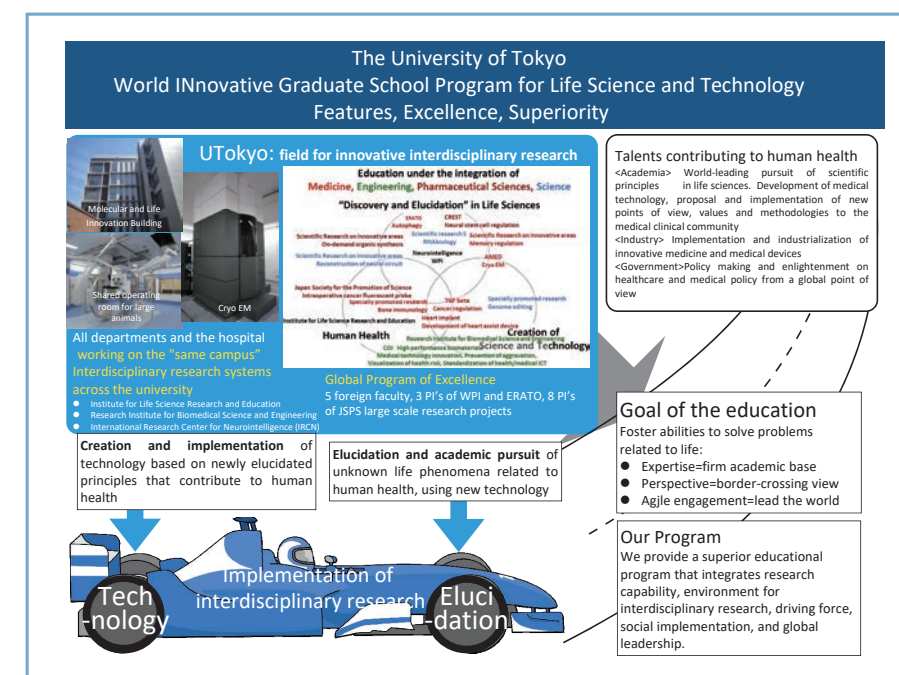
Specialized expertise: Specialist capability that makes an individual second to none with regard to a particular purpose or area of knowledge.

Broader perspective: Based on the expertise above, ability to survey various academic fields and identify fundamental cross-disciplinary problems. Faculty members who will provide guidance to the program students are leaders conducting cutting edge research in their own discipline, while remaining flexible and open to methods and ideas of other fields.

Agile engagement: Ability to think about the way research should proceed based on the big picture, and to develop research by building collaborative relationships with researchers in appropriate fields. Communication skills, capacity for understanding, information gathering ability, etc., are also included.

### Integrate technology and mechanistic elucidation, and take initiative in the development of academic disciplines and industries that contribute to human health.

A unique feature of this program is that



UTokyo is the "field" for innovative, interdisciplinary research and training, where "basic science/elucidation of phenomena" and "technology/clinical practice/application" complement each other like the front and rear wheels of a car.

students are able to learn about both the elucidation of life phenomena (related to basic medical sciences and life sciences) using state-of-art technologies, and the technologies (related to clinical practice and engineering) that contribute to human health based on the elucidated principles and theories.

Life science has made tremendous progress and has been able to elucidate new phenomena thanks to many technical developments, such as recombinant DNA technologies based on biochemistry or microscopy based on physics. In parallel, new

principles have revealed the target molecules for drug discovery, and new treatment techniques have been created. In other words, in order to elucidate life phenomena and create technologies, an ecosystem where both are performed at a highest level as two halves of a whole is necessary. Therefore, this program aims to promote knowledge professionals who can integrate both technology and mechanistic elucidation, as well as contribute to the development of academic disciplines and industries that contribute to human health.

[Number of scheduled student recruitments] 40  
[Number of anticipated program graduates] 40  
[Number of people engaged in the program] 77  
[Students' affiliated schools and departments]  
4 Graduate Schools, 22 Departments  
<Graduate School of Medicine> Molecular Cell Biology, Functional Biology, Pathology Immunology and Microbiology, Radiology and Biomedical Engineering, Neuroscience, Social Medicine, Internal Medicine, Reproductive, Developmental and Aging Sciences, Surgical Sciences  
<Graduate School of Engineering> Bioengineering,

Mechanical Engineering, Electrical Engineering and Information Systems, Precision Engineering, Materials Engineering, Applied Chemistry, Chemical System Engineering, Chemistry and Biotechnology, Nuclear Engineering and Management  
<Graduate School of Pharmaceutical Sciences> Pharmaceutical Sciences, Pharmacy  
<Graduate School of Science> Biological Sciences  
[WISE Cooperating Institutions]  
9 companies  
Astellas Pharma Inc. / Olympus Corporation / CANON MEDICAL SYSTEMS CORPORATION / SHIONOGI & CO.,

LTD. / Sysmex Corporation / Janssen Pharmaceutical K.K. / DAIICHI SANKYO COMPANY, LIMITED / Takeda Pharmaceutical Company Limited / Utokyo Innovation Platform Co., Ltd.

### Message from WISE Cooperating Institution



TAKADA Yoichi, Ph.D.  
General Manager, Healthcare IT First Division, Canon Medical Systems Corporation

### Development of Leaders for Global and Collaborative Research

Canon Medical Systems Co. continuously provides innovative medical device systems. To create innovation, it is essential to develop cutting-edge technologies in collaboration with researchers in medicine, engineering, pharmaceutical, and science fields. We explore the technologies by finding needs from the clinical viewpoints and understanding academic significance. We hope this program at the University of Tokyo will support the growth of creative leaders, and that they lead projects for the development of new medical technologies.

### Student's Voice



KOHATA Ai  
D2 Graduate School of Engineering, The University of Tokyo



OTAKE Saya  
D2 Graduate School of Engineering, The University of Tokyo

### Aspiring to become an interdisciplinary person who contributes to human health

We joined the Program with the hope of broadly understanding the field of life science as researchers with engineering background. The Program provides us many opportunities not only to obtain knowledge through multidisciplinary lectures, seminars and experiments, but to interact with students and faculty from the fields of medicine, pharmaceutical sciences and science. Through discussions with them, we get inspiration from their perspectives, and at the same time realize the importance of becoming masters in our own expertise.



## Excellent Leader Development for Super Smart Society by New Industry Creation and Diversity

[Program Coordinator] MIYAURA Chisato (Vice-president, Tokyo University of Agriculture and Technology)

### Message from the President



CHIBA Kazuhiro  
President, Tokyo University  
of Agriculture and Technology

Developing dynamic doctoral degree holders with practical abilities who can expand values for the future to pioneer a 'Super-Smart Society'

Our university's goal is to foster human resources who will lead the knowledge-based society of the future via scientific inquiry and knowledge based on public service, sociality, internationality and ethics as well as to educate students to become people who care for others on a large scale. This program plays a key role to acquire abilities for practical action while designing the vision for future generation and sharing each other's perspective. By respecting the individuality of others and developing their own originality, we expect them to discover their own talents and connect them to social implementation. Then, they can play an active role as powerful and dynamic doctoral students who will pioneer a 'Super-Smart Society' where cyberspace and real-world space merge.

### Driving the "Super Smart Society" by New Industry Creation and Diversity

In this program, based on agriculture and engineering, we will produce high-level human resources with doctoral degrees who can implement the Society 5.0 "Super Smart Society" in 5th Basic Plan for New Science and Technologies to solve social problems. We feature "Creation of New Industries" and "Diversity" which are essential for the creation of excellent innovation.

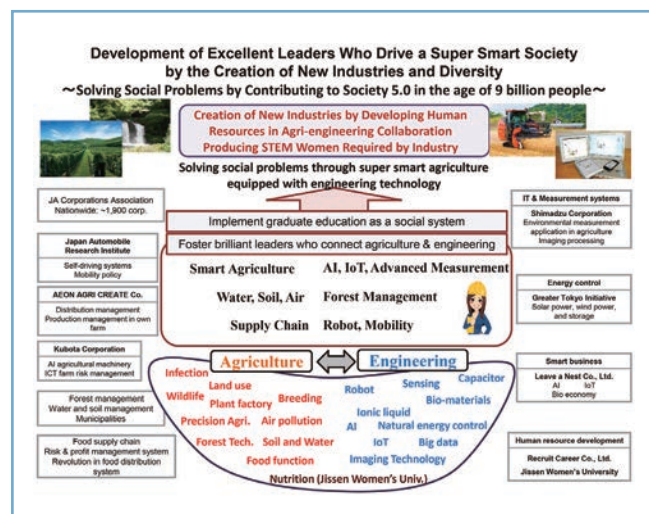
As for "Creation of New Industries", we will apply the cutting-edge engineering technologies such as Artificial Intelligence (AI), machine learning, advanced measurement and IoT, robot, smart mobility (automated driving), and energy control to agriculture. We will cultivate human resources with doctoral degree who will create and drive the safe, secured and sustainable new industries regarding "Smart Food Supply Chain"

or "Smart Production System", harmonizing with water, air, soil and weather, and promoting the "Smart Agriculture" or "Smart Stock Farming" at an accelerated rate with ICT.

Collaborating with nine partner organizations and eight overseas partner universities, we will produce a "knowledge professional" with big-picture perspective, originality and high-level specialization for industry and international organizations.

As for "Diversity", regardless of gender or nationality, diversity-related courses are required for all the WISE

Students, which characterize our cultivation of high-level human resources with doctoral degrees.



This program develops excellent human resources who challenge application of research outcomes for Society 5.0 "Super Smart Society" through postgraduate education.

Year of selection FY 2018

### [Fields of diplomas]

Doctor of Philosophy

Name of the program to be noted: Doctoral Program for World-leading Innovative & Smart Education



[Office and section in charge] Education Affairs Office  
[Inquiries] 042-367-5545  
[URL] <http://www.wise.tuat.ac.jp/en/>

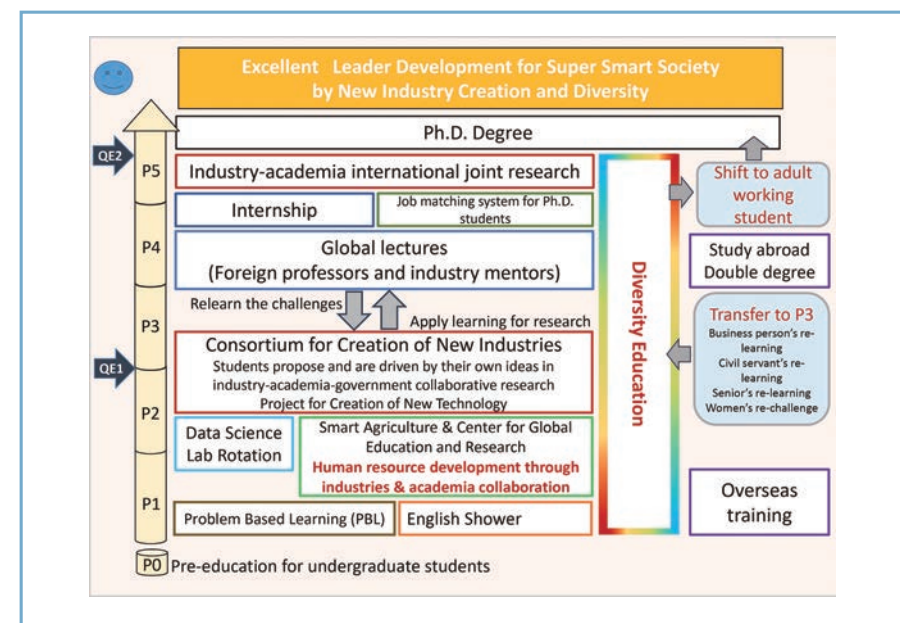
The vision of human resources cultivated by the WISE Program is;

(1) Challenging "creating new industries through agri-engineering collaboration" and thereby leveraging cutting-edge engineering technology to solve the social challenges relating to agriculture, (2) Strengthening the understanding of diversity (gender, nationality, social experiences, etc.) which is essential for innovative human resources, and (3) Excellent leadership with a big-picture perspective, originality, appreciation of diversity, international competitiveness, and high-level specialization.

### Developing active leaders in industries or international organizations by collaborating with partner organizations

This program consist of a five-year integrated program (master's + doctoral) and students who have completed a master's course are also accepted.

We conduct problem-proposal-type industry-academia joint research where students themselves can challenge to propose and drive to build the "Consortium for the Creation of New Industries" with the partner organizations. We already built collaboration and cooperation with companies at an organizational level. We established the system where both parties can have a consensus systematically so that the research outcomes can be published by students paying attention to intellectual properties. Also, young researchers in



This curriculum develops excellent human resources who drive a "Super Smart Society" collaborating with private companies, public institutes and overseas partner organizations with a five-year integrated postgraduate program as a pillar.

companies are encouraged to join this program to obtain a doctoral degree.

To cultivate excellent leaders, enhancement of education in global perspective is indispensable. Foreign researchers commit in this educational program collaborating with the top-class universities in North America, Europe and Asia. World top-class researchers from these partner organizations come to Japan, give global lectures, and accept training or study abroad of Japanese students, as well as activating international joint researches.

We provide lectures by practitioners from

the collaborating companies and project-based practical education under the Consortium for the Creation of New Industries composed of private companies and public research institutes.

To complete the program, besides meeting the completion requirements of the department, students must pass the Qualifying Examination (QE) by taking the courses provided by the WISE Program. Students will take the QE in the last semester of the 2nd year of the master's course and in the 3rd year of the doctoral course.

### DATA

#### [Number of scheduled student recruitments]

18 (general) + 7 (transferred) Total 25

#### [Number of anticipated program graduates]

18-22

#### [Number of people engaged in the program]

18-22

#### [Students' affiliated schools and departments]

4 Graduate Schools, 28 Courses

<Graduate School of Agriculture> Science of Biological Production, Studies in Sustainable and Symbiotic Society, Applied Biological Chemistry, Bioregulation and Biointeraction, Natural Resources and Eco-materials, Environmental Science on Biosphere, Environmental Conservation, Environmental and Agricultural Engineering, International Environmental and Agricultural Science, Cooperative Division of Veterinary Sciences, Agriculture

<Graduate School of Engineering> Biotechnology and Life Science, Applied Chemistry, Mechanical Systems Engineering, Electronic and Information Engineering, Applied Physics, Electrical and Electronic Engineering, Computer and Information Sciences, Industrial Technology and Innovation, Joint Doctoral Program for Sustainability Research <United Graduate School of Agricultural Science> Biological Production Science, Applied Life Science, Symbiotic Science of Environment and Natural Resources, Agricultural and Environmental Engineering, Agricultural Economy and Symbiotic Society <Graduate School of Bio-Applications and Systems Engineering> Bio-Functions and Systems Science, Cooperative Major in Advanced Health Science, Food and Energy Systems Science

#### [WISE Cooperating Institutions]

8 universities (including 7 foreign universities), 5 companies, 1 general incorporated foundation, 1 public interest incorporated association, 1 general incorporated association, 1 research institute (including 1 foreign institute) KUBOTA Corporation / AEON AGRI CREATE CO.,LTD / SHIMADZU CORPORATION / Japan Automobile Research Institute / Japan Agricultural Corporations Association / Create Tokyo Initiative / Leave a Nest Co., Ltd. / Recruit Career Co., Ltd. / Jissen Women's University / Cornell University / University of California, Davis / University of Oxford / The Leibniz Centre for Agricultural Landscape Research (ZALF) / University of Bonn / Vietnam National University of Forestry / Gadjah Mada University / The University of North Carolina at Chapel Hill

### Message from WISE Cooperating Institution



Dr. IIDA Satoshi  
Senior Technical Advisor,  
KUBOTA Corporation

### Human resources development by field-based industry-academia partnership

Our company now promotes research and development with the keywords of "innovation", "field-based research and development", "smart agriculture" and "ICT agricultural machinery". We also promote diversification and globalization in our general business operation.

The vision of the WISE Program fits with our policies, thus, we would like to cooperate with the creation of new industries and development of excellent leaders by applying the know-how which our company has cultivated to the education.

### Student's Voice



UKAWA Chinatsu  
2nd year of the master's course,  
Department of Food and Energy  
Systems Science, Graduate School  
of Bio-Application and Systems  
Engineering

### The birthplace of an integration of agriculture and engineering

During my study abroad at the Leibniz Centre for Agricultural Landscape Research, I was supervised by a researcher who specialized in machine learning. We often discussed our research with agricultural researchers for further improvement. It was my first collaboration with researchers from different fields, so the process of combining different perspectives was fascinating. That was a good opportunity for me to realize the joy of working across the fields and to think about how I would like to contribute to our society in the future.



# Creating sustainable societies through [Material×Information] multi-talented human resource development

[Program Coordinator] YAMAGUCHI Takeo (Professor, Institute of Innovative Research / School of Materials and Chemical Technology, Tokyo Institute of Technology)

## Message from the President



MASU Kazuya  
Tokyo Institute of Technology,  
President

## University-wide efforts to empower students to become multitiered individuals in materials science and informatics

As part of education reform, the University has created a system to provide joint education by removing the disciplinary walls among the six graduate schools, Institute of Innovative Research, and Institute for Liberal Arts. This program empowers students to become “multitiered individuals” who can capitalize on original ideas for social innovation in the converged fields of materials science and informatics. In addition to encompassing the entire University, the program provides specialized doctoral education in collaboration with private corporations, the National Research and Development Agency, and top-notch overseas universities. Under the leadership of the President, we established a University-wide integrated education curriculum that utilizes the strength of the University in materials science and informatics research, and values our ties to society to transform students into excellent “multitiered individuals”.

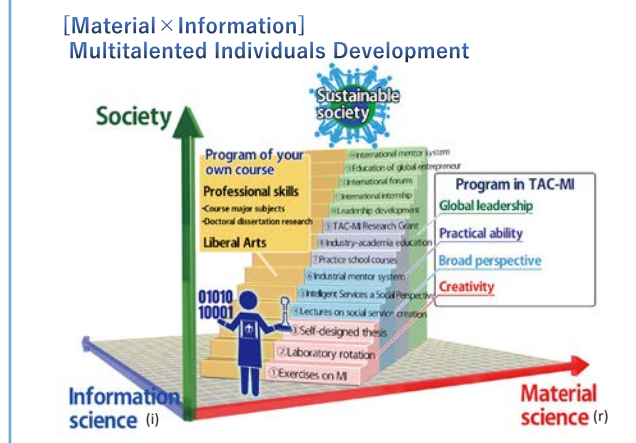
## Fostering individuals who can create new industries

The program empowers students to become “multitiered individuals” who utilize informatics to conceptualize new ideas through multifaceted thinking and a broad perspective as well as contemplate new social services when approaching original research on materials and informatics. Multitiered individuals are expected to create new industries that link materials and informatics to build a sustainable society. Although the manufacturing industry in Japan (unique Japanese Monotsukuri industry) is very strong, industry growth necessary to continue to lead the world will be difficult using the conventional way of thinking.

Due to advances in informatics such as data science, simulation, and machine

learning, the discovery and design of new materials are becoming possible. The era utilizing information technology has arrived, allowing market-specific optimization and production management of devices and processes as well as the creation of social services from consumer trends. However, traditional materials research is conducted at a specific level such as the molecular material or device and process level. A broader perspective that encompasses the

eventual social services has yet to be fostered. Consequently, graduate-level education must aim to converge materials science and



“Multitiered individuals” empowered by this program can freely move across complex space with axes of materials science, informatics, and social services. Due to diverse training, they flourish professionally.

## [Fields of diplomas]

Doctor of Engineering, Doctor of Science, Doctor of Philosophy, “Tokyo Tech Academy for Convergence of Materials and Informatics (TAC-MI)” is added.

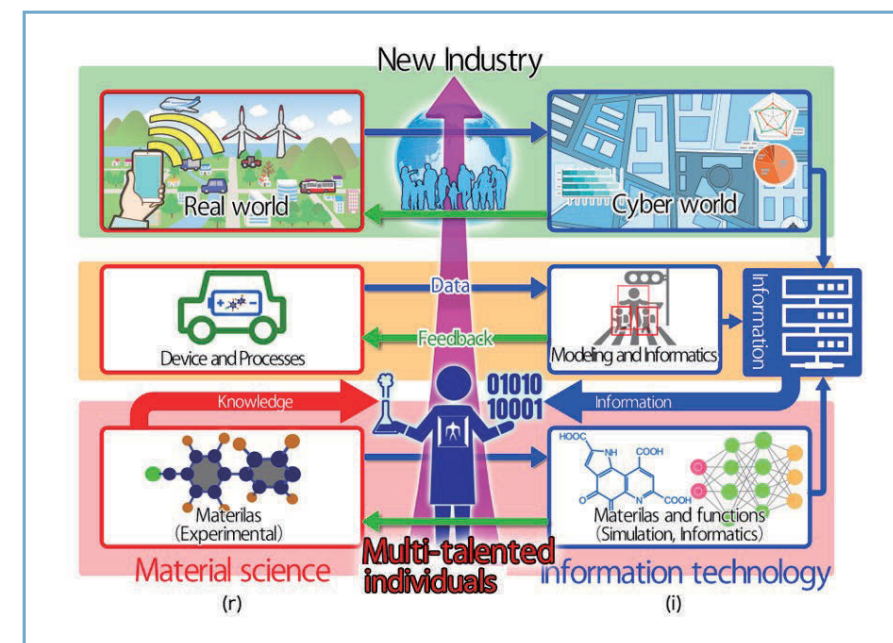
[Office and section in charge] Tokyo Tech Academy for Convergence of Materials and Informatics Group, Promotion Office for Education Programs  
[Inquiries] 03-5734-3793  
[URL] <https://www.tac-mi.titech.ac.jp/en/>

informatics through a broad perspective from molecules to social services. Students develop the following abilities: 1) creativity to realize multifaceted ideas across the fields of materials science and informatics, 2) a broad perspective to identify social issues accurately by sifting through a vast amount of information, 3) initiative to take action to solve challenges by spiraling outward and expanding from the atomic or molecular level to social innovation towards attaining a sustainable society, and 4) global leadership ability to introduce new services to the world.

By working in a team of exceptional students from diverse backgrounds to tackle various challenges, students learn different viewpoints and foster a cross-disciplinary understanding to communicate effectively. The program is offered as a joint effort of all six graduate schools, the Institute of Innovative Research, and the Institute for Liberal Arts. The program education is provided in cooperation with private corporations, the National Research and Development Agency, and top-notch overseas universities.

## Program characteristics and excellence

The program focuses on “new industry creation” and “new field creation”, which is the foundation of new industry. We aim to create new industry by advancing from materials-based industries to next-generation industries. Financial, trading, and software industries



The program empowers students to think from a broad perspective free from a traditional classification as they can easily cross the boundaries of “materials science” and “informatics” and can move through information world.

have incorporated with information technology and shifted into areas with higher information value. In contrast, materials-based industries have yet to fully utilize high information value. A path forward is to create industries with high information value built upon materials. Currently, no education program fosters talent who can create such industries. Although double-major programs in some countries allow students to study materials science and informatics independently, opportunities for cross-disciplinary interactions among students and faculties as well as to connect

ideas from molecules to social innovation are woefully lacking. The characteristics and excellence of the program are to produce “multitiered individuals” who are unprecedented “knowledge professionals”. Knowledge professionals are materials scientists systematically educated in state-of-the-art informatics or information scientists who understand and can systematically apply state-of-the-art materials research. Not only do they recognize the connection of materials to social services, but they are also passionate about creating new industries.

## DATA

[Number of scheduled student recruitments] 10-23  
[Number of anticipated program graduates] 8-20  
[Number of people engaged in the program] 78  
[Students' affiliated schools and departments]  
6 graduate schools, 12 departments  
<School of Materials and Chemical Technology>  
Chemical Science and Engineering, Materials Science and Engineering  
<School of Science> Chemistry, Physics  
<School of Computing> Mathematical and Computing Science, Computer Science  
<School of Life Science and Technology> Life Science

and Technology  
<School of Engineering> Mechanical Engineering, Systems and Control Engineering, Electrical and Electronic Engineering  
<School of Environment and Society> Transdisciplinary Science and Engineering, Innovation Science  
[WISE Cooperating Institutions]  
2 public research institutes, 7 overseas universities, 25 companies  
NIMS / AIST / Leiden University / McGill University / Max Planck Institute / Imperial College London / Cornell University / Sorbonne University / Tsinghua University / TOYOTA MOTOR

CORPORATION / Nissan Motor Co., Ltd. / Mazda Motor Corporation / Toshiba Corporation / JFE Steel Corporation / JX Nippon Mining & Metals Corporation / ASAHI KASEI CORPORATION / Mitsubishi Chemical Corporation / SUMITOMO CHEMICAL Co., Ltd. / TOSOH CORPORATION / MITSUBISHI GAS CHEMICAL COMPANY, INC. / Sumitomo Electric Industries, Ltd. / SHOWA DENKO K.K. / TDK Corporation / LG Japan Lab Inc. / Panasonic Corporation / FUJIFILM Corporation / AGC Inc. / ZEON CORPORATION / Showa Denko Materials Co., Ltd. / KANEKA CORPORATION / Toyo Seikan Group Holdings, Ltd. / NAGASE & CO., LTD. / Hamamatsu Photonics K.K. / ENEOS Corporation

## Message from WISE Cooperating Institution



HASHIMOTO Kazuhito  
National Institute for Materials  
Science (NIMS), President

## Contribute to develop outstanding individuals for materials innovation

This is the third year since the National Institute for Materials Science (NIMS) joined TAC-MI as a collaborating institution. We are very happy to say that the laboratory rotation program in TAC-MI is going well and has initiated collaborative research between Tokyo Tech and NIMS, where a master student has been able to present the results at academic conferences. We would like to continue to work together to develop human resources to drive materials innovation based on our data-driven research.

## Student's Voice



KOMATSU Yuya  
1st-year doctoral student, School of  
Materials and Chemical Technology,  
Department of Chemical Science and  
Engineering

## Practical research experience in materials informatics

When I learned that materials science research could be drastically more effective by applying informatics, I decided to participate in the “Materials×Informatics” program. In particular, solving challenging, real industrial problems using the materials informatics skills we learned is a great opportunity and experience. Additionally, the TAC-MI program provides many social events to interact with industry professionals as well. Personally, it reminds me of how the research can contribute to the global society.



## Global Pro-Active Root Technology Program

[Program Coordinator] OHISHI Kiyoshi (Executive Director・Vice President, Nagaoka University of Technology)



Message from the President



AZUMA Nobuhiko  
Nagaoka University of Technology, President

### Establishing a world-class base for applied root technology instruction

A variety of students participate in this outstanding graduate program, including those with corporate experience, those from other higher learning institutions, as well as international students. We believe that it is extremely important for students with such diverse backgrounds to actively engage with equally diverse faculty in various regions of the world in the pioneering of new academic fields. In addition, the application of "Root Technology" combining IT, power electronics, and materials science provides many solutions for new lifestyles. Numerous overseas universities, domestic and foreign enterprises, and local governments who support the idea of developing knowledge professional human resources are newly participating in the program. We look forward to your continued support.

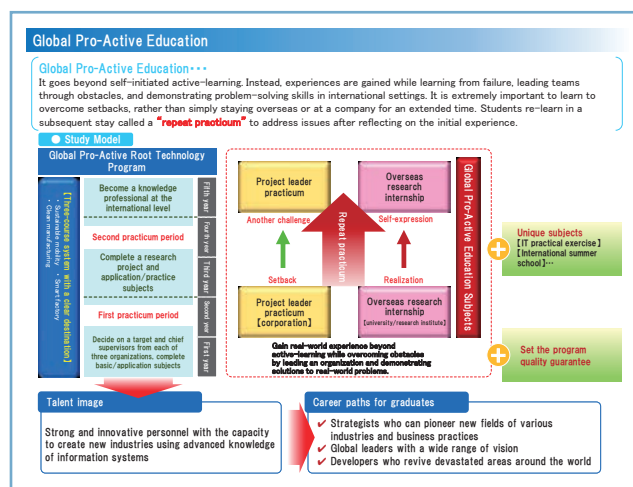
### Development of human resources for root technologies able to contributing to the realization of SDGs

Our University was appointed as a World Hub University for the United Nations Sustainable Development Goals (SDGs) Goal 9 ("Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation") of the United Nations Academic Impact program (only one institution in the world appointed for each of the 17 SDG initiatives) as a university serving as a model for innovative efforts related to the SDGs. This is a testament to the recognition that the University and its graduates are contributing to infrastructure development, innovation, and sustainable industrialization globally. Our University is the only institution selected from the East Asia region, including Japan.

This program brings together the

world's highest level of research capabilities and pioneering educational methods, to which the University has continuously made contributions. Specifically, the "Root Technology" that forms the basis of all industries and that integrates "IT," "materials science," and "electrical engineering" contributes to the realization of the SDGs in collaboration with domestic and overseas industries and the world's leading research facilities. This is a five-year integrated education program for doctoral candidates geared towards training knowledge

professionals. In this program, the following four competencies will be honed to the "world-class level" through "Global Pro-Active Education": 1. Ability to pioneer innovative



Characteristics of the teaching curriculum in global pro-active education, vision for human resources to be cultivated, and the professional career path of graduates

### DATA

[Number of scheduled student recruitments] 15  
[Number of anticipated program graduates] 15  
[Number of people engaged in the program] 65  
[Students' affiliated schools and departments] 1 graduate school, 1 department  
<Graduate School of Engineering> Science of Technology Innovation  
[WISE Cooperating Institutions] 13 universities, 12 public research institutes, 2 local public bodies  
Aalto University / Mondragon University / University of York / Bristol University / University of Sheffield

/ University of Leeds / University of Deusto / Indian Institute of Technology Madras / University of Antwerp / University of Bordeaux / TH Köln-Technology, Arts, Sciences / Friedrich-Alexander Universität Erlangen-Nürnberg, FAU / Universität Bielefeld / Sankyo Tateyama, Inc / Sumitomo Electric Industries, Ltd / Nagaoka Power Electronics Co., Ltd / Unipulse Corporation / Fuji Electric Co., Ltd / SANKI ENGINEERING CO., LTD / Japan Business Create Co., Ltd / IBSYSTEM Co., Ltd / Japan Fine Ceramics Association / Niigata Industrial Creation Organization / The Institute of Applied Energy / National Institute

of Advanced Industrial Science and Technology / Niigata City / Nagaoka City

### [Fields of diplomas]

Doctor(Engineering)

Name of the program to be noted: WISE Program (Global Pro-Active Root Technology Program Course)



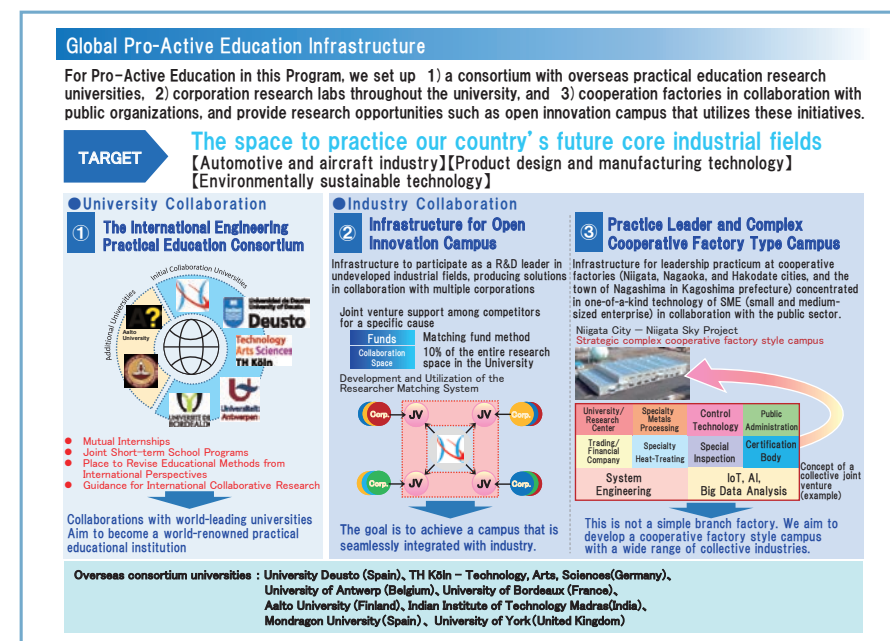
WISE Program  
Global Pro-Active  
Root Technology Program

[Office and section in charge] Division of Academic Affairs  
[Inquiries] 0258-47-9241  
[URL] <https://www.nagaokaut.ac.jp/e/wise/>

academic fields to form the basis for a career as a doctorate-level human resource; 2. Advanced IT capabilities in AI, IoT, and data science that can continuously adapt in concrete ways without pretensions; 3. Human-driven pioneering able to open up unexplored areas while building and utilizing a diverse human resources network; 4. Design thinking and implementation capacities enabling the effective planning and proposal (production) of strategies demanded in the Society 5.0 era.

### Features of a "Global Pro-Active Education" and Establishing a Suitable Environment

Since its foundation, our University has adopted pioneering teaching methods, such as requiring on-the-job training (long-term internships) at companies in Japan and overseas for approximate half-year terms. The world's top research achievements in the fields of materials science and power engineering, as well as unique practical competencies form the source of graduates empowered to play an active role as leaders. This program demonstrates pioneering teaching methods that can only be achieved through a long-term program of five years of master's and doctoral degree-focused instruction. That is what we refer to as "Global Pro-Active Education." "Global Pro-Active Education" incorporates a collaborative education method (dual system) in which advanced European industry members and academia collaborate,



Establishing an environment for realizing global pro-active education

and share experiences to foster leadership in various aspects of business and research. Students have already experienced a number of setbacks and difficulties while engaging in advanced work at their home and overseas destinations. After returning to the University, the students share their experiences and continue to work with their academic advisors and mentors to overcome these obstacles while studying during their second dispatch. This is a teaching method referred to as repetitive training, which serves to provide the experience of re-learning what was lacking in the university environment and of

tackling challenges in the field. In addition, as the human resources who will lead the next generation of Society 5.0 must constantly incorporate new IT technologies, all students enrolled in this program will build proficiency with the latest IT technologies such as AI, IoT, and data science. In order to maximize the effectiveness of such learning, we will promote the establishment of a suitable learning environment together with collaborating universities, research institutes, members of industry, and government agencies in Japan and abroad.

### Message from WISE Cooperating Institution



Prof Dr Jon Garcia-Barrutabeña  
University of Deusto, Spain

### Promotion of joint education and research projects on sustainable automotive engineering with four European universities

The University of Deusto and the Nagaoka University of Technology have organized a joint program in the form of a consortium of graduate schools from five countries on sustainable automotive engineering. Students accurately responded to multifaceted questions from corporate development staff and companies such as Audi and university faculty members from five countries at a remote presentation held in September 2020. We are pleased that this program is able to cultivate human resources who are truly active in society.

### Student's Voice



OKAWA Ayahisa  
3-year major program in science of technology innovation

### JP-DE industry-academia research on complex porous ceramics for environmental purification

As first step toward realizing my dream of fully actualizing my research skills internationally, I conducted research on the process of creating new ceramics at the Friedrich-Alexander Universität Erlangen-Nürnberg (FAU) in Germany. The Fraunhofer Institute (IISB) is located on the campus of FAU, and Siemens, a multinational general electrical equipment company, is located nearby. Participating in these joint projects allows me to deepen my understanding of German industry-academia collaboration.



## Graduate Program of Transformative Chem-Bio Research

[Program Coordinator] YAMAGUCHI Shigehiro (Professor, Institute of Transformative Bio-Molecules, Nagoya University)

### Message from the President



MATSUOKA Seichi  
President, Nagoya University

### A Program to Catalyze the Fusion of Chemistry and Biology – Cultivating Science and Doctoral Students of the Future

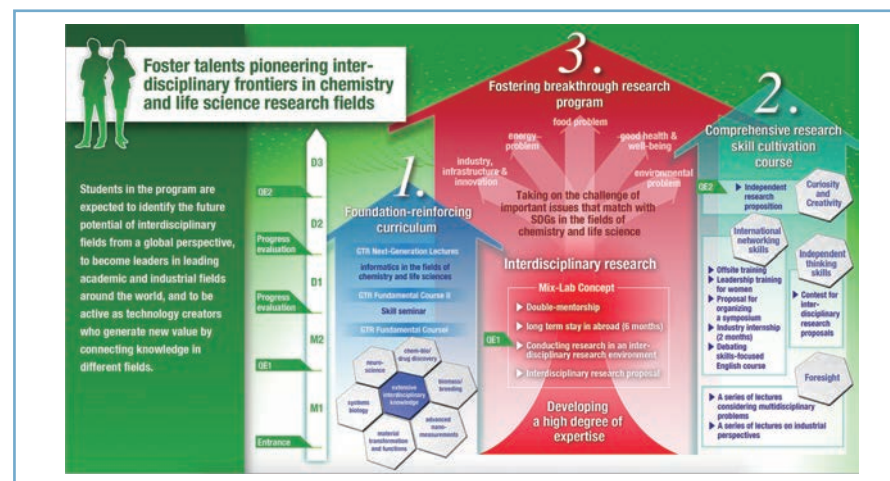
A university's role is to promote excellent research and cultivate talented individuals with multifaceted abilities. As part of its WISE programs, Nagoya University has created the Graduate Program of Transformative Chem-Bio Research (GTR), based on the top-notch research findings of Institute of Transformative Biomolecules (ITbM), as part of WPI (World Premier International Research Center Initiative), and cultivation of talent in the Integrative Graduate Education and Research Program in Green Natural Sciences. The world is changing rapidly and dramatically as science and technology advance. This program provides interdisciplinary and international environments that will generate novel ideas and perspectives in science. We promote this project wholeheartedly, with the goal of training doctoral students with the capacity to promote original sciences, acquire a global perspective, and create networks. We believe that this project will cultivate future world leaders.

### Beyond interdisciplinary frontiers to achieve breakthroughs

To achieve sustainable development of society, the human race must solve many challenges, including environmental and energy problems, stable food production, the development of materials leading to industrial and technological innovations, and life science research that contributes to the promotion of health. Accordingly, the roles of chemistry and life science research are expected to become increasingly important. To make breakthroughs in these challenges confronting science and society, we need to pioneer interdisciplinary research fields that can open new horizons. To overcome the barriers between conventional disciplines that stand in the way of such efforts, an excellent research power to break through is essential. The research power to break through consists

of two elements: the power to overcome and the power to connect. The former involves a frontier spirit, power of execution, and confidence that can be developed only by

taking the initiative in carrying out attractive and high-quality research. The latter involves connecting different disciplines and leading to the creation of innovative ideas for solving



Three powers fostered by GTR: basic knowledge across chemistry and life science, comprehensive research power to advance, and research power to break through only acquired by active involvement in interdisciplinary research.

### [Fields of diplomas]

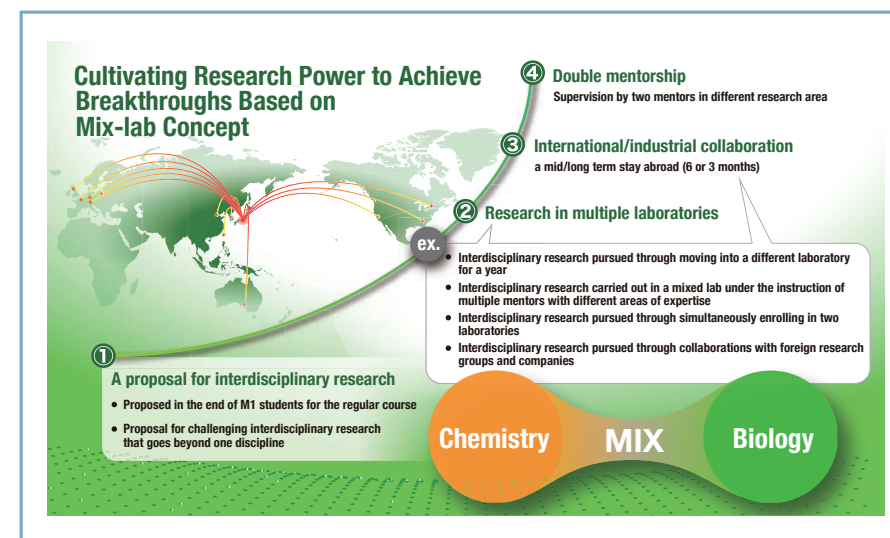
Doctor of Science, Doctor of Engineering, Doctor of Agricultural Sciences, Doctor of Pharmaceutical Sciences. Completion of "Graduate Program of Transformative Chem-Bio Research" is noted on the diploma.

[Office and section in charge] The GTR Student Support Office  
[Inquiries] 052-789-2954  
[URL] <http://www.itbm.nagoya-u.ac.jp/gtr/en/>

problems through free and open-minded discussions. The Graduate Program of Transformative Chem-Bio Research (GTR) intends to cultivate this research power to break through and train researchers who will advance interdisciplinary frontiers and create the knowledge of the future. Each year, GTR trains around 30 researchers who have acquired an excellent research power to break through and who challenge themselves to create new knowledge that will aid in the development of society.

### The "Mixed Lab" Concept offers optimal opportunities

GTR consists of three pillars of programs and courses. A high degree of expertise is required for conducting high-quality cutting-edge research, and a broad range of knowledge must be acquired with curiosity to launch into different fields of study. To achieve this, GTR provides a curriculum aimed at developing foundational strengths, covering a wide range of disciplines including material transformation/functions, advanced nano-measurement, chem-bio/drug discovery, systems life science, neuroscience, and biomass/breeding. GTR also offers a course for cultivating comprehensive research power. With a variety of activity plans, the course develops foresight, inventiveness, research creativity, ability to create personal connections, human networks, and an international mindset. The last and the most



The research power to break through via the mixed lab concept involves four steps: early proposal of interdisciplinary study, research in a different environment, working in foreign organizations, and receiving guidance from two mentors.

important of the three is the program for developing research power to break through.

The Institute of Transformative Biomolecules (ITbM), the parent organization of GTR, has produced many prominent findings that could have been materialized only through interdisciplinary research in chemistry and biology. The key to success lies in the mixed lab concept, in which researchers of different disciplines work together to generate innovative ideas through daily discussions, and then collaborate to realize these ideas. The mixed lab, which allows world-class researchers to enthusiastically work on interdisciplinary studies, offers an optimal opportunity for researchers in training. The

GTR program further expanded the mixed lab concept to develop research power to break through. This program encourages students to create a proposal for interdisciplinary research at an early stage so that they establish a strong mindset for crossing boundaries. They are then required to do a joint study in an interdisciplinary environment (in multiple laboratories) with a foreign collaborating institution or a company. At the final stage, students complete their doctoral dissertation under the guidance of two mentors. Thus, GTR trains capable researchers who will play a pivotal role in the next generation, making full use of the know-how accumulated in ITbM in its realization of the mixed lab concept.

### DATA

[Number of scheduled student recruitments] 30  
[Number of anticipated program graduates] 30  
[Number of people engaged in the program] 68  
[Students' affiliated schools and departments]  
4 graduate schools, 10 departments  
<Graduate School of Science> Material Science (Chemistry), Biological Science  
<Graduate School of Engineering> Molecular and Macromolecular Chemistry, Materials Chemistry, Biomolecular Engineering  
<Graduate School of Bioagricultural Sciences> Forest and Environmental Resources Sciences,

Plant Production Sciences, Animal Sciences, Applied Biosciences  
<Graduate School of Pharmaceutical Sciences> Basic Medicinal Sciences  
[WISE Cooperating Institutions]  
3 public research institutes, 1 university, 3 companies, 1 organization  
Institute for Molecular Science, National Institutes of Natural Science / National Institute for Basic Biology, National Institutes of Natural Science / the Graduate University for Advanced Studies / Institute of Physical and Chemical Research / Kaneka Co. / Konica Minolta,

Inc. / Japan Tobacco Inc., Plant Innovation Center / ITbM-GTR consortium

### Message from WISE Cooperating Institution



SHINOZAKI Kazuo  
Senior Advisor, RIKEN Center for Sustainable Resource Science

### Jointly training researchers able to solve global environmental issues

Institute of Transformative Biomolecules (ITbM), the parent organization of Graduate Program of Transformative Chem-Bio Research (GTR), and RIKEN Center for Sustainable Resource Science (CSRS) have been holding joint workshops every year since 2015, pursuing a broad range of joint research and promoting personnel exchanges. Through our concerted efforts with GTR, CSRS intends to contribute to fostering excellent researchers who are capable of solving global environmental and resource-related problems.

### Student's Voice



KINOSHITA Satoru  
Nagoya University, Graduate School of Science, Division of Biological Science, 2nd year of Ph.D. course

### GTR helps students grow to overcome limitations in research

I joined GTR to gain the ability to develop my own research. A fascinating aspect of GTR is that I can broaden my research from various perspectives through discussions with people in different fields, especially when I have identified a new and interesting aspect of my research. In addition to my research experiences, I also had valuable opportunities such as joining an entrepreneurship training camp in the U.S. and launching several student-initiative events. I have learned a lot since I joined GTR.



## DII (Deployer-Innovator-Investigator) Collaborative Graduate Program for Accelerating Innovation in Future Electronics

[Program Coordinator] AMANO Hiroshi (Professor, Director of the Institute of Materials and Systems for Sustainability Center for Integrated Research of Future Electronics, Nagoya University)



### Message from the President



MATSU Seichi  
President, Nagoya University

### Fostering of diverse doctoral human resources who connect science and technology to innovation

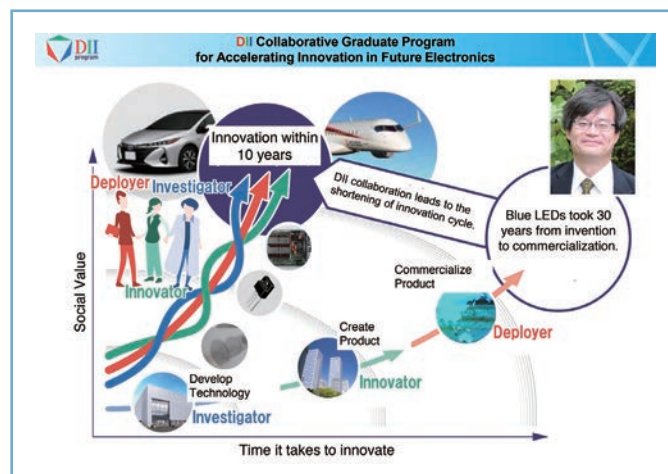
Making effective use of scientific discoveries in society is extremely difficult and takes time. It is also difficult to achieve on your own. To overcome these challenges, the DII (Deployer-Innovator-Investigator) program fosters leaders in the field of electronics from three types of perspective: human resources who explore challenges in this field to promote research, human resources who translate research results into specific products, and human resources who create social value and start businesses. To this end, we have developed a system of collaboration with industry, national research institutes, overseas research institutes, and universities and also launched the Doctoral Education Consortium. We will make every effort to promote the project with the hope that it will foster outstanding human resources needed by the world.

### Accelerating product innovation from 30 years to 10 years

In this program, on the basis of his experience that it took 30 years from the start of research and development on gallium nitride crystal to practical use of blue LEDs, Prof. Hiroshi Amano (Program Coordinator) fosters three types of human resources who will play different roles in the rapid and continuous creation of product innovation in future electronics. Since the key for accelerating innovation is for three types of human resources, we named this "DII collaboration," with DII standing for Deployer, Innovator, and Investigator. Based on this idea (DII), the program offers curriculums to nurture excellent human resources according to the vision of the future imagined by each student while improving abilities in one's field of expertise and acquiring experience, as well as developing the ability to work

collaboratively in teams with different types of human resources. This program accepts students with a keen interest in manufacturing and products. More specifically, in addition to basic academic skills necessary to acquire high levels of expertise and comprehensive capabilities, as well as the motivation to explore the frontiers of engineering and create new value, the following four items are added as qualifications of students for participating in the program: (1) a higher level

of basic academic capabilities; (2) strong motivation and enthusiasm to explore and practice leading-edge engineering and disseminate it in society; (3) the ability to



To complete the acceleration of product innovation, which used to take 30 years, within 10 years through collaboration between the three types of human resources (DII)

### [Fields of diplomas]

Doctor of Engineering

Name of the program to be noted: Completion of DII Collaborative Graduate Program for Accelerating Innovation in Future Electronics

[Office and section in charge] DII Office

[Inquiries] 052-747-6985

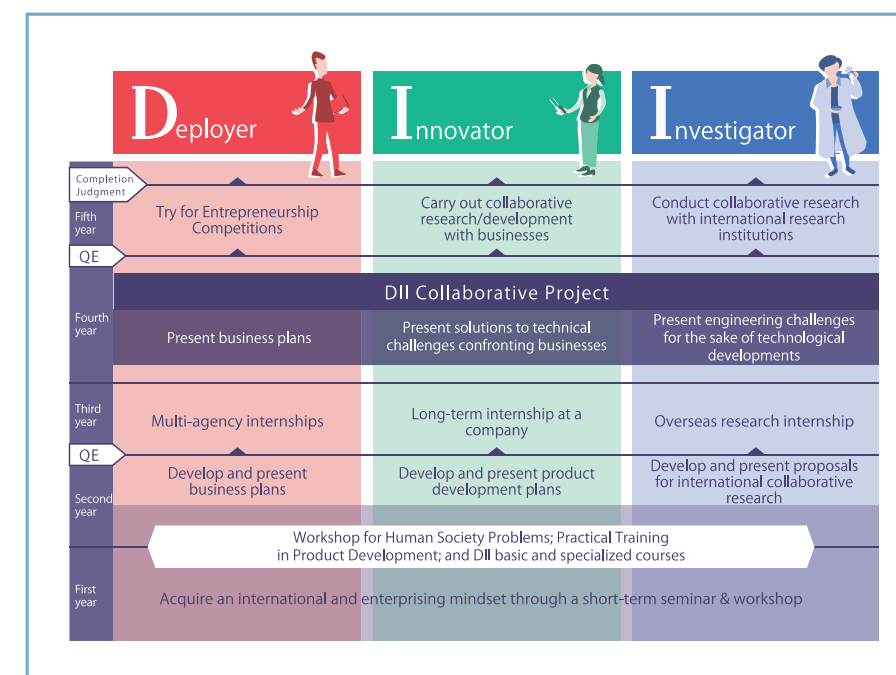
[URL] <https://www.dii.engg.nagoya-u.ac.jp/en/>

discuss, disseminate information and practice in the international arena; and (4) the initiative to take proactive and independent actions.

### Close guidance by industry-government-academic collaboration

In this program, researchers and engineers from companies, national research institutes and other institutions serve as mentors and provide students with direct guidance over a long period of time. All students participate in the short-term overseas internship immediately after the start of the program. In the second half of the second year, each student selects courses from among those aimed at each Deployer, Innovator, and Investigator type and works to acquire necessary skills. In the DII basic subjects, the environment for e-Learning will be enhanced for students to study anytime and anywhere. English-language education and transferable skills training will also be provided to improve students' international communication skills. In the Workshop for Human Society Problem Challenge, leading figures in a variety of industries are invited to give lectures to allow students to learn about the various challenges related to the creation of future electronics as well as ideas and technologies to solve them.

In Long-term Internship, students study in host organizations for six months. Deployer course students visit multiple organizations, such as venture companies, to establish a variety of personal relationships and develop



Curriculum to acquire reliable basic skills to conduct the DII Collaborative Project and improve skills in fields of expertise according to the three types

their international perspectives, foresight, and planning abilities. The Innovator course offers a long-term internship at a company where students learn about the key points for completing product development and aim to launch collaborative research. Investigator course students take up long-term residence and conduct collaborative research at overseas institutes. They deepen their studies, develop the foundation for international collaborative research, and write international co-authored papers.

The DII Collaborative Project in the fourth year is the program's most ingenious initiative and aims to enable students to experience DII collaboration and understand the importance of cooperation. Teams of different types of DII students are formed based on the abilities, knowledge and experience they obtained through their internships, and they work together to solve challenges for future electronics in the real world.

### DATA

[Number of scheduled student recruitments] 15-23  
[Number of anticipated program graduates] 18-23  
[Number of people engaged in the program] 101  
[Students' affiliated schools and departments] 1 graduate school, 13 departments  
<Graduate School of Engineering> Electronics, Electrical Engineering, Information and Communication Engineering, Materials Physics, Applied Physics, Materials Process Engineering, Materials Design Innovation Engineering, Chemical System Engineering, Mechanical Systems Engineering, Aerospace Engineering, Micro-Nano Mechanical Science and Engineering,

Energy Engineering, Applied Energy  
[WISE Cooperating Institutions] 3 universities, 3 overseas research institutes, 3 domestic research institutes, 18 companies  
Innovation for High Performance Micro-electronics / Interuniversity Microelectronics Center / Office ATOQS / Japan Aerospace Exploration Agency / National Institute for Materials Science / National Institute of Advanced Industrial Science and Technology / KAPION Inc. / SCIOCS COMPANY LIMITED / DENSO CORPORATION / TOSHIBA CORPORATION / TOYOTA CENTRAL R&D LABS., INC. / Hitachi, Ltd. Central

Research Laboratory / FUJITSU LABORATORIES LTD. / Miraiproject Corporation / Sumitomo Electric Industries, Ltd. / National University of Singapore / TAIYO NIPPON SANSO CORPORATION / Tokyo Electron Ltd. / TOYODA GOSEI CO., LTD. / TOYOTA MOTOR CORPORATION / Nissan Motor Co., Ltd. / Furukawa Electric Co., Ltd. / Mitsubishi Electric Corporation / Nanjing University / Japan Venture Capital Association / NC State University / Forschungszentrum Jülich

### Message from WISE Cooperating Institution



MAKINO Takahiro  
Founder / Owner, Miraiproject Corporation

### Expectations for developing persons with flexible thinking and empathy

In times of rapid change, there is an impression that empathetic managers, along with strong leadership, are growing new businesses. Commercializing cutting-edge research and development that will change the future involves a great deal of risk, so empathetic persons are needed to make multiple companies, universities, and countries want to cooperate with each other. I would like to be continuously involved in this graduate program with a strong awareness of the fact that many persons will stand out with flexible thinking and empathy.

### Student's Voice



HOSHINO Sena  
Department of Materials Physics, Graduate School of Engineering, Nagoya University - 2nd year Master's Program

### Acquiring experiences of collaborating from practical learning

When it comes to innovations, many people focus on the cross-disciplinary cooperation. However, DII program has a belief that another essence for innovations is a collaboration between three types of personnel, namely D, I and I. I empathized this policy, so I joined this program. Our program provides opportunities to create products like a light emitting device by team. Through the curriculums we can not only broaden our knowledge but also learn the significance of collaborations.



# Innovation of Advanced Photonic and Electronic Devices

[Program Coordinator] KIMOTO Tsunenobu (Professor Graduate School of Engineering, Kyoto University)

## Message from the President



MINATO Nagahiro  
President, Kyoto University

Through the WISE Program, Kyoto University seeks to cultivate advanced “knowledge professionals” who will play key roles in industry, academia, and government.

In 2017, Kyoto University was granted Designated National University Corporation (DNU) status by the Japanese government. One of the four pillars of the university's DNU strategy is “fostering the next generation of researchers and promoting the international mobility of young researchers.” Under the DNU initiative, the university is making efforts to further internationalize its education, foster diverse human resources, and recruit excellent human resources in order to generate a high-level flow of talent.

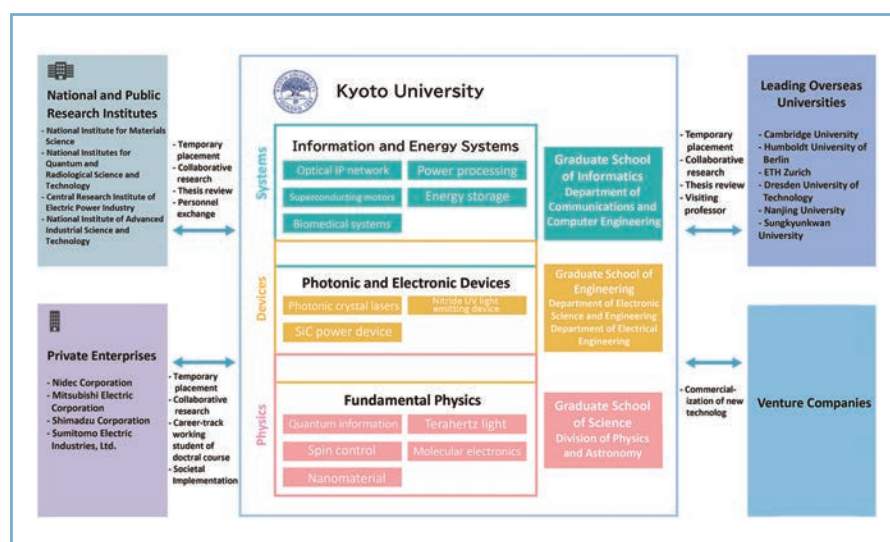
In line with its DNU strategy, the university continues to provide unique high-quality programs under the government's Doctoral Program for World-leading Innovative & Smart Education (WISE Program). The programs are provided in close cooperation with leading companies and world-class research institutes in Japan and leading universities around the world with the aim of cultivating advanced “knowledge professionals” and promoting the reform of the university's graduate schools.

## Objective

Human society is currently entering a period of significant transformations focused on electronics such as the IoT (Internet of Things) revolution, wearable information devices, self-driving and electric cars, and smart grid. In such a society, many high-performance photonic and electronic devices function as the core of the hardware while being integrated, and require further performance enhancement and creation of new functions in the future. On the other hand, the explosive expansion of knowledge, due to advances in science and technology in recent years, has given rise to the problem of a lack of comprehensive outlook as a significant subdivision of specialized fields was developed. In particular, it is considered that specialized education in a specific discipline

is not enough to solve issues of a wide range of fields of human society such as advanced information-oriented society, environment,

energy, and artificial intelligence. It is essential to nurture talents who can make right decisions while looking at everything, from



Scheme of Innovation of Advanced Photonic and Electronic Devices

## DATA

[Number of scheduled student recruitments] 20  
[Number of anticipated program graduates] 5-20  
[Number of people engaged in the program] 38  
[Students' affiliated schools and departments] 3 graduate schools, 4 departments  
<Graduate School of Engineering> Electronic Science and Engineering, Electrical Engineering  
<Graduate School of Science> Physics and Astronomy  
<Graduate School of Informatics> Communications and Computer Engineering  
[WISE Cooperating Institutions] 6 universities, 2 organizations, 2 public research

institutes, 4 private enterprises  
University of Cambridge / Humboldt University of Berlin / ETH Zurich / Dresden University of Technology / Nanjing University / Sungkyunkwan University / National Institute for Materials Science / National Institutes for Quantum and Radiological Science and Technology / Central Research Institute of Electric Power Industry / National Institute of Advanced Industrial Science and Technology / Nidec Corporation / Mitsubishi Electric Corporation / Shimadzu Corporation / Sumitomo Electric Industries, Ltd.

## [Fields of diplomas]

Doctor (Engineering), Doctor (Science), Doctor (Informatics)

Name of the program to be noted: Innovation of Advanced Photonic and Electronic Devices Doctoral Program

[Office and section in charge] Innovation of Advanced Photonic and Electronic Devices Doctoral Program for World-leading Innovative & Smart Education Office  
[Inquiries] 075-383-2494  
[URL] <http://www.e-takutsu.ceppings.kyoto-u.ac.jp/>

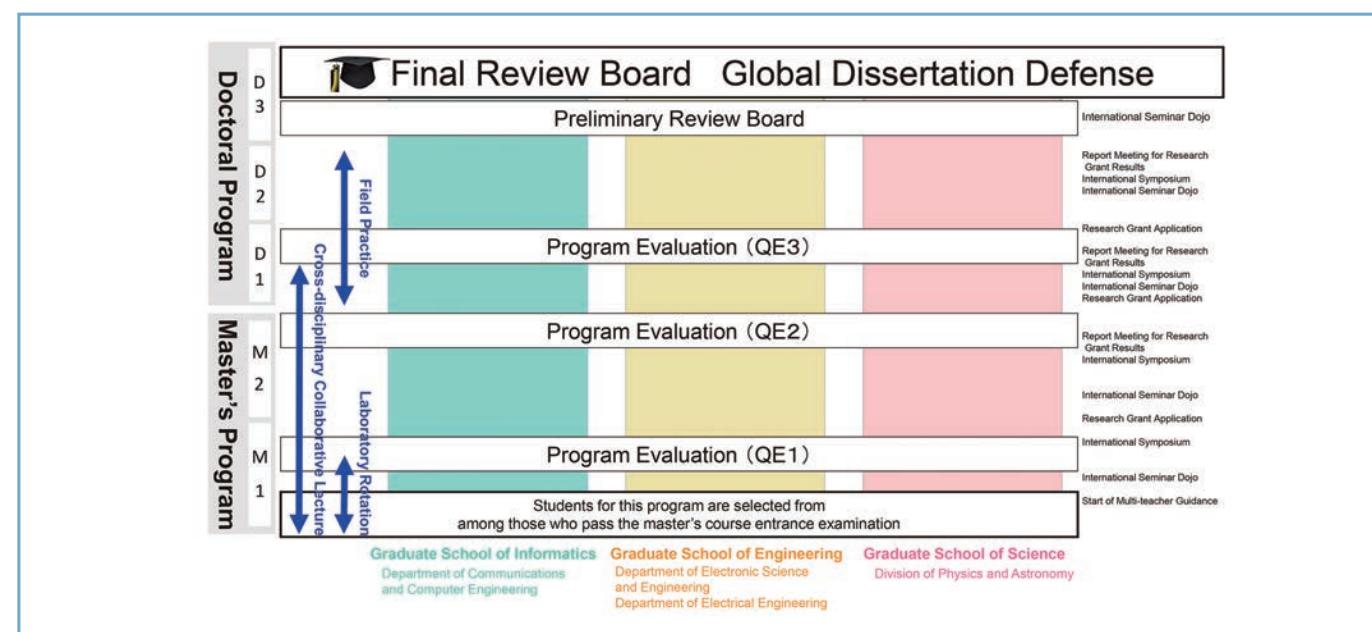


Image of Master's / Doctoral Education and Degree Examination

fundamental theories to system application, with a holistic perspective, resolve challenging issues, and lead the critical fields in the future.

At Kyoto University, we have our original scientific concepts and key technologies that should be called "Originated in Our University". This WISE program promotes combined and vertically integrated education focused on the field of photonic and electronic devices, extending from deepening the understanding of fundamental physics and theory to the management and application of systems and information. Also, we collaborate with private enterprises representing Japan around the

world, national and public research institutes with the highest level of research capabilities, and top-class and leading overseas universities. Moreover we systematically implement education and quality assurance of a global standard and raise world-class professionals of knowledge who create "Advanced Photonic and Electronic Devices" through an integrated 5-year doctoral degree program.

## Nurture Talent

With the common philosophy of "Challenging

the physical limits and developing an information-oriented and energy-saving society", the WISE Program (Doctoral Program for World-leading Innovative & Smart Education) aims at nurturing international pioneers who can lead the field of advanced photonic and electronic devices as well as related academic fields, specifically, those with the following abilities.

1. Originality
2. Holistic perspective
3. Challenge ability
4. International mindedness
5. Self-dependence

## Message from WISE Cooperating Institution



OHSHIMA Takeshi  
Director, Department of Advanced Functional Materials Research/Quantum Brain Science Research Directorate/National Institutes for Quantum and Radiological Science and Technology

Contributing to human resource development at the WISE Program "Innovation of Advanced Photonic and Electronic Devices" with External Stimulation

I am aware that the development of professionals of knowledge is steadily conducted by the multidisciplinary education and research beyond the framework of research fields, institutions and countries. As a researcher belonging to a collaborative institution that conducts research and development from basics to applications in the fields such as quantum beams, nuclear fusion, materials science, life science, and medicine, we would like to provide students with opportunities to gain various experiences, giving a good stimulus.

## Student's Voice



HARA Masahiro  
Graduate School of Engineering, Department of Electronic Science and Engineering, 2nd year master's student

New ideas come up through interaction with researchers in various fields

I decided to join this program attracted to crosscutting education, which is one of the features of this program. I've been engaging in fundamental research on semiconductor material and device. Even though my research interests mainly include basic material properties, I feel it is essential to always think about how my research will make practical devices or systems better. I believe this program will give me a valuable experience to get acquired such a wide perspective toward academic discipline not limited to my research field.



# Transdisciplinary Program for Biomedical Entrepreneurship and Innovation

[Program Coordinator] KANAI Yoshikatsu (Professor, Graduate School of Medicine, Osaka University)

## Message from the President



NISHIO Shojiro  
President, Osaka University

Offering a new program to train doctoral students with practical research and entrepreneurial (social implementation) skills to drive innovation in medical, dental, pharmaceutical, and life sciences

Under the OU (Osaka University) Vision 2021, Osaka University aims to be a world-leading university that contributes to social transformation. Our unique coursework in this program fosters students' practical research skills to achieve internationally superior research results in the fields of medical, dental, pharmaceutical, and life sciences, as well as entrepreneurial (social implementation) skills to effectively translate their research results to society using those practical research skills. The program started with 17 students in 2019, while 28 new students joined in 2020. The courses offered will help them become doctoral students who will contribute to the prosperity of our society, such as by improving the quality of life (QOL) and eradicating the threat of various diseases. Osaka University aims to expand its innovation through this program.

## Professionals with research & entrepreneurial skills

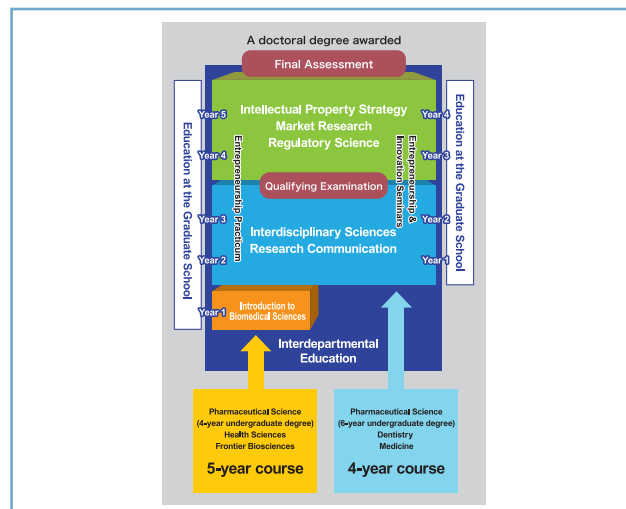
Japanese biomedical research, despite producing various original and internationally superior research findings, is lagging behind that of other countries in translating the results of basic research for application to the society. At Osaka University, we have been developing doctorally qualified human resources with practical research skills to produce internationally superior research results and oversee biomedical science, as well as entrepreneurial skills to implement the research results in society. Such human resources will be the experts in knowledge that are needed in this society.

Students develop their practical research skills through discussion with our outstanding researchers regarding the techniques to overcome scientific challenges. Moreover,

these discussions regarding the challenges they face in student-centered research, which is an education system unique to our graduate school, strengthens their practical research skills. In addition, students develop an ability to examine their research by interacting with researchers working in fields different from their own, making them aware not only of advanced scientific expertise but also of the uniqueness of their own research.

To develop their entrepreneurial skills, we offer lectures to provide students with detailed knowledge about the

market and needs analysis, intellectual property strategy, and regulatory science, which is later put into practice by students.



Students receive training for "practical research skills" and "entrepreneurial skills" in addition to the conventional education received in graduate school.

## DATA

[Number of scheduled student recruitments] 15-30  
[Number of anticipated program graduates] 20  
[Number of people engaged in the program] 117  
[Students' affiliated schools and departments] 4 graduate schools, 6 departments  
<Graduate School of Medicine> Medicine, Health Sciences  
<Graduate School of Dentistry> Oral Science  
<Graduate School of Pharmaceutical Sciences> Medical Pharmacy, Advanced Pharmaco-Science  
<Graduate School of Frontier Biosciences> Frontier Biosciences

[WISE Cooperating Institutions] 15 companies, 1 independent administrative agency, 1 national institute, 1 national research and development agency, 1 local public body, 1 government agency  
Pfizer Inc. / Novartis Pharma K.K. / Johnson & Johnson Innovation / IQVIA Solutions Japan K.K. / Bayer Yakuhin, Ltd. / Eli Lilly Japan K.K. / Chugai Pharmaceutical Co., Ltd. / Otsuka Pharmaceutical Co., Ltd. / Shionogi & Co., Ltd. / Daiichi Sankyo Company, Limited / Mitsubishi Tanabe Pharma Corporation / Cytiva / SYSMEX CORPORATION / Takara Bio Inc. / Quantum Operation, Inc. / Osaka

Prefectural Government, Department of Commerce, Industry and Labor / Pharmaceuticals and Medical Devices Agency / National Institute of Health Sciences / National Institutes of Biomedical Innovation, Health and Nutrition / Japan Patent Office

## [Fields of diplomas]

Ph.D. (Medicine), Ph.D. (Health Sciences), Ph.D. (Nursing), Ph.D. (Dentistry), Ph.D. (Pharmaceutical Sciences), Ph.D. (Pharmacy), Ph.D. (Frontier Biosciences), Ph.D. (Science), Ph.D. (Engineering)  
Name of the program to be noted: Completion of Transdisciplinary Program for Biomedical Entrepreneurship and Innovation

Furthermore, by visiting the companies and business ventures that participate in social implementation of research findings, students cultivate a bold attitude that involves taking high risks and learn social implementation through their experience.

Quality Assurance of the Degree

At the end of the 3rd year of the 5-year program (the 2nd year of the 4-year program), students will take the Qualifying Examination (QE). In the QE, practical research skills acquired through practice will be assessed by examining originality and international competence in research that will lead to social implementation. At the end of the program, students will take the Final Assessment. In the assessment, entrepreneurial skills will be assessed. Students present own research for its implementation to society and its problem-solving plan. In addition, students defend their doctoral thesis at the graduate school of their affiliation.

## A global academia-industry-government network

To foster "experts in knowledge" who translate research results for application in the society based on their ability to investigate biomedical science, we must work with other graduate schools and introduce education that is linked to society, in addition to offering the conventional specialized education provided in graduate schools.

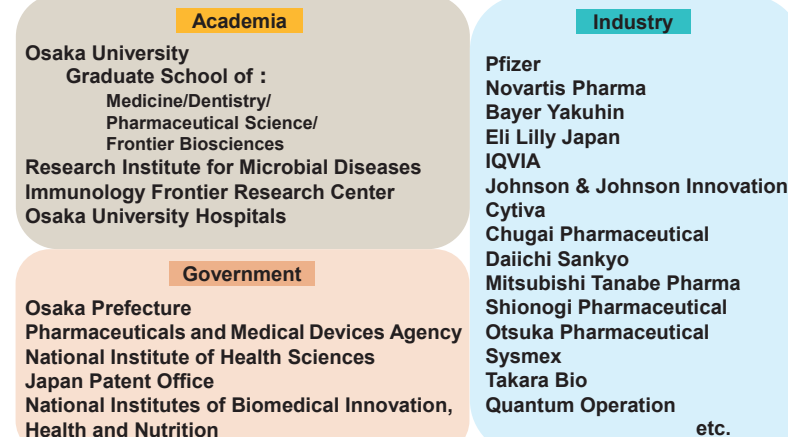
Therefore, our program promotes education



大阪大学 卓越大学院プログラム  
生命医学の社会実装を推進する卓越人材の涵養  
Transdisciplinary Program for Biomedical Entrepreneurship and Innovation

[Office and section in charge] Administrative Office for the Transdisciplinary Program for Biomedical Entrepreneurship and Innovation (WISE), Graduate School of Medicine  
[Inquiries] 06-6210-8231  
[URL] <http://www2.med.osaka-u.ac.jp/bei/en/>

## A global academia-industry-government network



We promote an education system in which industry, government, and academia together develop qualified doctoral human resources possessing both practical research skills and entrepreneurial skills.

through a global academia-industry-government network.

Osaka University has many scientists who lead cutting-edge research and produce internationally outstanding research results in areas such as immunology and autophagy. This provides students with an environment in which their practical research skills are strengthened through active cross-departmental research and education. In partnership with the Graduate School of Medicine, Dentistry, and Life Sciences, Research Institute for Microbial Diseases, Immunology Frontier Research Center, Osaka

University Hospital, and Dental Hospital, we encourage students to develop their "practical research skills," which is the ability to consider biomedical science and perform basic research. Furthermore, Osaka Prefecture, PMDA, National Institute of Health Sciences, National Institute of Biomedical Innovation, Health and Nutrition, and Japan Patent Office; domestic and overseas large pharmaceutical companies; and bio-ventures participate in our education activities, providing students with various opportunities to develop their "entrepreneurial skills".

## Message from WISE Cooperating Institution



SHIMIZU Takeshi  
IQVIA Solutions Japan K.K.  
Management Consulting Senior Principal, Head of Management Consulting

## Core human resources through the transformation of healthcare industry

The healthcare industry is at a transformational stage and has new paradigms such as preventive, regenerative medicine, and digital treatment as well as uses new diagnostics, treatments, and compound-derived drugs. This program represents a valuable opportunity to develop a complex mindset for dealing with situations in which drastic changes in success models could occur, and for dealing with changes caused by financial pressure such as an increase in the elderly population or a higher cost of drug development.

## Student's Voice



HIRATO Yumi  
Second year in the Master Course, Advanced Pharmaco-Science, Graduate School of Pharmaceutical Sciences, Osaka University

## Bring our research results to society and build a wide network

I decided to join this program because I believe that not only research skills but also the skills and mindsets to return research findings to society are crucial for future researchers. The program provides an environment in which we can improve our ability to incorporate research results to society. Moreover, the wide network of faculty members in industry, government, and academia, and the interactions between students, have offered me valuable opportunities to broaden my horizons.



# The Frontier Development Program for Genome Editing

[Program Coordinator] YAMAMOTO Takashi (Professor, Graduate School of Integrated Sciences for Life, Hiroshima University)

## Message from the President



OCHI Mitsuo  
President of Hiroshima University

## Welcome to Hiroshima University: 'The Frontier Development Program for Genome Editing' on the theme of 'Developing a Future Society with Genome Editing'

Two female scientists have been awarded The Nobel Prize in Chemistry 2020 for the development of a new method for genome editing that can rewrite the genetic code of life. Now, the method is drawing attention worldwide as it is thought to bring a revolution to life science.

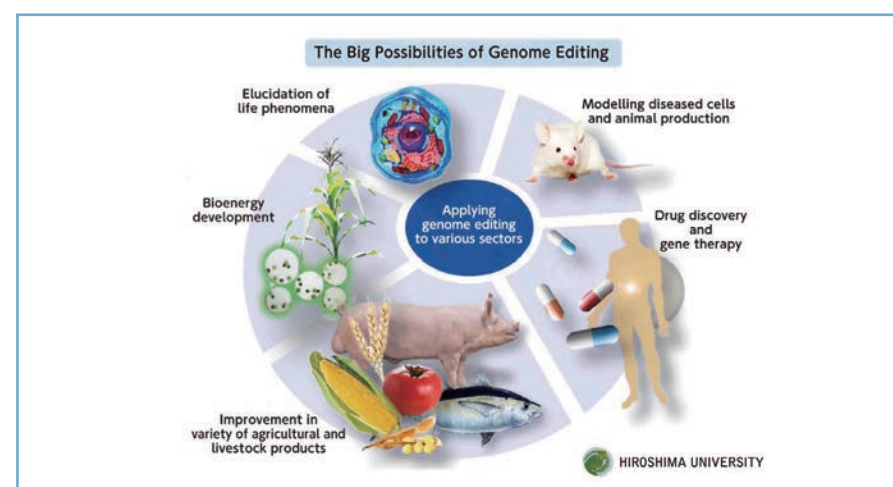
Coupled with some of the top-class researchers in Japan in the field of genome editing, Hiroshima University has been promoting various projects as it intends to become one of the leading institutions in Japan for the education of genome editing. While making sure to take a reasonable care for implementing genome editing research in terms of clearing its safety and ethical issues, the program above focuses on developing researchers who will lead the future of genome editing research in the world with a view to successfully designing their career path. The university is hoping to attract well-motivated students who are capable of creating new industries that can unlock world's future.

## What are the capabilities trained by the program?

Genome editing, which is a new technology to freely modify various organisms' genomic information by using artificial DNA-cutting enzymes (genome editing tools), has rapidly expanded in recent years. This is due to technologies that can be used in a wide range of applications, from microbes to animals and plants, as well as the fact that competition to develop the technologies has been intensifying. It is imperative to promote research and development in genome editing for industrial and medical applications such as selective breeding, drug discovery, and gene therapy, in addition to basic research with ethical considerations in mind in Japan. In particular, the cutting-edge research style has changed a lot with the development of

CRISPR-Cas9, a new genome-editing tool introduced in 2012. While genome editing using CRISPR-Cas9 is becoming more popular

in Japan at a constant speed due to its simplicity, there are only a few developers and experts on Japan's unique genome editing



Genome editing is expected to be an available technique to use from basic research to various applicable fields (Development of biofuels from algae, improvement of useful species, drug discovery, and gene therapy)

## DATA

[Number of scheduled student recruitments] 11  
[Number of anticipated program graduates] 1-11  
[Number of people engaged in the program] 63  
[Students' affiliated schools and departments]  
2 graduate schools, 2 departments  
<Graduate School of Integrated Sciences for Life>  
Integrated Sciences for Life  
<Graduate School of Biomedical and Health Sciences>  
Biomedical Sciences  
[WISE Cooperating Institutions]  
3 universities, 1 company  
Center for iPS Cell Research and Application,

Kyoto University / Graduate School of Technology, Industrial and Social Sciences, Tokushima University / Department of Molecular and Cellular Biology, Harvard University / Technical Research Center, Mazda Motor Corporation



The Frontier Development Program for Genome Editing

[Office and section in charge] Collaboration Office, Education Office, Hiroshima University  
[Inquiries] 082-424-4676  
[URL] <https://genome.hiroshima-u.ac.jp/en/index.html>

## [Fields of diplomas]

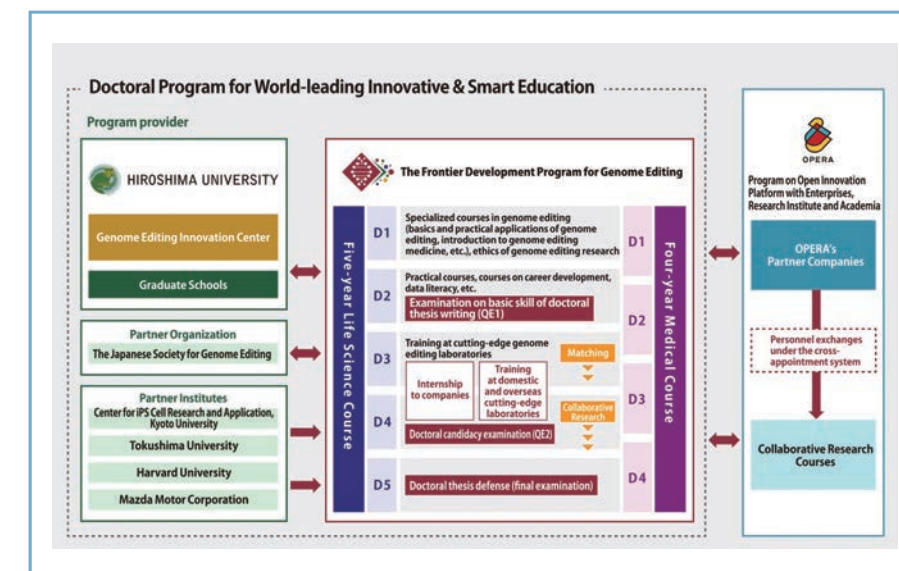
Doctor of Philosophy in Science, Doctor of Philosophy in Engineering, Doctor of Philosophy in Agriculture, Doctor of Philosophy, Doctor of Philosophy in Medical Science, Doctor of Philosophy in Dental Science, Doctor of Philosophy in Pharmaceutical Science  
Name of the program to be noted: The Frontier Development Program for Genome Editing

technology. Despite this situation, genome editing technology's intrinsic value is its use in genetic engineering and disease treatment in biological species that have been difficult to modify genetically up until now, and possibly for industrial applications.

Hiroshima University is one of Japan's leading universities in genome editing research and is affiliated with several core researchers who run The Japanese Society for Genome Editing. Moreover, Program on Open Innovation Platform with Enterprises, Research Institute and Academia (OPERA) has conducted with companies in a variety of fields for the project of developing the basic technologies to use industrial genome editing and also advanced the research and development, including human resources development and career path formation in collaboration between industry and academia. According to a curriculum conducted by top national and international genome editing researchers, this program develops human resources that can respond flexibly to industrial structure changes based on new industries and social trends to them.

## Courses offered: Life Science Course / Medical Course

This program has two courses and after the third year under the organizational structure to experience the speed of cutting-edge research, features the development of advanced and practical research and



The program aims to foster scientists and developers who play a role in creating new genome editing industries. (Industrial technology / Basic technology developers, Drug discovery / therapeutic scientists, Entrepreneurs of related ventures)

development abilities by acquiring the ability to develop in society (the ability to implement in society) through collaborative research with OPERA participating companies and partner institutes.

### ① Overview of Life Science Course

This course is a five-year degree program (transfer students can also take this course from their third year). We develop the leading-edge human resources for future genome editing by teaching students the basic to advanced knowledge and skills of genome editing in the first and second year, from the third year with practicing research to utilize the acquired knowledge and skills through

basic courses and internships for social implementation.

### ② Overview of Medical Course

This course is a four-year degree program. We develop the advanced human resources for genome editing working in the field of related medicine through advanced training at partner institutions in Japan and abroad while practicing doctorate thesis research using the acquired knowledge and skills after systematically learning the basic to advanced knowledge and skills of genome editing in the first and second year.

## Message from WISE Cooperating Institution



TAKAMI Akihito  
Supreme Principal Engineer, Technical Research Center, Mazda Motor Corporation

## Genome editing technologies show great promise

Mazda Motor Corporation collaborated with Hiroshima University and the Tokyo Institute of Technology for studying bio-derived liquid fuel to produce renewable biomass (microalgae) as an alternative to fossil fuels such as gasoline and diesel fuel, for the realization of a sustainable automobile society.

Genome editing technologies are innovative technologies which hold promise in dramatically improving microalgal productivity, which is an issue with microalgal bio-derived liquid fuel.

## Student's Voice



ICHIKAWA Kennosuke  
2nd year student, Doctoral Course in the Graduate School of Integrated Sciences for Life, Hiroshima University

## Learn genome editing technologies with a broader perspective

I have joined this program to gain a wide range of knowledge about genome editing technologies and apply it to my own research. One of this program's features is that I will be able to interact with researchers who utilize genome editing technologies in various fields. The interaction with researchers in different fields is a very good chance to look at the future of my own research from a bird's eye view; I am joining this program so that I will continue to be inspired every day.



## Global Health Elite Programme for Building a Healthier World

[Program Coordinator] ARIYOSHI Koya (Professor, Department of Global Health, School of Tropical Medicine and Global Health, Nagasaki University)

### Message from the President



KOHNO Shigeru  
President of Nagasaki University

Promoting human health and peace, and pursuing research that contributes to the improvement of global health through the study of science

We believe that being selected as part of the WISE Program offers students an important opportunity to assist Nagasaki University (NU) in achieving its goal "to become a world-class center of "global health" education and research that contributes to human health on a global scale". In order to innovate graduate school education, it is important that this programme strives to become a driving force that can effectively strengthen the education systems of the university. Having the strong partnership between NU School of Tropical Medicine and Global Health and London School of Hygiene and Tropical Medicine as a foundation of our WISE Programme, we are committed to foster leaders in the field of global health through working in collaboration with both internal and external research institutions. We believe that the focus of the programme to train experts with hands-on experience is very important in addressing health challenges and improving health worldwide from a global perspective.

### Train global health professionals who can build a healthier world

In the 21st century, the globalization of economy, industry and distribution has rapidly progressed. This rapid growth in globalization has caused both social and environmental issues to increase which requires global attention. In particular, emerging and re-emerging infectious diseases such as HIV/AIDS, Ebola virus disease and Malaria have become global health issues and cause for concern throughout the world. Hence, we believe there is an urgent need to promote global health and encourage international societies to work together to eliminate the problems we are facing on a global scale.

In order to contribute to solving these global issues, Nagasaki University (NU) has launched a degree programme, WISE Programme ("Doctoral Programme for World-

leading Innovative and Smart Education") through affiliation with internationally renowned institutions in global health, the London School of Hygiene and Tropical

Medicine (LSHTM, UK). Having the NU School of Tropical Medicine and Global Health at its core, NU WISE Programme aims to foster leaders in global health with a mission to



Having Nagasaki University's long history in infectious disease research and education as a foundation, the Nagasaki University WISE Programme was established based on a strong collaboration between TMGH and LSHTM

### DATA

[Number of scheduled student recruitments] 50-55

[Number of anticipated program graduates] 5-12

[Number of people engaged in the program] 59

[Students' affiliated schools and departments]

5 graduate schools, 17 departments

<Graduate School of Global Humanities and Social Sciences> Department of Global Humanities and Social Sciences

<Graduate School of Engineering> Department of Advanced Engineering, Department of Science and Technology, Department of Advanced Technology and Science for Sustainable Development

<Graduate School of Fisheries and Environmental Sciences> Department of Fisheries Science, Department of Environmental Science, Department of Environment and Fisheries Resources, Department of Marine Science

<Graduate School of Biomedical Sciences> Health Sciences, Disaster and Radiation Medical Sciences, Medical and Dental Sciences, Infection Research, Life Sciences and Radiation Research, Advanced Preventive Medical Sciences, Pharmaceutical Sciences

<School of Tropical Medicine and Global Health> Department of Global Health, Nagasaki University - London School of Hygiene and Tropical Medicine Joint PhD Degree

Programme for Global Health

[WISE Cooperating Institutions]

4 universities, 1 Incorporated Administrative Agency, 1 National Research and Development Agency, 1 Corporate Company

London School of Hygiene and Tropical Medicine / Hokkaido University Research Center for Zoonosis Control / National Research Center for Protozoan Diseases, Obihiro University of Agriculture and Veterinary Medicine / School of International Health, Graduate School of Medicine, The University of Tokyo / National Center for Global Health and Medicine / JICA / Sysmex Corporation

### [Fields of diplomas]

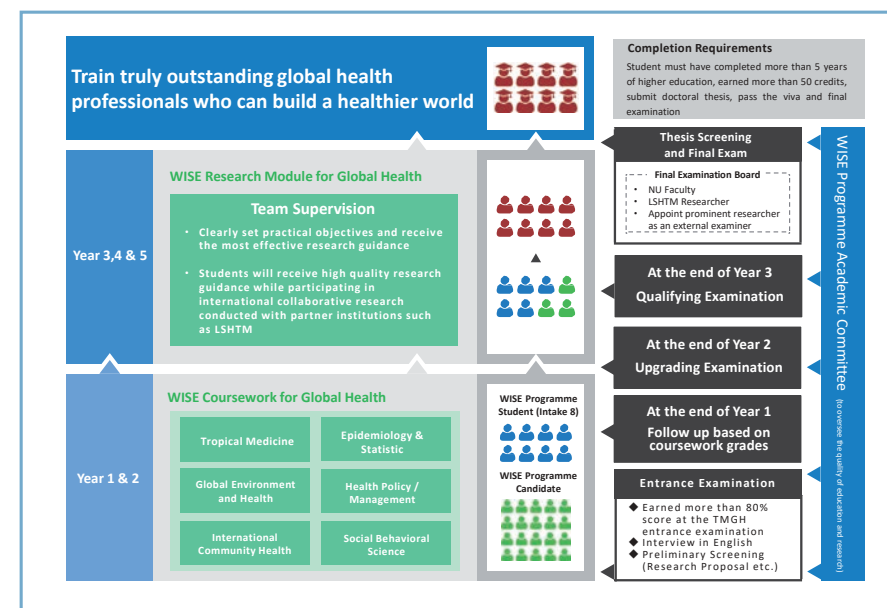
Doctor of Philosophy, Doctor of Philosophy in Medical Science, Doctor of Philosophy in Dental Science, Doctor of Philosophy in Pharmaceutical Science, Doctor of Philosophy in Engineering, Doctor of Philosophy in Environmental Science, Doctor of Philosophy in Fisheries Science, Doctor of Philosophy in Marine Science

Award title: "Global Health Elite Programme for Building a Healthier World"

"train global health professionals who can build a healthier world". Specifically, we focus on training leaders who have the ability to understand the health challenges on a field level and are dedicated to addressing health issues utilizing their academic knowledge and practical skills in areas such as global policy planning and implementation.

In addition to strengthening our collaboration with accredited international institutions such as LSHTM, we are dedicated to training leaders and pursuing common goals throughout the various internal departments such as Nagasaki University Institute of Tropical Medicine (Nekken), Graduate School of Biomedical Sciences and overseas research stations in Kenya, Vietnam and the Philippines. With our 75 year history and proven success in educating professionals in the field of infectious disease, we are committed to expanding both our education and research areas.

Furthermore, our mission is also focused on further developing our collaboration with external organizations such as Hokkaido University Research Center for Zoonosis Control; National Research Center for Protozoan Diseases, Obihiro University of Agriculture and Veterinary Medicine; School of International Health, Graduate School of Medicine, the University of Tokyo; National Center for Global Health and Medicine; JICA; Sysmex Corporation. Whilst strengthening relationships with our partner organizations, we aim to develop our programme so it functions



The WISE Programme ensures superior education and research in the area of global health through developing quality curriculum and holding regular upgrade and qualifying examinations

as a hub in the field of global health in Japan.

### Top-level education and research programme in global health

The Nagasaki University WISE Programme consists of a five-year doctoral programme. Up to the second year of the Master's degree programme, the lectures are focused on the coursework and are taught by faculty staff including practitioners whose specialized areas are cross-disciplinary and innovative. In particular, the Epidemiology and Statistics modules are taught using LSHTM teaching

materials and by LSHTM faculty staff invited to teach in Nagasaki. Furthermore, advanced modules have been established in order to meet course requirements and facilitate quality research.

From the third year onwards, students will focus on their research work. Each student is assigned a supervisory team. By assigning faculty members specializing in different areas of research, the programme aims to maintain a diversity so students can set practical objectives and receive the most effective research guidance from their experienced supervisory team.

### Message from WISE Cooperating Institution



Peter Piot  
Director of London School of Hygiene and Tropical Medicine

### Addressing global and public health challenges through high-quality research, education and innovation

We are proud to have a long-standing partnership with Nagasaki University, Japan's leading university in tropical medicine and global health. Our partnership reached a new milestone when we launched a Joint PhD programme for Global Health in 2017. We are excited by the selection of the Nagasaki University WISE Programme, which we believe further consolidate collaboration and nurture emerging research leaders who can address future global health issues.

### Student's Voice



KATSUNO Kei, MD, MPH  
NU-LSHTM Joint PhD Degree Programme for Global Health, Year 3

### Fight against infectious diseases - what does it take to advance global health R&D?

The global fight against infectious diseases continues to persist. Innovations to advance global health R&D are much needed. In this program, I aim to develop actionable strategies to expedite drug discovery and development for infectious diseases that primarily affect millions of people in low- and middle-income countries.



# Graduate Program for Power Energy Professionals

[Program Coordinator] HAYASHI Yasuhiro (Professor, Faculty of Science and Engineering, Waseda University)

## Message from the President



TANAKA Aiji  
President of Waseda University

Waseda University is leading an advanced graduate program in collaboration with 12 other universities, producing Ph.D. holders who will positively impact the future of energy

Waseda University provides the environment where professors and researchers conduct internationally significant researches, and where they reflect those results on education. Waseda plays a key role in collaborations with 12 other universities, private corporations, and international research institutions to develop international standards in graduate educational programs across disciplines. Consequently, we will be committed to pioneering future energy research that will contribute to human society. Even in the post COVID-19 society, Waseda will continue to develop new educational methods with new digital technology for our future students.

## Fostering doctoral resources to innovate power and energy

The world has seen emerging global trends such as the shift to digital and AI, and a focus on global environmental protection for the realization of a sustainable society. In response, the industry sector related to electric power and energy infrastructure is entering a period of structural transformation. Many technological innovations have been achieved, such as renewable energy and systems for its management; electric vehicles; storage batteries; and IoT. As a result, the energy supply sector has begun a shift to small-scale distributed work. Now there is an urgent need for unconventional transformation and reconstruction of energy networks.

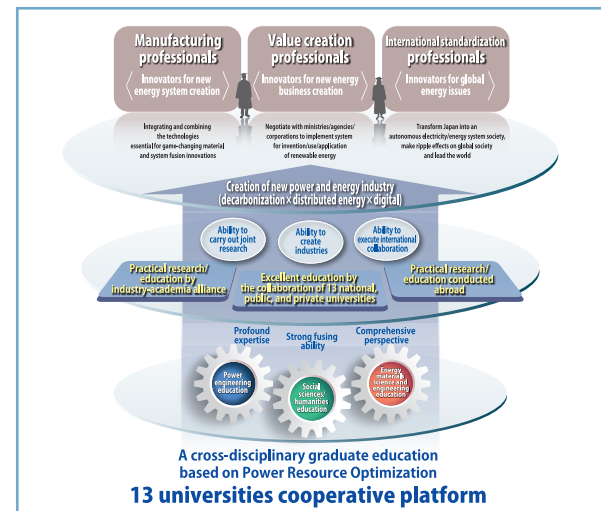
This program provides an inter-university platform for collaborative education and research among 13 national, public, and

private universities, so as to optimize the energy value chain, the core of Japan's future vision for Society 5.0, and to enable the creation of new industries.

The program promotes more practical education and research than usual, in collaboration with domestic and overseas companies and research institutes spanning numerous energy fields.

We envision a new generation of advanced intellectual professionals who will design the future society, particularly: 1) manufacturing professionals who can innovate new energy systems; 2) business creation professionals

who can innovate new energy business models; and 3) international standardization professionals who can innovate global energy



Graduate School Platform for 13-University Collaboration: A human resource development scheme that will contribute significantly to the creation of new electric power and energy industries.

## [Fields of diplomas]

Doctor of Science, Doctor of Engineering, Doctor of Information Science, Doctor of Philosophy, Doctor of Philosophy (Engineering), Doctor of Philosophy in Engineering, Doctor of Philosophy at the Graduate School of Information Science and Technology  
Graduates will receive certificates of program completion, awarded jointly by all 13 universities.

[Office and section in charge] PEP Program Administration Office  
[Inquiries] 03-5286-3238  
[URL] <https://www.waseda.jp/pep/en/>

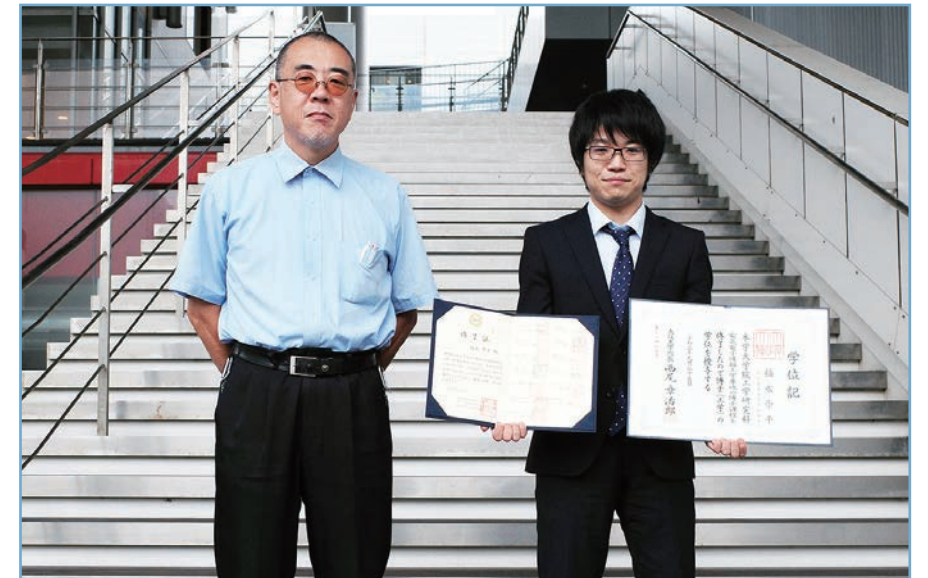
practices.

We offer a five-year program to give students an integrated education and research experience to ensure that they acquire six pillars of deep expertise; bird's-eye view perception; strong fusion; joint research; industrial creation; and international collaboration, all essential for new era intellectual professionals.

## Cross-disciplinary education and standardization education

This program sees the energy value chain of the future as ranging from the tiniest component, the electric charge, to huge power networks. With that vision, we have prepared a comprehensive curriculum that includes: the materials field, which produces highly functional distributed power resources; the power engineering field, for optimal integration, control and operation of resources; and the humanities and social sciences, to design an optimal society. Ten credits are required in seven courses, including: Power Resource Optimization, a multidisciplinary course in power engineering and energy materials; Social Science for Energy Innovation, lectures on the implementation of innovative energy infrastructure systems, intended to hone the students' skills and vision for business development; and Seminar on Business Creation.

The program also develops the students' capacity through: specialized elective courses



Those who complete this program will receive both: their diploma from their home university; and a certificate of completion signed by the presidents of the 13 member universities. (On the right, the first graduate of the program)

that leverage the unique expertise of each university; panoramic elective courses including lecture courses on leadership development lectures and basic AI/IoT; multi-layered education and research guidance; and seminars on new industry creation—all in collaboration with a comprehensive group of research organizations. Furthermore, in coordination with Japan's power and energy system standardization measures, the EMS Shinjuku R&D Center, established at Waseda University as a paragon of neutrality and fairness, has been partially opened to provide unparalleled international standardization education.

We ensure high quality of education with various types of examinations, including selective examination (SE); qualification examination (QE); final examination 1 (FE1) for evaluation of advanced research expertise; and final examination 2 (FE2) to verify acquisition of 45 credits or more and publication of one or more papers co-authored in collaboration with institutions at international academic societies and the like. PEP has already begun fostering society-energizing human resources: our first graduate has completed the course ahead of schedule.

## DATA

[Number of scheduled student recruitments] 20-26  
[Number of anticipated program graduates] 20-26  
[Number of people engaged in the program] 60  
[Students' affiliated schools and departments]

Waseda University 3 graduate schools, 7 departments, Hokkaido University 1 graduate school, 1 department, Tohoku University 1 graduate school, 1 department, University of Fukui 1 graduate school, 3 departments, University of Yamanashi 1 graduate school, 1 department, Tokyo Metropolitan University 1 graduate school, 1 department, Yokohama National University 1 graduate school, 2 departments, Nagoya University 1 graduate school, 1 department, Osaka University 1 graduate school, 1 department, Hiroshima University 1 graduate school, 1 department, Tokushima University 2 graduate schools, 2 departments, Kyushu University 1 graduate school, 1 department, University of the Ryukyus 1 graduate school, 3 departments  
Waseda University  
(Graduate School of Advanced Science and Engineering) Advanced Science and Engineering, Applied Chemistry, Electrical Engineering and Bioscience, Nanoscience and Nanoeengineering  
(Graduate School of Fundamental Science and Engineering) Applied Mechanics and Aerospace Engineering, Electronic and Physical Systems  
(Graduate School of Environment and Energy Engineering) Environment and Energy Engineering  
Hokkaido University  
(Graduate School of Information Science and Technology) Information Science (Course of Systems Science and Informatics)

Tohoku University  
(Graduate School of Engineering) Electrical Engineering  
University of Fukui  
(Graduate School of Engineering)  
System and Infrastructure Engineering for Safe and Sustainable Society (Electrical System), Fundamental Engineering for Knowledge-Based Society (Electronic Material), Advanced Interdisciplinary Science and Technology (Electrical and Electronics Engineering)  
University of Yamanashi  
(Integrated Graduate School of Medicine, Engineering, and Agricultural Sciences) Engineering (Special Educational Program for Green Energy Conversion Science and Technology, Energy Materials Science Course, Green Energy Conversion Science and Technology Major)  
Tokyo Metropolitan University  
(Graduate School of Urban Environmental Sciences) Urban Environmental Sciences (Applied Chemistry for Environment)  
Yokohama National University  
(Graduate School of Engineering Science) Chemistry and Life Science, Mathematics, Physics, Electrical Engineering and Computer Science  
Nagoya University  
(Graduate School of Engineering) Electrical Engineering  
Osaka University  
(Graduate School of Engineering) Electrical, Electronic, and Infocommunications Engineering  
Hiroshima University

(Graduate School of Advanced Science and Engineering) Advanced Science and Engineering (Electrical, Systems, and Control Engineering Program)  
Tokushima University  
(Graduate School of Sciences and Technology for Innovation) Science and Technology (Department of Electrical and Electronic Engineering)  
(Graduate School of Advanced Technology and Science) Systems Innovation Engineering (Department of Electrical and Electronic Engineering)  
Kyushu University  
(Graduate School of Information Science and Electrical Engineering) Electrical and Electronic Engineering  
University of the Ryukyus  
(Graduate School of Engineering and Science) Electrical and Electronics Engineering, Material, Structural and Energy Engineering, Interdisciplinary Intelligent Systems Engineering  
[WISE Cooperating Institutions]  
18 universities, 2 companies, 2 research institutes, 1 industry-academia collaboration organization  
Hokkaido University / Tohoku University / University of Fukui / University of Yamanashi / Tokyo Metropolitan University / Yokohama National University / Nagoya University / Osaka University / Hiroshima University / Tokushima University / Kyushu University / University of the Ryukyus / The University of Tennessee / University of Chicago / University of Washington / Tsinghua University / Chulalongkorn University / Technical University of Munich / ENEOS Corporation / Tokyo Gas Co., Ltd. / Central Research Institute of Electric Power Industry / National Institute of Advanced Industrial Science and Technology / Power Academy

## Message from WISE Cooperating Institution



NAKAIWA Masaru  
Director-General, Fukushima Renewable Energy Institute, AIST (FREA)

## Expect to produce global prominent leaders in energy industry

As one of the world's leading research institutes for renewable energy, we participate in this program and provide "Practical Seminar on Technological Excellence" that allows students to experience the state-of-the-art research facilities and research environment with multinational personnel. We are impressed by the high sensitivity of the students to new knowledge and feel that we can rely on them as our future partners. I hope that in the future we will produce many global prominent leaders in the energy industry.

## Student's Voice



FUKUNAGA Shuhei  
Division of Electrical, Electronic and Information Engineering, Graduate School of Engineering, Osaka University - Graduate

## Studies across boundaries of discipline and nationality

I applied for this program because I was fascinated by the idea of a cross-disciplinary educational system with 13 Japanese universities collaborating. Through lectures and practical training, I gained insights about how to apply my research to other fields and even about the kind of strategies necessary we need to make our results useful for society. It was also valuable to me because I could exchange deeply, across disciplines and nationalities, with the other students in the program.



## WISE program for Sustainability in the Dynamic Earth

[Program Coordinator] NAKAMURA Michihiko (Professor, Graduate School of Science, Tohoku University)

### Message from the President



OHNO Hideo  
President, Tohoku University

### Fostering leaders of social progress in anticipation of the New Normal Producing leaders equipped with the latest executive skills, capable of handling a wide range of risks

The COVID-19 crisis demands a "New Normal," which our university is addressing by advancing education, research, and social synergy as we "strive for creativity and innovation" while leading social progress. Now, as in the past, our university implements diverse degree programs as part of a positive cycle of education, research, and social synergy aimed at developing highly specialized human resources.

The WISE Program for Sustainability in the Dynamic Earth covers the fields of environmental studies, earth science, and disaster science. For two years it has produced knowledge professionals who are equipped with the latest executive skills and capable of handling a wide range of risks, making this degree program central to our graduate school innovations.

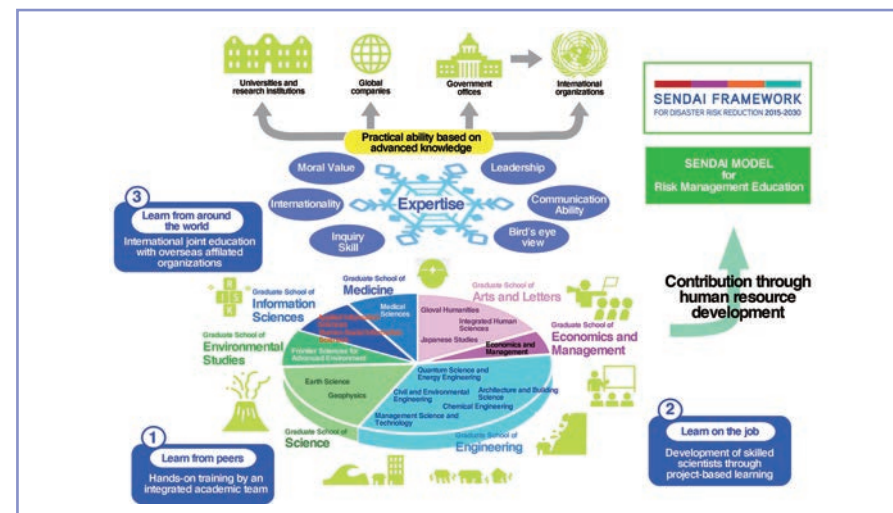
### Study the Earth, Discover the future

Located in an orogenic belt, Japan is prone to natural disasters such as earthquakes, volcanic eruptions, and torrential rain, which has led to high demand from society for quality scientific research. With continued advances in our knowledge of Earth's structure, the field of Earth system science has evolved into a precise understanding of the mechanism of dynamic phenomena, which is seamlessly linked to disaster science. In addition, modern society faces new large-scale risks such as space environment disasters caused by fluctuations in the planetary space magnetic field.

Earth scientists in Japan have specialized in research into subduction zone phenomena such as earthquakes and volcanic eruptions. Now, these fundamental studies have

progressed to the stage where they can directly lead to essential improvements in our disaster prevention capabilities. Moreover,

many disasters are caused by both natural environmental factors and a combination of information, social, and economic factors. To



We will develop "snow crystal-type human resources" with multifaceted abilities through hands-on education that integrates literary sciences, collaborative education with industry-government partners and international joint education.

### DATA

[Number of scheduled student recruitments] 15  
[Number of anticipated program graduates] 15  
[Number of people engaged in the program] 69  
[Students' affiliated schools and departments] 7 graduate schools, 15 departments  
<Graduate School of Science> Earth Science, Geophysics  
<Graduate School of Engineering> Quantum Science and Energy Engineering, Chemical Engineering, Civil and Environmental Engineering, Architecture and Building Science, Management Science and Technology  
<Graduate School of Information Sciences> Applied

Information Sciences, Human-Social Information Sciences  
<Graduate School of Environmental Studies> Environmental Studies for Advanced Society  
<Graduate School of Medicine> Medical Sciences  
<Graduate School of Arts and Letters> Japanese Studies, Global Humanities, Integrated Human Sciences  
<Graduate School of Economics and Management> Economics and Management  
[WISE Cooperating Institutions]  
7 universities, 1 incorporated administrative agency, 4

companies  
Stanford University / Harvard University / University of Washington / University College of London / University of Indonesia / Sorbonne University / University of Hawaii at Manoa / JICA / Tokio Marine & Nichido Fire Insurance Co., Ltd / Nippon Koei Co., Ltd / Penta-Ocean Construction Co., Ltd / NTT DATA, Inc

### [Fields of diplomas]

Doctor of Philosophy (Science) / (Engineering) / (Information Sciences) / (Environmental Studies) / (Medical Sciences) / (Letters) / (Economics) / (Management), Doctor of Philosophy  
Name of the program to be noted: WISE program for Sustainability in the Dynamic Earth

[Office and section in charge] WISE Program for Sustainability in the Dynamic Earth Office  
[Inquiries] 022-795-5591  
[URL] <https://www.syde.tohoku.ac.jp/english/>

build a society that can respond to diverse and complex risks, we need to further elucidate the mechanisms governing natural phenomena and improve corresponding prediction techniques. We must also urgently develop skilled scientists who have the practical ability to understand humans and society and communicate scientific research results to society. This program aims to produce knowledge professionals who can seamlessly acquire and convey advanced knowledge for improving our understanding of issues related to Earth system science.

### Study among diversity, on the job, from around the world

In this program, we will achieve these educational objectives through hands-on training by an integrated academic team with the participation of a wide range of departments. This style of training exploits the fact that students learn more from each other than from lectures.

As a second educational policy, we will invite private companies and organizations to build a "Sustainability Study Consortium." One of the consortium's purposes is to develop skilled scientists that are adept at working in the field through project-based learning. Students will learn the basics of risk management, which forms the basis of all industries.

The third policy of this program is to provide international joint education with



PBL lab-courses (left: Drone flight test for evacuation support; upper right: mineral resource lab by an JOGMEC expert) and JICA expert's lecture on International trend and practical knowledge for disaster risk reduction & Sendai Framework

director-class faculty members from overseas affiliated organizations. In collaboration with faculty members who have experience of United Nations organizations and the Japan International Cooperation Agency (JICA), we plan to collaborate with international organizations to conduct research education and achieve international contributions.

Through the three educational policies unique to this graduate degree program: "study among diversity, on the job, from around the world," we will develop "snow crystal-type human resources" with multifaceted abilities. We aim to supply these human resources to a wide range of sectors, including industry, government, and academia.

In 2015, the United Nations adopted the "Sendai Framework for Disaster Risk Reduction," a framework for countries around the world to implement disaster prevention and mitigation. Tohoku university has made a significant contribution to formulating this framework and will further contribute to achieving this goal through education. The Tohoku region is characterized by globally rare large-scale disasters and massive natural risks; thus, researchers visit this region from all over the world. By taking advantage of our location, this program aims to create digital teaching materials and disseminate them internationally via the Internet.

### Message from WISE Cooperating Institution



MIYOSHI Nobuhiro  
General Manager  
Infrastructure Engineering  
Dept. Sendai Branch Office,  
Nippon Koei Co., Ltd.

### To build disaster resilient nation and development of region

As a construction consulting firm, we are involved of planning, design, maintenance, and management of social structures. We are working on developing plans to prevent and mitigate natural disasters, emergency measures to be taken during a disaster, and permanent measures for regional development and the environment. In this program, we would like to cultivate human resources that can contribute to building a nation resilient to disasters and to fostering regional development by utilizing the expertise and experience.

### Student's Voice



NISHIO Takuya  
1st year of Doctoral Program  
in Earth Science, Graduate  
School of Science

### 3Es – Experiences, Empowerment, and Encounters –

We can discern a regularity from complex physicochemical processes on the Earth by unraveling them from various viewpoints. I believe that it is the case for our modern global society. This program helps us gain interdisciplinary knowledge, nurture creativity, and have an ability to apply them to other things through various experiences in industry, government and academia. Moreover, one of the most attractive points of this program is meeting colleagues with various backgrounds and exchanging ideas.



# Applied Humanities Program for Cultivating Global Leaders

[Program Coordinator] YONEMURA Chiyo (Dean of Graduate School of Humanities, Professor, Chiba University)

## Message from the President



TOKUHISA Takeshi  
President of Chiba University

## Fostering top management personnel who will lead the diversity society by utilizing humanities

Based on the philosophy of "Always Aim Higher", Chiba University promotes outstanding education and research that integrates humanities and science, intending to develop next-generation human resources who can play an active role as leaders in the global society. At the same time, we continue to take on constant challenges, such as reforming the structure based on our vision.

This program will cultivate flexible cultural imagination and a bird's-eye view of literacy through exploration activities for various issues in Asia-Eurasia, a pluralistic world, based on a distinctive educational and research base in the humanities field our university and affiliated universities. In the future, the trained human resources will lead a diversified society in collaboration with industry. We hope that this program's graduates will serve as a bridge between the humanities and the community.

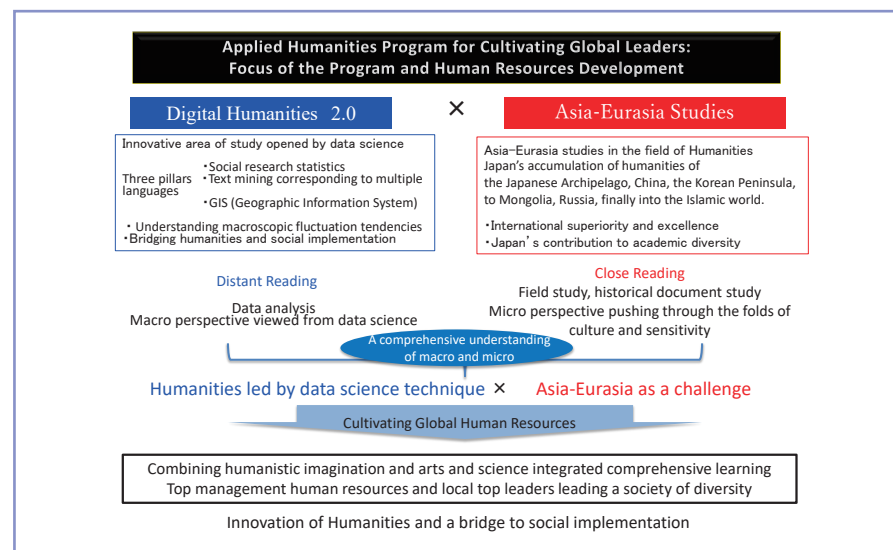
## Asia-Eurasia × Digital Humanities: Challenge of Humanities

Humanities is the study of thoughts, words, behavior, ways and history of society that link people together. It is a seemingly roundabout way of gaining a fundamental understanding of people. Yet, what we see in front of us is a complex world in which people of increasingly diverse backgrounds move and come into contact with one another, which causes friction. Because we are in such a modern world, there is a need for a new study of humanities to move into the folds of diverse cultural backgrounds and sensitivity and ever-changing social dynamics to be able to identify guidelines for the resolution of issues.

The first focus of the program is Asia-Eurasia. This area covering East Asia, Southeast Asia, Russia in Northern Eurasia and the Islam world is not only deeply

related to Japan's future direction, but it is an experimental site (developed areas facing challenges) where diverse issues of future

society arise in a pluralistic world where multi-ethnic, multi-lingual, multi-cultural and multi-religious elements are mixed. It is the region



Asia-Eurasia × Digital Humanities: Bridging Humanities and Social Implementation

## DATA

[Number of scheduled student recruitments] 12  
[Number of anticipated program graduates] 3-12  
[Number of people engaged in the program] 67  
[Students' affiliated schools and departments]

Chiba University 2 graduate schools, 4 departments, 1 program,  
Okayama University 1 graduate school, 3 departments, Nagasaki  
University 1 graduate school, 1 department, Kumamoto University  
1 graduate school, 3 departments, The Graduate University for  
Advanced Studies 1 graduate school, 1 department  
Chiba University  
<Graduate School of Humanities and Studies on Public Affairs>  
Humanities, Studies on Public Affairs and Social Sciences,  
Humanities and Studies on Public Affairs

<Graduate School of Science and Engineering> Mathematics  
and Informatics  
<Graduate Degree Program of Global and Transdisciplinary  
Studies>  
Okayama University  
<Graduate School of Humanities and Social Sciences>  
Japanese and Asian Culture, Human Socio-Culture, Socio-  
Cultural Sciences  
Nagasaki University  
<Graduate School of Global Humanities and Social Sciences>  
Global Humanities and Social Sciences  
Kumamoto University  
<Graduate School of Social and Cultural Sciences> Modern Social

Human Studies, Cultural Science, Human and Social Sciences  
The Graduate University for Advanced Studies  
<School of Cultural and Social Studies> Japanese History  
[WISE Cooperating Institutions]  
6 Universities, 1 Inter-University Research Institute Corporation,  
1 public interest incorporated foundation, 3 Companies  
Okayama University / Nagasaki University / Kumamoto University  
/ The Graduate University for Advanced Studies / Zhejiang  
Gongshang University / Institute for Oriental and Classical  
Studies, National Research University "Higher School of  
Economics"(Russia) / National Museum of Japanese History /  
Aeon Environmental Foundation / AEON CO.,LTD / JTB Tourism  
Research & Consulting Co. / Chiba Bank

## [Fields of diplomas]

Doctor of Philosophy (Philosophy), Doctor of Philosophy (Public Affairs)

Name of the program to be noted: Applied Humanities Program for

Cultivating Global Leaders

[Office and section in charge] Student Affairs Office for  
Humanities and Social Sciences (WISE Program)

[Inquiries] 043-290-2997

[URL] <https://jinbun-takuetsu.chiba-u.jp/top/>

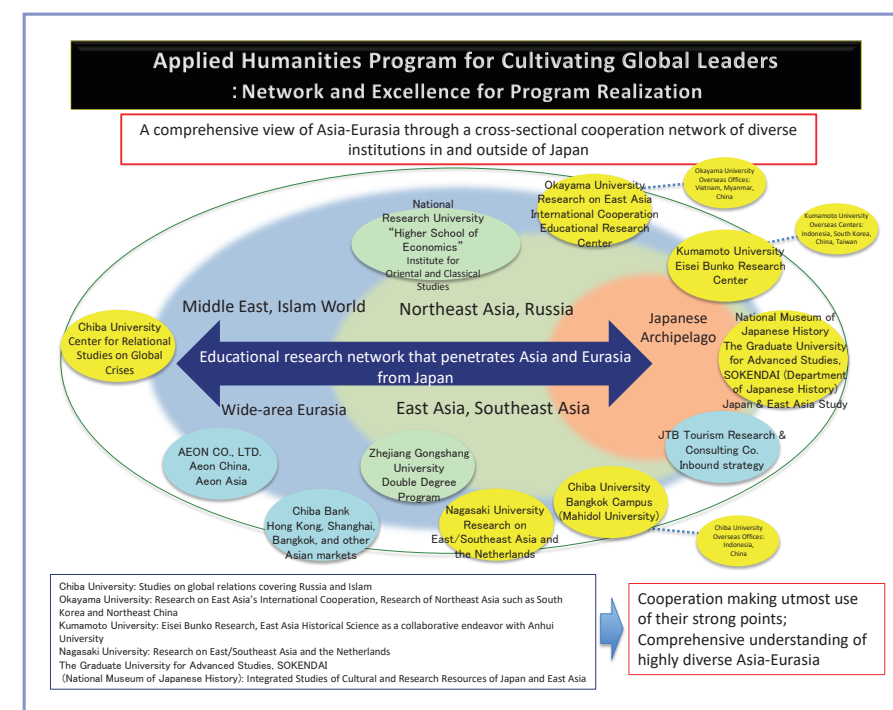
where the strength to deal with an ever-changing world is tested. The program aims to cultivate the capacity to closely analyze the pluralistic world of Asia-Eurasia on multiple levels.

The second focus is on Digital Humanities. In order to analyze the direction of a changing society, technology to visualize environmental changes and social space with GIS (Geographic Information System) or data science technology to forecast the trends of social movement by making utmost use of social research statistics and text mining (statistical analysis of text) is necessary. It is also an important focus of the program to localize data science in the application of analysis in Humanities to understand the social movement of Asia-Eurasia.

## Excellent Educational Program Through a Cooperative Network

As stated above, the program aims to cultivate individuals to lead in the future diverse environment by comprehensively learn two realms: micro perspective and technology to move into the folds of culture and sensitivity; and macro perspective and technology to see from the perspective of data science (Digital Humanities).

This program to cultivate such individuals has structured a broad network in and outside of Japan. In Japan, we coordinate with Chiba University, Okayama University, Nagasaki University, Kumamoto University, The Graduate



Excellent educational program implemented within a wide-area network

University for Advanced Studies, National Museum of Japanese History, AEON CO., LTD., JTB Tourism Research & Consulting Co., and Chiba Bank. In addition, we have a network with institutions of higher education in intercommunication in Asia and Eurasia regions. Training in local offices of universities throughout China, Taiwan, South Korea, Thailand, Indonesia, Vietnam, and Myanmar

is offered, and training opportunities are also planned at local branch offices of AEON and JTB. Graduate students participating in the program may receive guidance not only from the graduate school they belong to but also from a diverse line-up of professionals in other affiliate institutions. Students will heighten their motivation for study and research in regular meetings for research reports and discussions to encourage one another and engage in friendly competition.

## Message from WISE Cooperating Institution



YAMAMOTO Yuriko  
Director and Secretary  
General of Aeon Environmental  
Foundation

## Thinking of the World from Asia

AEON CO., LTD. has been working on global management to exist and prosper together with the local region centering on Asia. In order to develop business in the Asian market, it is necessary to learn about the lives of customers in the region, realize an environment of society for diversity, and pursue global values. We think that Takuetsu University's graduate program accepts the challenge of such an initiative by industry-academia collaboration.

## Student's Voice



YAMAMOTO Kyosuke  
First Year Master's Course, Graduate  
Degree Program of Global and  
Transdisciplinary Studies, Chiba University

## Motive and reason for participating in this program

I am studying representation in media from the perspective of gender and race. I decided to enroll in this program because my research mainly focuses on diverse analyses, including how representation circulating across national borders is interpreted and reported. I wanted to use text mining and digital humanities to focus on the research from a transnational perspective.



## Innovative Medicine CHIBA Doctoral WISE Program

**[Program Coordinator]** NAKAYAMA Toshinori (Dean of Graduate School of Medicine, Vice-President of Chiba University, Professor, Department of Immunology, Advanced Biomedical Science, Graduate School of Medicine, Chiba University)

## Message from the President



TOKUHISA Takeshi  
President of Chiba University

## Fostering creators of new "medical knowledge" and innovators of world-leading innovative medicine

Based on the philosophy of "Always Aim Higher", Chiba University promotes outstanding education and research that integrates humanities and science, intending to develop next-generation human resources who can play an active role as leaders in the global society. At the same time, we continue to take on constant challenges, such as reforming the structure based on our vision.

This program will develop human resources with flexible thinking ability, challenging spirit, and resilience through education in collaboration with the world's top research institutes and familiar with multiple specialized fields. In the future, they will create new medical knowledge and medical innovation. We hope that this program's graduates will become world-leading human resources to develop modern medicine and medical care and realize a sustainable healthy society.

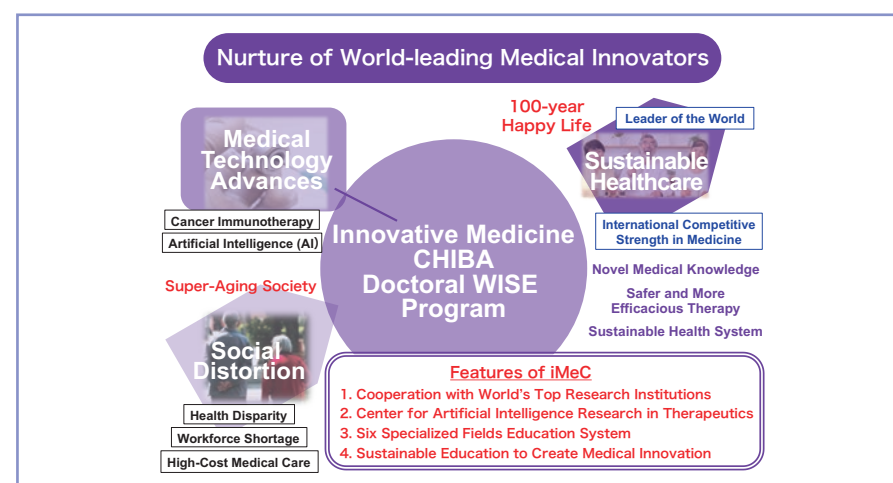
## Nurture of World-leading Medical Innovators

The latest technologies including cancer immunotherapies and artificial intelligence are dramatically advancing medical care. Continuous creation of "novel medical knowledge" is imperative for Japan, which is a super-aging country, to lead the world as a future model to achieve a sustainable healthier society.

The Graduate School of Medical and Pharmaceutical Sciences takes a lead role in operation of Innovative Medicine CHIBA Doctoral WISE Program (iMeC-WISE), based on its more than 100-year history. iMeC-WISE implements the new graduate education system in cooperation with world-class academic and research institutions, including RIKEN and the University of California San

Diego (UC San Diego), many companies and the Center for Artificial Intelligence Research in Therapeutics of Chiba University.

Through innovative comprehensive training with a focus on multidisciplinary close mentoring to nurture high level of broader



iMeC-WISE nurtures world-leading medical innovators in cooperation with many world-class institutions and the Center for Artificial Intelligence Research in Therapeutics of Chiba University.

## DATA

**[Number of scheduled student recruitments]** 15  
**[Number of anticipated program graduates]** 5-15  
**[Number of people engaged in the program]** 66  
**[Students' affiliated schools and departments]**  
 4 graduate schools, 10 departments  
 <Graduate School of Medical and Pharmaceutical Sciences> Frontier Medicine and Pharmacy, Medical Sciences, General Pharmaceutical Sciences  
 <Graduate School of Science and Engineering> Mathematics and Informatics, Earth and Environmental Sciences, Advanced Science and Engineering, Creative Engineering, Fundamental

Engineering  
 <Graduate School of Nursing> Nursing  
 <Graduate School of Horticulture> Environmental Horticulture  
**[WISE Cooperating Institutions]**  
 4 universities, 3 public research institutions, 8 companies  
 University of California San Diego / University of Southern California / Charité – Universitätsmedizin / University of Toronto / Institute of Physical and Chemical Research / National Institute of Advanced Industrial Science and Technology / National Institute

of Radiological Sciences / Takeda Pharmaceutical Co., Ltd / Microsoft Japan Co., Ltd / Sysmex Corporation / Eli Lilly Japan K.K. / Olympus Corporation / DNA Chip Research Inc. / H.U. Group Research Institute G.K. / GeneFrontier

## [Fields of diplomas]

Medical Sciences and Pharmaceutical Sciences, Doctor of Philosophy (Medicine), Doctor of Philosophy (Pharmacy)  
 Name of the program to be noted: Innovative Medicine CHIBA Doctoral WISE Program

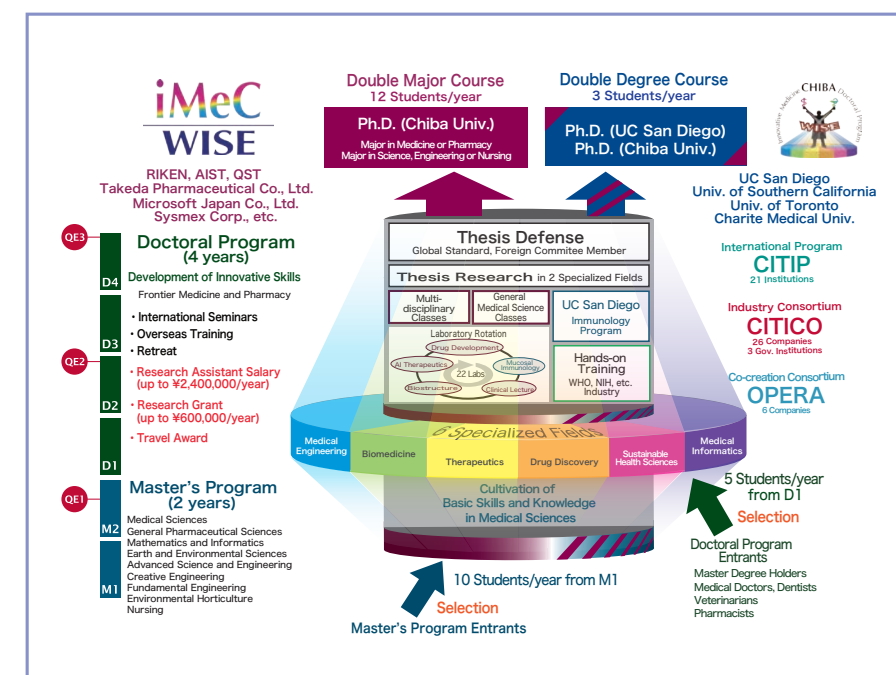
perspective, cooperativeness, leadership and entrepreneurship, iMeC-WISE aims to foster the next generation of outstanding researchers and innovators who will contribute to the development of medical sciences, pave the way to novel therapies and drugs, and develop sustainable healthcare systems.

## Sustainable Education System to Create Medical Innovation

Talented graduate students with different backgrounds will major in at least two out of the six specialized fields, which are organized beyond departments and institutions: Therapeutics, Medical Engineering, Biomedicine, Drug Discovery, Sustainable Health Sciences and Medical Informatics. The students are required to cultivate basic skills and knowledge on Medical Sciences studying in nine areas of the two-year Master's Program. Then they accomplish at least two projects in different fields, equivalent to double majors, in Frontier Medicine and Pharmacy of the four-year Doctoral Program. Each student is guided by professors from three fields and takes the curriculum to nurture multidimensional skills necessary for the creation of interdisciplinary innovation: rotation training, self-planned overseas training, self-directed retreat and others. The International Double Degree Course, in which students can earn Ph.D. degrees from both Chiba University and a foreign university such as UC San Diego is provided. The Chiba



**[Office and section in charge]** WISE Program Office, Academic Affairs Division, Inohana Campus Administration, Chiba University  
**[Inquiries]** 043-226-2817  
**[URL]** <https://www.m.chiba-u.jp/dept/imec/en/>



Students cultivate basic skills and knowledge on Medical Sciences in the Master's Program and then take either the Double Major Course or the International Double Degree Course.

Innovative Therapeutics International Program (CITIP) for global education containing 37 visiting professors of 21 foreign institutions, and the Chiba Innovative Therapeutics Industry Consortium (CITICO) for industry-government-academia collaborative education consisting of 26 companies, and three government institutions are also engaged in this program.

Ten students for the Master's Program and five students for the Doctoral Program enter iMeC-WISE every year. Qualifying examinations (QEs) are conducted at three stages to assure

the quality of the academic degree: QE1 in the 2nd year of the Master's Program, QE2 at the end of the 2nd year of the Doctoral Program, and QE3 at the end of the Program. Each dissertation committee includes at least one foreign professor to ensure that the degree is based on the international standards.

iMeC-WISE provides students with financial support and the career development office as well as subsequent post-graduate employment positions to maximize each student's potential and build the foundation for career success.

## Message from WISE Cooperating Institution



MATOBA Ryo, Ph.D.  
President & CEO of DNA Chip Research Inc.

## From innovation to reinvention, to nurture creators of a new value

The revolution of the social system has been demanded in the world, which is going into a super aging society. We have to develop creativity for producing new concepts to deal with diversity and changes in modern society. We would like to further advance gene and genome technology, and contribute to this program to nurture brilliant PhDs who can open up a new era.

## Student's Voice



ISHINO Takamasa  
D1, Frontier Medicine and Pharmacy, Graduate School of Medical and Pharmaceutical Sciences, Chiba University

## Taking multifaceted approach to fulfill unmet medical needs

There are various problems in modern healthcare that are not related only to medical sciences but also to the economy and social structure. In the Innovative Medicine CHIBA Doctoral WISE Program, I would like to take the Double Major course, which is organized beyond departments and institutions, so that I can acquire abilities to develop novel drugs and therapies and to apply my knowledge of medicine to a wide range of fields. This program provides plentiful support to make these wishes come true, and I am happy to participate in it.



## Forefront Physics and Mathematics Program to Drive Transformation

[Program Coordinator] MURAYAMA Hitoshi (University Professor, Kavli Institute for the Physics and Mathematics of the Universe, the University of Tokyo)



### Message from the President



GONOKAMI Makoto  
President, the University of Tokyo

### Maximizing the potential of basic science specialists and transforming attitudes towards Doctoral study through reform of graduate-level education

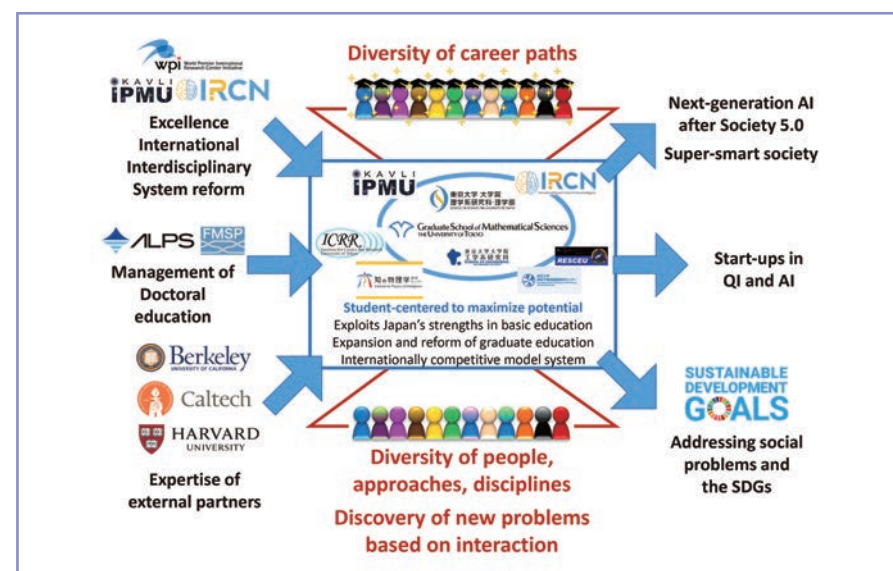
Under the “World-leading Innovative Graduate Study” (WINGS) concept, the University of Tokyo has set up a series of 5-year integrated Masters–Doctoral degree programs to educate “Knowledge Professionals”. These highly skilled Doctoral graduates will become our future leaders and take on the challenge of creating new value. The Forefront Physics and Mathematics Program to Drive Transformation (FoPM) aims to reform graduate-level education, first in the basic sciences and then throughout the entire university, by using the international experience gained through the management of our two World Premier International Research Centers (WPIs). We expect the basic science specialists educated in this program to follow a diverse range of career paths, and anticipate that this will transform students' and society's attitudes towards Doctoral study.

### Advancing social innovation through basic science

Mathematics provides the quantitative basis of all academic disciplines and physics underpins the fundamental laws of all of the natural sciences. It thus follows that physicists and mathematicians play an essential role in the current shift to a knowledge-based society. Such basic science specialists do not only contribute to academic research in their respective fields; their work can also have a great impact on society. For example, the discovery of the DNA double helix, the invention of blue LEDs, and even the development of the internet would not have been possible without the contributions of these basic scientists. Physics and mathematics are also expected to be instrumental in achieving the UN's Sustainable Development Goals (SDGs) and solving the

major problems, including the energy crisis and climate change, that are facing our society today.

With this in mind, the “Forefront Physics and Mathematics Program to Drive Transformation” (FoPM) uses education in



Connecting people and research beyond traditional boundaries

### DATA

[Number of scheduled student recruitments] 40  
[Number of anticipated program graduates] 40  
[Number of people engaged in the program] 108  
[Students' affiliated schools and departments] 3 graduate schools, 6 departments  
<Graduate School of Science> Physics, Astronomy, Earth and Planetary Science, Chemistry  
<Graduate School of Engineering> Applied Physics  
<Graduate School of Mathematical Sciences> Mathematical Sciences  
[WISE Cooperating Institutions] 13 universities, 4 public research institutes, 3

companies  
Nippon Steel Corp. / NTT Corp. / Macromill, Inc.  
/ École Polytechnique / California Institute of Technology / UC Berkeley / Korea Institute for Advanced Study / National Taiwan University / ETH Zurich / Tsinghua University / Seoul National University / Harvard University / Princeton University / Peking University / ENS de Lyon / HSE University / CERN / Mathematical Sciences Research Institute / IHES / Paul Scherrer Institute

### [Fields of diplomas]



Doctor of Philosophy, Doctor of Science, or Doctor of Engineering  
Name of the program to be noted: The Forefront Physics and Mathematics Program to Drive Transformation

[Office and section in charge] WINGS Desk, Academic Affairs Office of the Graduate School of Science  
[Inquiries] 03-5841-4078  
[URL] <https://www.s.u-tokyo.ac.jp/en/FoPM/>

state-of-the-art physics and mathematics to cultivate logical, flexible, and non-biased thinking. The program aims to foster specialists in the basic sciences who can exert a wide influence on science, technology, and social innovation.

### Connecting science and society through educational reform

FoPM builds on the University of Tokyo's two World Premier International (WPI) Research Centers, the Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU) and the International Research Center for Neurointelligence (IRCN), which have been instrumental in the internationalization and reform of research systems at the University of Tokyo. The program offers a curriculum in which students come into contact with a diverse range of people and research fields and work together in friendly competition. We also utilize the expertise of our external partner institutions, which include UC Berkeley, Caltech, and Harvard, and have, for example, introduced a system in which students experience research in a group other than the one they choose on entry to the graduate school. This system provides the students with a wider perspective on their entire research field. In addition, to ensure that research involving those from different backgrounds can proceed smoothly, we offer a new seminar given by an expert in diversity education and regular seminars

	M1 Year 1	M2 Year 2	D1 Year 3	D2 Year 4	D3 Year 5
QA	PE	QE			FE
	Portfolio management				
Diversity: Research	Lab Rotation	International Experience			
	Regular Discussions with Secondary Supervisors				
	Introductory Courses/Contemporary Lectures				
	SDGs Course/Executive Program/Mathematics and Society				
Diversity: People	Web Admission Diversity and Ethics Training				
Cross interaction	Study Abroad in UTokyo	TED-like 4PM Seminar			
Diversity: Careers	Writing and Presentation				
	AI and Quantum Computing				
	Mathematics in Society Hands-on Course/Entrepreneurship International Career Seminar				
Support Systems	Diverse Instructors/All-English Curriculum/Financial Support				

Coursework through which students develop skills useful for their future career and our future society

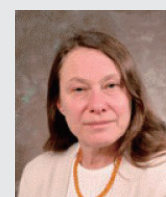
in which students mix casually with those from other research groups. In these regular seminars, students evaluate each other's short, active TED-type presentations aimed at those working in other fields. In this way, we provide a diverse and inclusive environment for research and education in which different cultures collide.

Under this environment, we offer courses designed to foster an outstanding level of specialist knowledge, as well as those in which students learn about the SDGs and the problems facing society today. Through these courses, students develop an awareness of how they can use their specialist knowledge

to solve such problems. In addition, the “Academic Writing and Presentation” and “AI and Quantum Computing” courses and the “International Career Seminar” allow students to acquire skills necessary for their future careers, regardless of the career path that they choose to follow.

Through this coursework, we aim to maximize the potential of students with an outstanding level of specialist knowledge. By training internationally competitive Doctoral graduates, we also aim to develop a model system for an internationally competitive graduate education that takes advantage of Japan's fundamental strengths.

### Message from WISE Cooperating Institution



GAILLARD Mary K  
Professor of Graduate School of Physics, University of California, Berkeley

### Mutually beneficial program for Berkeley and FoPM students via exchange

One of my students participated in the joint workshop organized by the University of Tokyo and UC Berkeley, and was impressed by the quality of the FoPM educational program and students he met in the joint workshop and mutual student visits. I very much believe that this mutually beneficial program for students from both institutions will train internationally minded graduates who can use their knowledge of physics and logical reasoning skills in a wide range of scientific fields.

### Student's Voice



SHIKAUCHI Minori  
M2 student, Department of Physics, Graduate School of Science

### Great opportunity to be creative and improve presentation skills

I applied for the course to deepen my understanding of other research fields and think of things from various viewpoints. In special seminars including the “4PM seminar”, which is regularly held once a month, I look forward to listening to topical talks given by invited speakers. We also have a chance to give short updates on our research. It is a good opportunity to receive a lot of feedback from students as well as the invited speakers. I really enjoy discussing with them and deepening the understanding of my work.



# World-leading Innovative Graduate Study: Advanced Business Law Program

[Program Coordinator] TAMURA Yoshiyuki (Professor, Graduate Schools for Law and Politics, The University of Tokyo)

## Message from the President



GONOKAMI Makoto  
President, the University of  
Tokyo

## Expectations for interdisciplinary education to equip students to lead social reform in the age of Society 5.0

The Advanced Business Law Program (ABLP) aims to foster knowledge professionals who can find solutions to various challenges businesses face in the age of innovation where AI, IoT and biotechnologies are continuing to progress, and who can identify and execute necessary changes in policy-making processes. The ABLP offers an ambitious curriculum designed to provide interdisciplinary education by integrating social sciences and sciences as well as integrating different categories within social sciences. Since the basic program had already been introduced before the ABLP was selected as the WISE Program, excellent students with diverse backgrounds, such as government officers, legal professionals, and those with undergraduate or graduate degrees in scientific fields have begun to gather for the ABLP from home and abroad. We expect that, in the so-called age of Society 5.0 with great changes, students who have completed the ABLP will flourish as visionaries prepared to advance social reform.

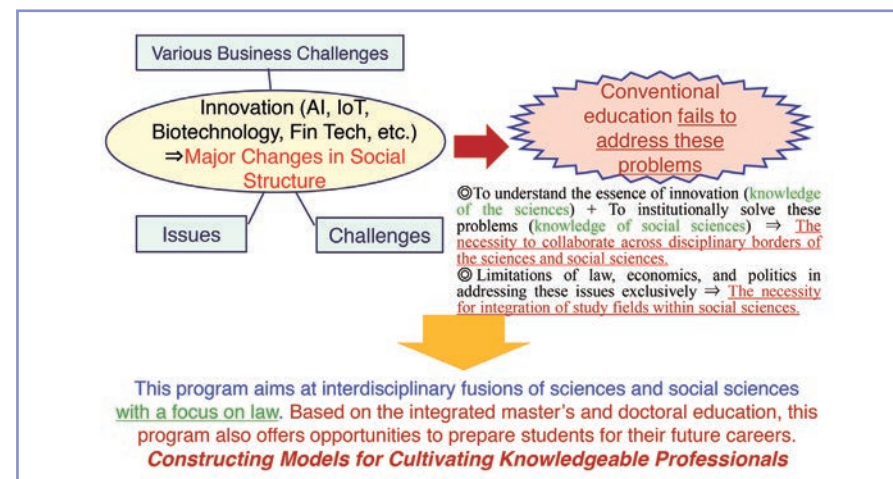
## Coping with various business challenges

The Fourth Industrial Revolution represented by AI, IoT and big data, and innovations such as biotechnologies, have raised various new problems and concerns of business. Conventional education, which has been divided into different academic disciplines, fails to address these issues. First, to understand the essence of innovation, knowledge of the sciences is necessary, meanwhile, to institutionally solve these business problems, knowledge of social sciences is required. Thus, it is necessary to collaborate across disciplinary borders of the sciences and social sciences. Second, since the academic fields of law, economics, and politics each have their own limitations in addressing these issues exclusively and separately, there is also a

necessity for integration of study fields within social sciences.

Even with the need of interdisciplinary

fusions, problems occurring in the actual society are intricately intertwined, it is almost impossible to develop and propose perfect



To propose specific solutions to various challenges businesses face as innovations advance, an interdisciplinary approach that integrates sciences and social sciences, fuses different topics from social sciences is indispensable.

## [Fields of diplomas]

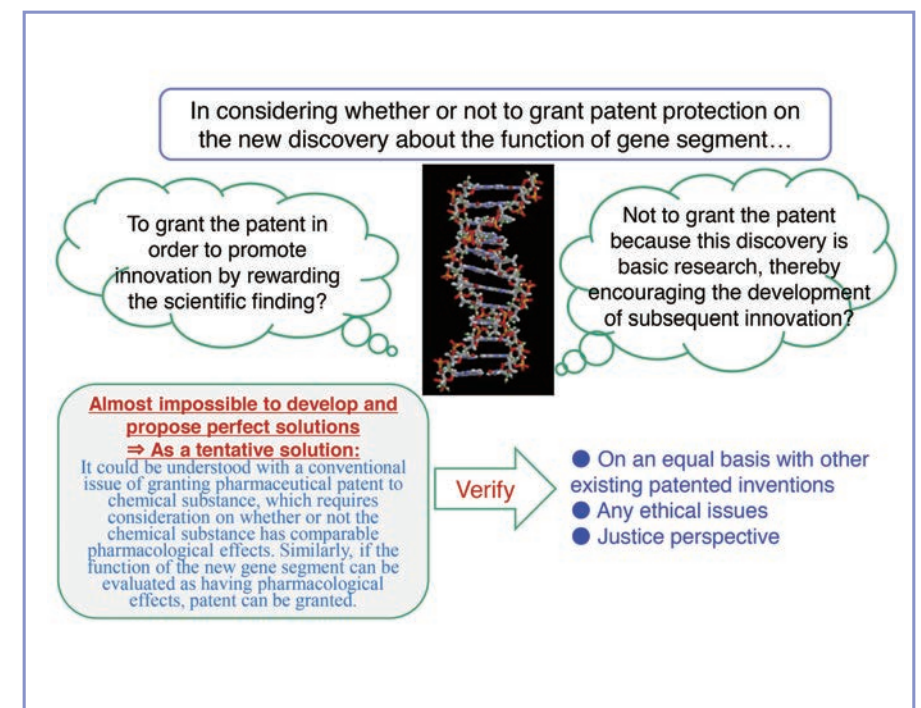
Doctor of Laws, Doctor of Engineering, Doctor of Philosophy in the field of Information Science and Technology, Doctor of Medical Science, Doctor of Philosophy in Management, Doctor of Philosophy in the field of public policy  
Name of the program to be noted: The World-leading Innovative Graduate Study: Advanced Business Law Program

[Office and section in charge] Advanced Business Law Program Office  
[Inquiries] 03-5841-1513  
[URL] <https://ablp.j.u-tokyo.ac.jp/english>

solutions to these complex problems from scratch. For example, in considering whether to grant patent protection on the discovery about the function of new gene segment, it is difficult to clearly determine which approach is better: to grant the patent in order to promote innovation by rewarding the scientific finding, or not to grant the patent because this discovery is basic research so as to encourage the development of subsequent innovation. Even though the determination is difficult, this problem can be legally reviewed. It could be understood with a conventional issue of granting pharmaceutical patent to chemical substance, which requires to consider whether chemical substance has comparable pharmacological effects. Taking the problem mentioned above as a question concerning the existence of effects, if the function of the new gene segment can be evaluated as having pharmacological effects, patent can be granted as a tentative solution to the problem. Meanwhile, law can justify it on an equal basis with other existing patented inventions, verify whether there are ethical issues from the perspective of justice.

## Producing the elites

This program provides the Basic Seminar for master's students and the Progress Seminar for doctoral students as compulsory subjects in order to reflect the aforementioned interdisciplinary fusion with a focus on law in the educational program. Aiming at



Law has the inherent characteristics that, even though new social problems have arisen, could use the existing legal system as a starting point, and deal with the issues by taking muddling through approach with gradual trial-and-error.

fostering interdisciplinary synergy effects, the program assembles students and professors specializing in natural science, economics, politics and law. This program will guide students to learn specific research methods of law where trial-and-error could be used as a possible approach, and enlighten students with values such as freedom, equality, and justice that inherent in law.

We expect that students who have

completed this program will flourish as elite practitioners, researchers, and policy planners to lead industry, government, and academia in the fields of business law.

## DATA

[Number of scheduled student recruitments] 7  
[Number of anticipated program graduates] 7  
[Number of people engaged in the program] 45  
[Students' affiliated schools and departments] 6 graduate schools, 14 departments  
<Graduate Schools for Law and Politics> Legal and Political Studies  
<Graduate School of Engineering> Architecture, Systems Innovation, Chemical System Engineering, Technology Management for Innovation  
<Graduate School of Information Science and Technology> Computer Science, Mathematical

Informatics, Mechano-Informatics  
<Graduate School of Medicine> Internal Medicine, Reproductive, Developmental and Aging Sciences, Surgical Sciences, Medical Science  
<Graduate School of Economics> Management  
<Graduate School of Public Policy> International Public Policy  
[WISE Cooperating Institutions] 4 universities, 6 enterprises, 1 public research institute  
Harvard Law School / Peking University / Seoul National University / National Taiwan University / Hitachi, Ltd. / FUJIFILM Corp. / SoftBank Corp. / Yahoo

Japan Corp. / Nippon Life Insurance Co. / Intellectual Property Department, Takeda Pharmaceutical Co., Ltd., / Institute for Monetary and Economic Studies, Bank of Japan

## Message from WISE Cooperating Institution



TODA Yuji  
Corporate Officer & General  
Manager, Intellectual Property  
Division, Hitachi, Ltd.

## Expectations for creating innovation-oriented professionals

Hitachi, Ltd. endeavors to provide global digital solutions by maximizing its strength of operational technology and related products as well as information technology such as AI and big data analysis. This program has an ambitious goal of creating professionals who can propose new institutional designs adhering to legal regulations while addressing the status of innovations in the age of change. We look forward to its achievements.

## Student's Voice



YAMAMOTO Mayuko  
School of Legal and Political Studies,  
Graduate Schools for Law and  
Politics, The University of Tokyo

## Learning many things from theories and practices

Through my work experience as a lawyer, I wanted to learn more about the protection of fashion design, especially from an economic perspective, so I enrolled myself in this program to study theories and practices through interdisciplinary education. Studying in such a favorable environment where various courses and lectures are offered by excellent professors and experts, I have opportunities to share what I have been taught as occasions arise. Thus far, my experience at university has been very fulfilling and rewarding.



# Engineering Education Program for Super Smart Society based on Advanced Quantum Science

[Program Coordinator] SAKAGUCHI Kei (Professor, School of Engineering, Tokyo Institute of Technology)

## Message from the President



MASU Kazuya  
President, Tokyo Institute of Technology

## Train “super-skilled PhD holders to lead a Super Smart Society” through university-wide interdisciplinary education

The University promotes pioneering education reform, which includes establishing a university-wide interdisciplinary education program and offers a consistent liberal arts education from the undergraduate to the doctoral program (interdisciplinary education of arts and science). In FY 2017, the University was selected as a Designated National University Corporation and has made strides in producing brilliant and captivating individuals with a doctoral degree by responding to social demand. With human resource and financial assistance from the Consortium partners and the university-wide support system, the program offers interdisciplinary education between cyber/physical space technologies with quantum science, which is an area that Tokyo Institute of Technology is leading the world. By offering such education, the University trains knowledge-professional super-skilled PhD holders, who can lead industry, government and academia in the forthcoming Super Smart Society.

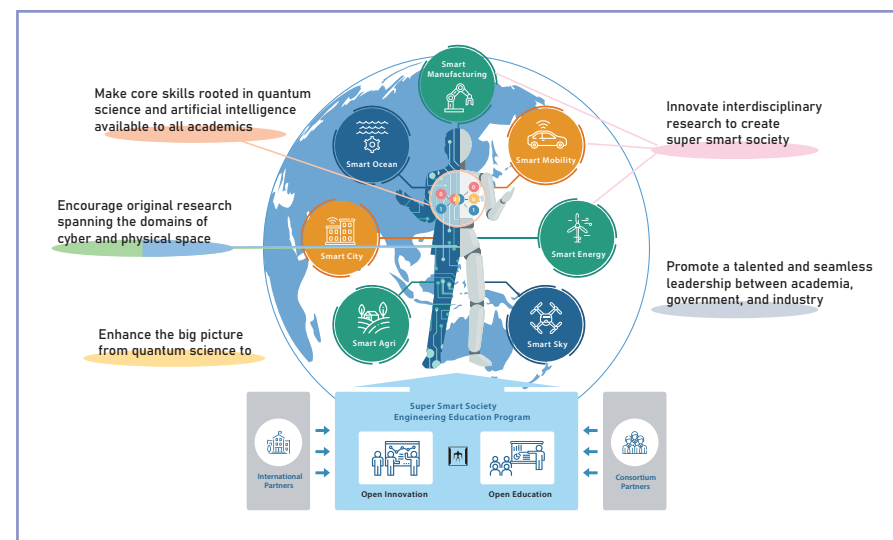
## Portrait of graduates: Who leads a Super Smart Society?

Leaders of the forthcoming Super Smart Society (SSS) must be able to integrate state-of-the-art quantum science with cyber and physical space technologies. For example, in SSS, sensor data collected via 5G/IoT are analyzed by AI to control robotics. In this process, sensors must be replaced with ultra-high sensitivity quantum sensors, and AI on quantum computers allows real-time analysis of big data. By integrating quantum science, it is thus possible to advance society into SSS.

Based on such a social background, the University established “the WISE Program for Super Smart Society”, an integrated master & doctoral program. As shown in Fig. 1, the program trains individuals who lead SSS with 1) core skills rooted in quantum science

and artificial intelligence, 2) ability to create original research spanning the domains of cyber and physical spaces, 3) ability to grasp

the big picture from quantum science to SSS, 4) ability to solve social issues through innovative interdisciplinary research, and 5)



(Figure 1) Image of program graduates

## DATA

[Number of scheduled student recruitments] 25-35

[Number of anticipated program graduates] 10-25

[Number of people engaged in the program] 113

[Students' affiliated schools and departments]

6 Schools, 14 Departments

<School of Engineering> Mechanical Engineering, Systems and Control Engineering, Electrical and Electronic Engineering, Information and Communications Engineering, Industrial Engineering and Economics

<School of Science> Physics

<School of Computing> Mathematical and Computing Science, Computer Science

<School of Life Science and Technology> Life Science and Technology

<School of Environment and Society> Architecture and Building Engineering, Civil and Environmental Engineering, Transdisciplinary Science and Engineering, Social and Human Sciences

<School of Materials and Chemical Technology> Chemical Science and Engineering

[WISE Cooperating Institutions]

6 public research institutes, 15 overseas universities, 16 corporations, 2 local / public bodies

National Agriculture and Food Research Organization / National Institutes for Quantum and Radiological Science and Technology / RIKEN Center for Advanced Intelligence Project / Japan Agency for Marine-Earth Science and Technology / NICT Wireless Networks Research Center / AIST Information Technology and Human

Factors / JTEKT Corporation / NEC Corporation / NSK Ltd. / Yaskawa Electric Corporation / Azbil Corporation / Hitachi Industrial Equipment Systems Co., Ltd. / Yokogawa Electric Corporation / Kodan Electronics Co., Ltd. / KDDI Corporation/SoftBank Corp. / Huawei Japan / SHO-BOND Corporation / DENSO Corporation / Kawasaki City / Ota City / Google LLC / SOLID Gear Inc. / CEA Leti / Georgia Institute of Technology / National Taiwan University of Science and Technology / University of Twente / University of Rome Tor Vergata / The Ohio State University / Thammasat University Thailand / Univ. Glasgow / Technical University of Munich / Fraunhofer Heinrich-Hertz-Institute / University of Sydney / Institute for Infocomm Research / Cornell University / Yonsei University / Asurion LLC / RWTH Aachen University

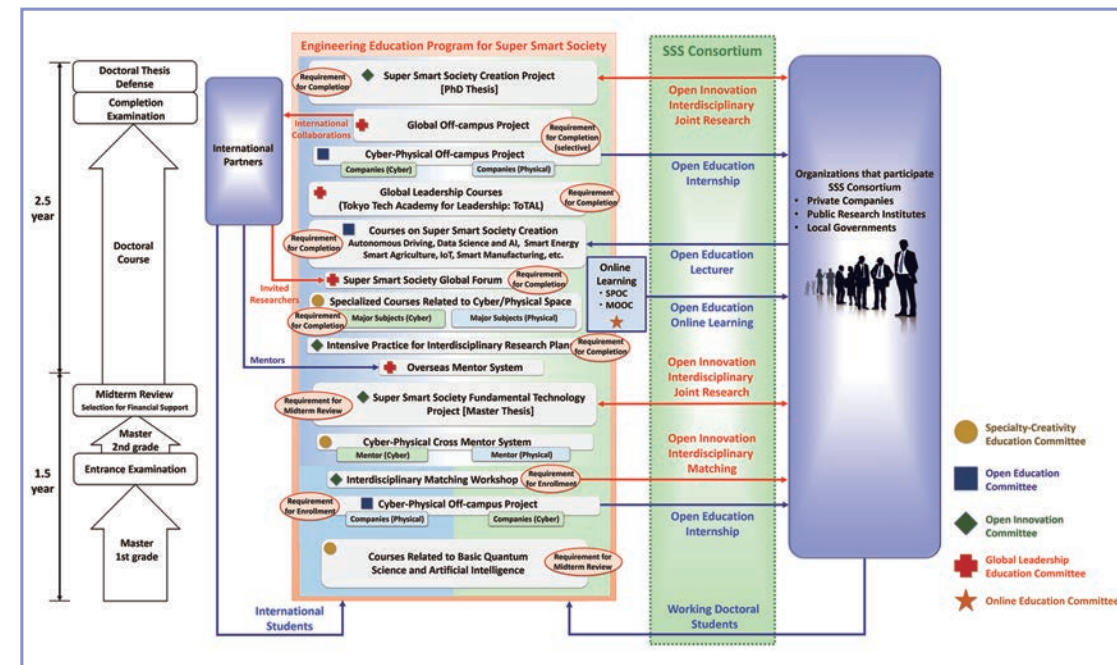
## [Fields of diplomas]

Doctor of Engineering, Doctor of Science, Doctor of Philosophy, appending the completion of the “WISE Program for Super Smart Society”

[Office and section in charge] WISE Program for SSS Group, Promotion Office for Education Programs, Student Division, Student Services Department

[Inquiries] 03-5734-2069

[URL] <https://www.wise-sss.titech.ac.jp/en>



(Figure 2) WISE Program for Super Smart Society

talented and seamless leadership between academia, government, and industry. The graduates from the program are expected to contribute in the domain of SSS engineering related to the future Earth such as 1) smart agriculture, 2) smart city, 3) smart ocean, 4) smart manufacturing, 5) smart mobility, 6) smart energy, and 7) smart sky.

## Features of WISE Program for Super Smart Society

The program is the core of the University's

SSS Promotion Project, and the main feature is to provide education with 72 faculty members collaboratively across six graduate schools and the Institute for Liberal Arts. Thus, interdisciplinary education is realized across the following fields: physical space technology in the School of Engineering, cyber space technology in the School of Computing, and quantum science in the School of Science. This is an exceptional education program that fosters specialization and originality across these fields.

Furthermore, in the field of SSS, it is necessary to train talent through social

program (orange) and the participating organizations of the Consortium (blue), the SSS Promotion Consortium (green) acts as a bridge to realize open education (blue arrow) to cultivate a broad perspective and open innovation (red arrow) to develop problem solving ability. By providing global leadership education in collaboration with overseas partner institutions, training global leaders with specialized knowledge and high ambition is another feature of the program.

## Message from WISE Cooperating Institution



KYUMA Kazuo  
President, National Agriculture and Food Research Organization

## Expectation for “knowledge professionals” towards realizing Society 5.0

In order to enhance the competitiveness of Japanese industry through the realization of “Society 5.0” which the government advocates as a super smart society, it is necessary not only to harness the strengths of “Monozukuri manufacturing” but also to create innovative industries and services utilizing ICT and AI.

I support this program in the hope that it fosters “knowledge professionals” who can recognize new needs, set goals, find solutions, and lead the smart society of the future.

## Student's Voice



NOGUCHI Takahiro  
The first year in the doctoral program, School of Engineering, Department of Electrical and Electronic Engineering

## Towards a super-skilled PhD holder with interdisciplinary education

I was attracted by the wide range of state-of-the-art fields not only mechanical, electrical and information technologies but also quantum science and AI, which are necessary to realize a Super Smart Society. Furthermore, through practicums, it is possible to experience cutting-edge technology such as automated driving, which is expected to be ubiquitous in a Super Smart Society. I applied for the program because I believe broad knowledge and intelligence will be powerful weapons in the future Super Smart Society.



## Development of WISE (World-leading Innovative & Smart Education) Program to foster AI (Artificial Intelligence) Professionals for Marine Industries

[Program Coordinator] SHOJI Ruri (Vice President, Professor, Tokyo University of Marine Science and Technology)

### Message from the President



TAKEUCHI Toshio  
President, Tokyo University of Marine Science and Technology

We strive to establish an excellent educational system that produces professionals who use AI and can lead global marine industries that combines marine science and engineering

TUMSAT has entered the second year of its WISE Program. In 2019, we established the Marine AI Development and Evaluation Center (MAIDEC), the core center for education and research activities. In 2020, the Marine AI consortium was established. As planned, we are procuring needed equipment and devices. It can be said that our WISE Program has just started moving as graduate students, who enrolled in April and October 2020, have begun to take the Program's courses. In 2024, when these students complete the Program, they will have acquired diverse skills and capabilities. I am looking forward to seeing them opening up the future of marine industries using AI. At TUMSAT, we all strive to provide an excellent program that combines marine science and engineering while establishing MAIDEC as an international core center that leads global marine industries.

### Development of AI professionals for marine industries

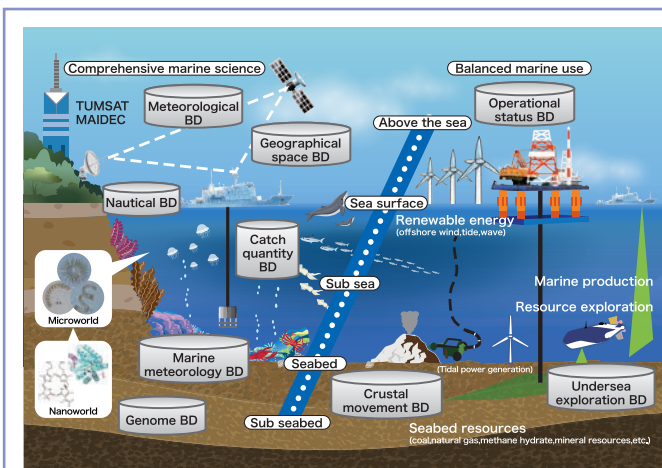
It is important to enhance Japan's presence in global marine industries as the marine-related working population decreases in modern society by producing individuals who create diverse values and novel systems that contribute to the realization of "Society 5.0 (ultra-smart society)." TUMSAT fosters the development of Artificial Intelligence (AI) Professionals and innovators. We train highly skilled experts who are not only literate in big data (BD) analysis and machine learning (ML) but also can assess AI performance. Based on expertise and field experiences gained at TUMSAT, they will drive the social implementation of AI and marine-related policies.

The WISE Program is established as a 5-year integrated graduate school course at TUMSAT.

The master's program provides lectures on BD analysis and ML to develop students' technical literacy, while practical skills beyond the courses are gained at MAIDEC. At the end of the master's program, students' basic ability to conduct doctoral dissertation research is assessed (Qualifying Exam). Through these efforts, we strive to develop specialists who can implement their knowledge and expertise gained at graduate school.

The doctoral program provides two introductory courses on AI and

society. Since AI is expected to be highly reliable, the Course on Advanced Reliability Assessments focuses on performance evaluation methods for AI. The Course on



Collect and analyze wide-ranging big data from the air to sub-seabed in a cross-sectional manner via industry-government-academia collaboration. Develop and provide an educational program on big data analysis and AI development assessments.

### DATA

[Number of scheduled student recruitments] 15  
[Number of anticipated program graduates] 15  
[Number of people engaged in the program] 42  
[Students' affiliated schools and departments] 1 graduate school, 9 departments  
<Graduate School of Marine Science and Technology>  
Marine Life Sciences, Food Science and Technology, Marine Resources and Environment, Marine Policy and Management, Marine System Engineering, Maritime Technology and Logistics, Safety Management in Food Supply Chain, Applied Marine Biosciences, Applied Marine Environmental Studies

[WISE Cooperating Institutions] 1 university, 3 public research institutes, 2 companies, 1 non profit organization  
National Institute of Maritime, Port and Aviation Technology / Japan Agency for Marine-Earth Science and Technology / Japan Fisheries Research and Education Agency / Technical University of Denmark / IDEA Consultants, inc. / BEMAC Corporation / NPO Marine Technologist

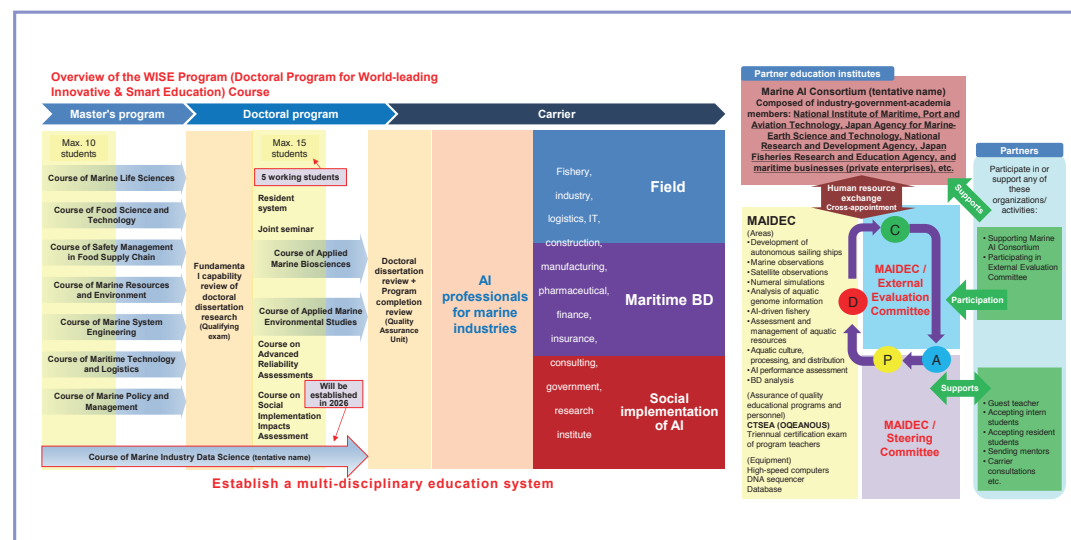
Year of selection FY 2019

### [Fields of diplomas]

Doctor of Philosophy or Doctor of Engineering Degree

The certificate of degree will include a statement that the person has completed the Doctoral Program for World-leading Innovative & Smart Education for the Development of AI Professionals in the Marine Industry.

[Office and section in charge] Academic Affairs Division  
[Inquiries] 03-5463-0503  
[URL] <https://www.g2.kaiyodai.ac.jp/marine-ai/eng/>



Education and research system to sustain excellence

Social Implementation Impacts Assessment discusses the impact of AI on society. In addition, the doctoral program cultures students' capabilities necessary to lead the social implementation of AI by providing opportunities to participate in real business projects at partner institutes (in-residence projects) and fieldwork.

Through these efforts, TUMSAT aims to establish the Course on Marine Industry Data Science (tentative name) in 2026 as a follow up to the WISE Program.

### Education and research system to sustain excellence

TUMSAT has established an education and

research system that spans wide-ranging fields such as marine, maritime, and fisheries. Students can learn about (1) the development of autonomous navigation vessels desired by the marine industry, (2) ocean observations using artificial satellites and Argo float data, (3) analysis of genomic information of aquatic organisms, (4) management of marine resources, and (5) establishment of next-generation smart fisheries. On November 1, 2019, we established the Marine AI Development and Evaluation Center (MAIDEC) to fully utilize state-of-the-art nautical training vessels such as Shinyo-Maru, the Field Science Center, and advanced navigation systems. In fiscal year 2020, moreover, we established a marine AI consortium

navigation officers, autonomous navigation vessels with automatic berthing systems, labor-savings in fishing and aquaculture using robots, and realization of high-production smart fisheries using automated and optimized water quality management based on weather forecasts and ocean information systems.

Fostering AI experts in marine industry will improve our entire society by stabilizing the food supply while conserving natural resources and solving labor shortages. When social implementation of AI is realized, the achieved high valued services can be expanded overseas and contribute to Sustainable Development Goals (SDGs).

### Message from WISE Cooperating Institution



TABATA Hideo  
Chairman,  
IDEA Consultants, Inc.

### We train experts who transform society by leading the marine industry

Real business fields are eagerly awaiting flexible thinking that leads to innovation. Utilization of the sea for industrial purposes such as fisheries, logistics, and resource/energy production will accelerate the accumulation of diverse data. We hope that the WISE Program produces the next generation of professionals who can understand the scientific meaning of such big data and make full use of information sharing technology to solve marine-related problems. We hope to contribute significantly to the Program.

### Student's Voice



IMAI Ryota  
1st year of doctoral program  
at Course of Maritime  
Technology and Logistics

### Full speed ahead using problem solving in the marine industry

Currently, marine vessels are operated by the knowledge and skills of experienced crews. Machine learning and big data technologies are expected to complement inexperienced crews and to help solve issues, including marine accidents and industry-wide labor shortages. TUMSAT's WISE Program is appealing to me because it provides opportunities to interact with partner institutions and to participate in real business activities. Additionally, it helps broaden my views and skills to conduct practical research.



## WISE Program for Nano-Precision Medicine, Science and Technology

[Program Coordinator] HANAYAMA Rikinari (Professor, Nano Life Science Institute, Kanazawa University)

### Message from the President



YAMAZAKI Koetsu  
Kanazawa University, President

### Training innovative individuals to pioneer new domains and to revitalize Japan's global competitiveness

At Kanazawa University, based on the central pillar of "training innovative individuals," we are reforming graduate school education and training advanced specialists to be leaders in academia and industry. For this program, we use the world-class research capabilities and research environment of the WPI Nano Life Science Institute with its world-leading researchers in delivering an educational program. I myself have also taken part in the residential training pre-program in which I stayed together with students and corporate participants, delivered lectures to students, interacted in student discussions, and renewed my own motivation to grapple with the issues. I expect students who study in this program to transcend disciplinary frameworks and challenge novel domains with courage as they grow into pioneering PhD-qualified individuals and become driving forces in the revitalization of our global competitiveness.

### Personnel who can develop for solutions to health issues

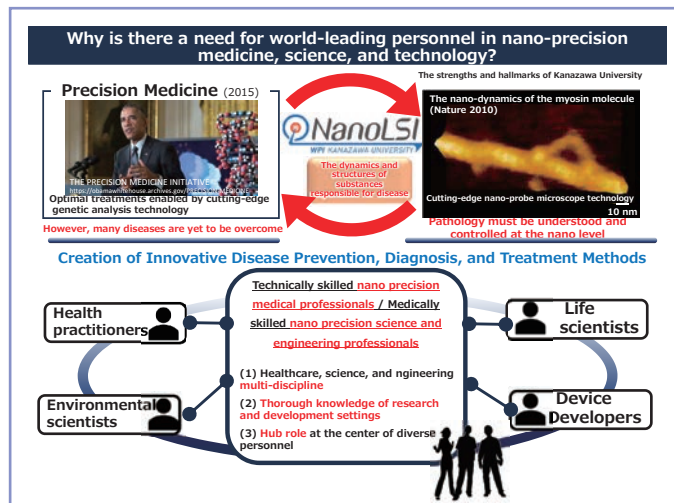
Cutting-edge technologies such as genetic analysis from the United States in 2015 have proposed a precision medicine that aims to deliver optimal patient-tailored treatment. While this has grasped the world's attention, many diseases are still not sufficiently controlled. We believe a major factor contributing to this is that the dynamics and structures of substances that cause disease within living organisms remain an uncharted territory at the nano level.

Therefore, this program focuses on five challenges to human society, namely, cancer, lifestyle diseases, neurological disorders, diseases from particulates, and diseases from nano materials, and draws fully on the research environment and results of the World Premier International Research Center Initiative (WPI) of the Nano Life Science

Institute with its world-leading researchers. In doing so, the program enables our students to study nano-precision medicine, science, and technology through the question of how their own specialist fields, nano science, and nano technology are applied to and used in medicine, science, and technology.

We educate PhD-qualified individuals who can bring about the innovation required to build a health infrastructure for humanity by applying these skills and knowledge. In other words, our program trains technologically

competent nano-precision medicine professionals and medically competent nano-precision science and technology professionals who will create innovative



Kanazawa University achieves world-leading research results in the understanding and control of pathology at the nano level and draws fully on this strength/status in training individuals to develop for solutions to health issues

### DATA

[Number of scheduled student recruitments] 12  
[Number of anticipated program graduates] 12  
[Number of people engaged in the program] 70  
[Students' affiliated schools and departments] 4 graduate schools, 14 departments  
<Graduate School of Natural Science and Technology>  
Mathematical and Physical Sciences, Material Chemistry, Mechanical Science and Engineering, Electrical Engineering and Computer Science, Environmental Design, Natural System  
<Graduate School of Medical Sciences> Medical Science, Medicine, Pharmacy, Pharmaceutical

Sciences, Health Sciences  
<Graduate School of Advanced Preventive Medical Sciences> Advanced Preventive Medical Science  
<Graduate School of Frontier Science Initiative> Transdisciplinary Sciences, Nano Life Science  
[WISE Cooperating Institutions]  
2 universities, 7 companies  
Imperial College London / University of British Columbia / Nikon Solutions Co., Ltd. / Pfizer R&D Japan G.K. / Ricoh Co., Ltd. / FUJIFILM Wako Pure Chemical Corporation / Olympus Corporation / Daicel Corporation / Hamamatsu Photonics K.K.

### [Fields of diplomas]

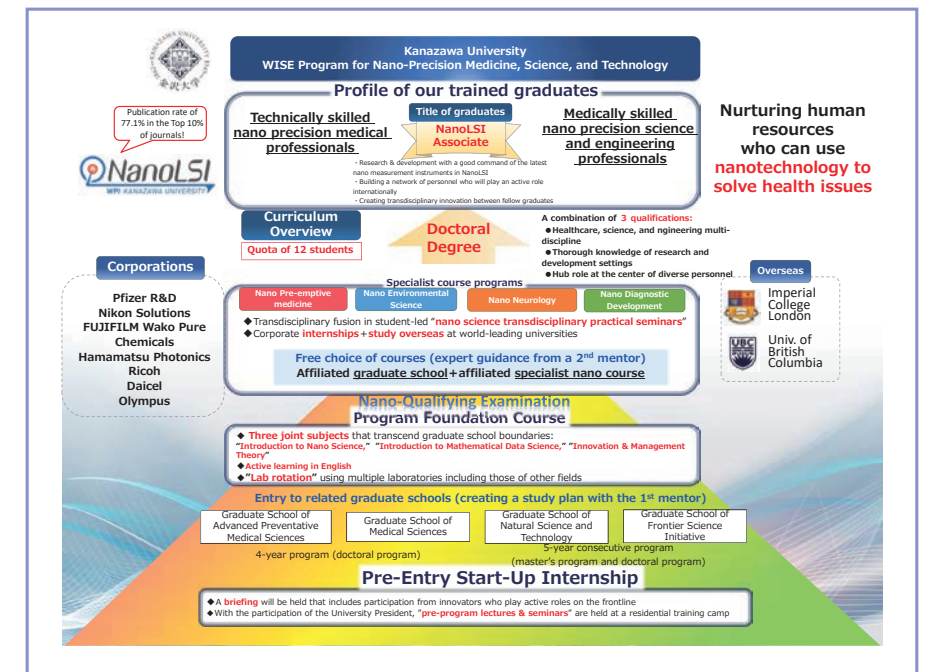
Doctor of Philosophy in Science, Doctor of Philosophy in Engineering, Doctor of Philosophy in Medicine, Doctor of Philosophy in Pharmacy, Doctor of Philosophy in Pharmaceutical Sciences, Doctor of Philosophy in Health Sciences, Doctor of Philosophy in Nano Science or Doctor of Philosophy  
Name of the program to be noted: WISE Program for Nano-Precision Medicine, Science and Technology

[Office and section in charge] WISE Program Office, Kanazawa University  
[Inquiries] 076-264-5959  
[URL] <https://nano-wise.w3.kanazawa-u.ac.jp/en/>

methods of prevention, diagnosis, and treatment through the understanding and control of pathology at the nano level.

### Creating innovation that continues from pre- to post-program

This program is a trans-disciplinary degree program covering the four graduate schools. With the aim of creating innovative individuals, the program builds and develops a trans-disciplinary education in science, technology, and medicine with a focus on nano-precision medicine and nano-precision science and technology. Before they enter the university, we host pre-program lectures and seminars for applicants joining the program. The pre-program is operated in a residential training format and includes participation from students at other graduate schools, senior students, and representatives from our corporate partners as well as the academics responsible for the program. While on the residential pre-program, participants acquire a taste of the potential for trans-disciplinary fusion by sharing their visions for the future of the program and getting to know one another. After entering the university, all students study the core subjects on the program's foundation course. These consist of mathematical data science and innovation management that are necessary to the realization of Society 5.0 and nanometrology and nano materials science, which serve as a basis for the program's transdisciplinary research. While on the foundation course, we cultivate a



This program is consisted of a foundation course that develops a comprehensive perspective and creativity and specialist course programs that furnish students with a global view and advanced specialization, pre-entry and post-complication.

comprehensive perspective and creativity as students engage in a broad study of real-world cases in transdisciplinary and applied research. Thereafter, students advance to the four specialist courses of Nano Pre-Emptive Medicine, Nano Neurology, Nano Environmental Science, and Nano Diagnostic Development and study how nano science is applied to the field of their specialist course. The specialist course program is student-led, whereby students conduct a transdisciplinary research project under the supervision of an academic staff member.

Our program graduates are conferred with a doctor's degree and can also acquire a qualification that enables them to perform research and development using the university's cutting-edge nano measurement technology. Through this, we aim to connect the program to corporate employment destinations, forge a personnel network, and create all types of transdisciplinary innovation, such as between fellow graduates, current students and graduates, and academic staff and graduates.

### Message from WISE Cooperating Institution



TSURUMUNE Atushi  
Nikon Solutions Co., Ltd.  
Bioscience Sales Headquarters  
AE Department Manager

Supported by a robust academic and industrial partnership, I expect great results from creative individuals who transcend disciplinary boundaries!

As a Nikon distributor, our company deals in cutting-edge microscopic and precision measurement instruments. Through the Nano Life Science Institute, we have formed a robust partnership of collaborative research and personnel exchange with Kanazawa University. For this program, by taking part in residential training and delivering lectures to students, with our focus on Nikon's technologies in optics and nano measurement, we support the cultivation of individuals capable of bringing innovation by transcending the boundaries of medicine, science, and technology.

### Student's Voice



NISHIDE Goro  
Graduate School of Frontier Science Initiative Division of Nano Life Science Doctoral course 1 year

### A program that strongly supports me in my goals and dreams

I aim to become a researcher with a broad knowledge and experience. While engaging in my previous research in biology, at times I required knowledge and experience from other academic disciplines (knowledge from the oncological field of medicine and experience from physics of handling high-speed atomic force microscopy). For this program, I can acquire a broad knowledge of science and medicine and come into contact with the latest global research through study overseas, which strongly supports me in my goals and dreams.



## Convolution of Informatics and Biomedical Sciences On Glocal Alliances

[Program Coordinator] KATSUNO Masahisa (Vice Dean, Professor, Nagoya University Graduate School of Medicine)



### Message from the President



MATSU Seichi  
President, Nagoya University

### Novel medical system to create a high-quality aging society

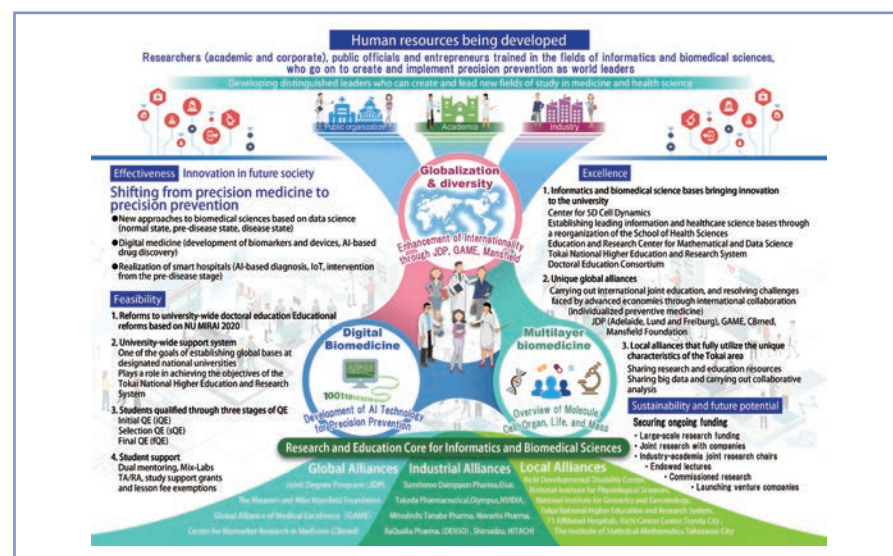
As a result of rapid developments of electronic medical devices and biomedical/life sciences, mass vaccination made many infectious diseases formidable threats. Cancers and other life-threatening diseases are also becoming curable by early diagnosis and treatment. On the other hand, rapid aging of the population causes serious social problems in developed countries. The problems make it an urgent necessity to create environments that are required for elderly people to carry out high quality of health and social lives. To implement these environments, it is necessary to develop a novel medical field in which diseases are predicted and prevented before people get ill. In this program, it is planned to develop cutting-edge researches of individual prevention and to nurture scientists who carry out these researches.

### From personalized prevention to social implementation

Currently, increases in cancer, dementia, and other diseases associated with an aging population have become a problem in both developed and developing countries. The situation is particularly serious in Japan, which is facing a critical situation with ballooning medical and nursing care costs and a shrinking working population in addition to a super-aged society and a rapidly declining birthrate. The key to resolving these issues is to shift from personalized medicine to personalized prevention. To achieve this, life science big data must be analyzed at multiple levels from the molecules to human society itself, allow understanding of the pathogenesis of undiagnosed diseases and develop preventive methods. In order to

achieve this goal, informatics and biomedical sciences must work in tandem. However, due to the high degree of specialization in

both medical sciences and informatics and the rapid pace of technological development, there is an overwhelming lack of people



The CIBoG program create a research base for informatics and biomedical sciences by collaborating with regional institutes to develop a new field of biomedical sciences that aims to implement individual prevention on the global society.

### [Fields of diplomas]

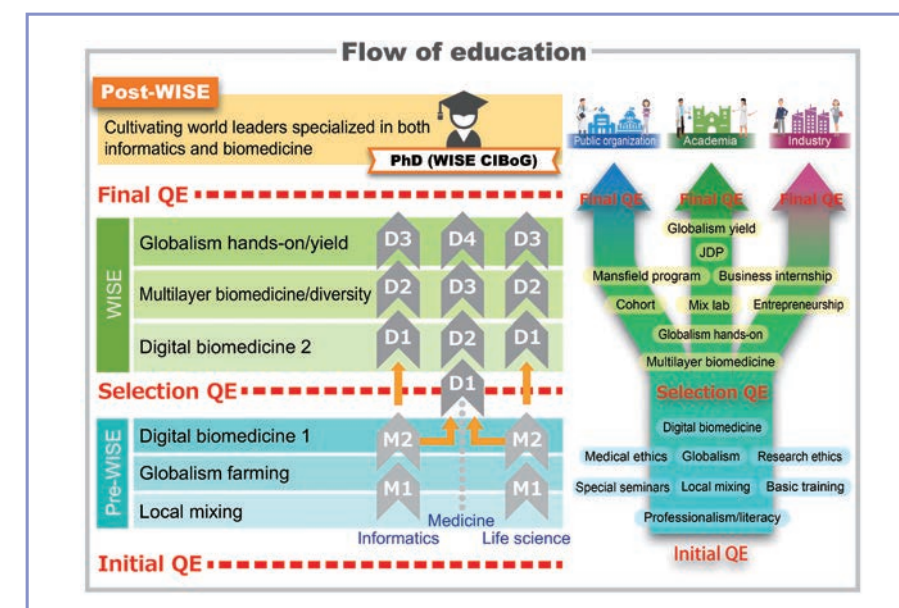
PhD in Medicine, PhD in Nursing Science, PhD in Radiological and Medical Laboratory Sciences, PhD in Physical and Occupational Therapy, PhD in Informatics, PhD in Pharmaceutical Sciences, PhD in Bioagriculture, PhD in Agricultural Sciences  
Name of the program to be noted: WISE Program, Informatics and Biomedical Sciences

[Office and section in charge] Office of CIBoG  
[Inquiries] 052-744-1946  
[URL] <https://cibog.med.nagoya-u.ac.jp/en/>

capable of conducting such integrated research and applying the results of that research to the society. Many of challenges we face in medicine today are no longer limited to national borders as is evident from our struggles against global scale infectious diseases. Development in a global scale is essential to collect and analyze big data and implement the findings to society. Global awareness and diversity are thus vital for developing human resources. The CIBoG program, therefore, aims to foster the development of researchers, administrators, and entrepreneurs with deep insight into informatics and biomedical sciences who can build a collaborative research system for big data analysis, create personalized prevention systems, and promote their social implementation.

### To develop globally competitive interdisciplinary research

CIBoG is based on 3 basic educational policies or pillars: Digital Biomedical Sciences, Multilayered Biomedical Sciences, and International and Diversity Education. During the five-year program (four years for medical doctors), students enrolled in the CIBoG program acquire proficiency in the three field that constitute the main pillars, through both basic science study and clinical practice. Graduates gain the ability to develop integrated medical and informatic research



The CIBoG program recruits students in informatics and biomedical science and supports them with financial aids to foster global leaders who can create and promote a new field that integrate informatics and biomedical science.

projects at a global level by applying what they learn in the CIBoG program. Digital Biomedical Sciences is a form of medical research that utilizes mathematical informatics. In CIBoG, the Graduate School of Medicine and the Graduate School of Informatics will not only work together to support graduate student education and research, but also to strengthen digital medicine education through the reorganization of the Department of Health Sciences and participation of the Institute of Statistical Mathematics, sure to prove a driving force behind this new graduate

education program. In addition, the Center for 5D Cellular Dynamics (C5CD), a center for integrated medicine and informatics analysis, has been established at the Tsurumai Campus. Through close collaboration between the wet and dry laboratories, C5CD will promote joint research among medical informatics research that integrates various related fields such as medicine, molecular biology, and mathematical sciences, with a focus on immunology, and promote spatio-temporal understanding of complex biological phenomena on a cell-by-cell basis.

## DATA

[Number of scheduled student recruitments] 20-22  
[Number of anticipated program graduates] 20-22  
[Number of people engaged in the program] 107  
[Students' affiliated schools and departments]  
Nagoya University 4 graduate Schools, 10 departments  
Gifu University 2 graduate schools, 2 departments  
Nagoya University  
<Graduate School of Medicine> Integrated Medicine,  
Integrated Health Sciences, Integrated Medicine Joint  
Degree with the University of Adelaide, Integrated Medicine  
Joint Degree with Lund University, the University of  
Freiburg, Medical Sciences  
<Graduate School of Informatics> Computing and Software

Systems, Intelligent Systems  
<Graduate School of Pharmaceutical Sciences> Basic  
Medical Sciences  
<Graduate School of Bioagriculture> Applied Biosciences  
Gifu University  
<Graduate School of Applied Biological Sciences> Applied  
Biological Sciences  
<United Graduate School of Agricultural Science> Agricultural  
Science  
[WISE Cooperating Institutions]  
12 universities, 5 public research institutes, 11 companies  
Gifu University / National Institute for Physiological Sciences  
/ Aichi Cancer Center / National Center for Geriatrics

and Gerontology / Aichi Developmental Disability Center  
Institute for Developmental Research / Institute of Statistical  
Mathematics / Shimadzu Corporation / Novartis Pharma /  
NVIDIA Corporation / Eisai Co., Ltd. / Olympus Corporation  
/ RaQualia Pharma / Sumitomo Dainippon Pharma Co.,  
Ltd. / Mitsubishi Tanabe Pharma Corporation / Takeda  
Pharmaceutical Co., Ltd. / University of Adelaide / Lund  
University / Albert-Ludwigs-Universität Freiburg / University  
of Nottingham / University of Hong Kong / University of  
Bologna / University of Alberta / LMU Munchen / Korea  
University / Erasmus Medical Centre Rotterdam / Monash  
University / CBmed / Hitachi Co., Ltd.

### Message from WISE Cooperating Institution



TAKAHASHI Takashi,  
MD, PhD  
Acting Director, Aichi Cancer  
Center Research Institute

### System decreasing the number of cancer patients in the aging society

As the advent of aging society, both the numbers of cancer patients and cancer deaths are increasing. It is urgent to develop biomedical systems to prevent and treat cancers. A huge amount of genome data analyzed using AI leads us to a dramatic development in the fields of cancer prevention and medical treatment. Through the development, people will be individually given prediction on susceptible cancer and effective treatment. I, therefore, expect this program to cultivate researchers capable of integrating informatics and biomedical sciences.

### Student's Voice



ISAJI Hikari  
Graduate School of Medicine,  
Master Course 2nd Grade

### Community life support system for patients with mental disorder in Japan

I study how mental disorder patients live in the local community. Through the questionnaire, I try to characterize lives of mental disorder patients to understand the usage of time for patients capable of living in the community stably and for a long time. In the CIBoG program, I would like to learn informatics in addition to biomedical sciences, and I wish to contribute for creating and developing supporting system for community lives of mental disorder patients. I also wish to become a researcher capable of contributing internationally.



## Graduate Program for Medical Innovation

[Program Coordinator] WATANABE Dai (Professor, Graduate School of Medicine, Kyoto University)

Message from  
the PresidentMINATO Nagahiro  
President, Kyoto University

Through the WISE Program, Kyoto University seeks to cultivate advanced “knowledge professionals” who will play key roles in industry, academia, and government

In 2017, Kyoto University was granted Designated National University Corporation (DNU) status by the Japanese government. One of the four pillars of the university's DNU strategy is “fostering the next generation of researchers and promoting the international mobility of young researchers.” Under the DNU initiative, the university is making efforts to further internationalize its education, foster diverse human resources, and recruit excellent human resources in order to generate a high-level flow of talent.

In line with its DNU strategy, the university continues to provide unique high-quality programs under the government's Doctoral Program for World-leading Innovative & Smart Education (WISE Program). The programs are provided in close cooperation with leading companies and world-class research institutes in Japan and leading universities around the world with the aim of cultivating advanced “knowledge professionals” and promoting the reform of the university's graduate schools.

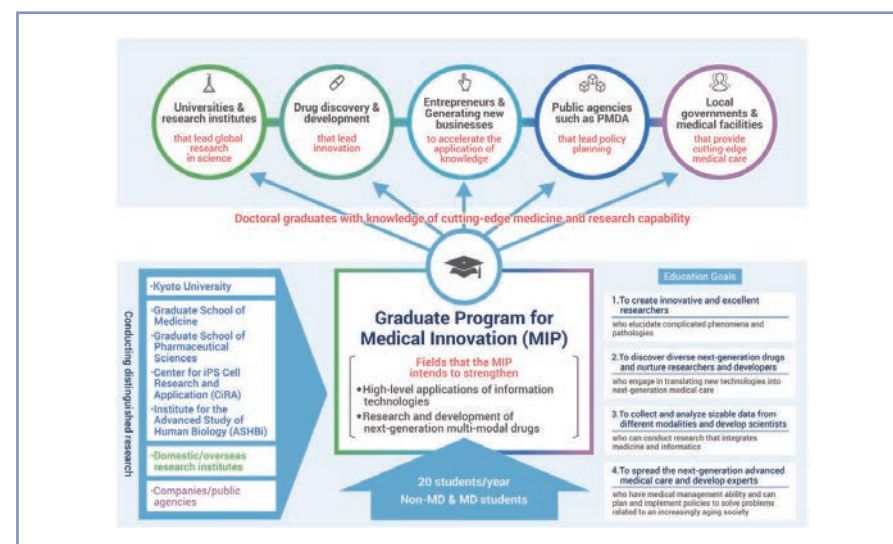
Education for Next-Generation  
Medical Innovators

In order for medical and healthcare innovation in Japan to be accelerated and disseminated worldwide, a system for training outstanding personnel capable of undertaking cutting-edge research and development, needs to be established strategically. Based on this idea, the Graduate Program for Medical Innovation aims to train both MD (medical doctor) students and non-MD students to be medical innovators with a global mindset. This will be achieved through collaboration between accomplished medical, pharmaceutical, and health science researchers at Kyoto University. [Education Goals]

1. To create innovative and excellent researchers who elucidate complicated phenomena and pathologies

2. To discover diverse next-generation drugs and nurture researchers and developers who engage in translating new technologies

3. To collect and analyze sizable data from different modalities and develop scientists into next-generation medical care



Education Goals of the Graduate Program for Medical Innovation

## DATA

[Number of scheduled student recruitments] 20  
 [Number of anticipated program graduates] 3-18  
 [Number of people engaged in the program] 103  
 [Students' affiliated schools and departments] 2 graduate schools, 7 departments  
 <Graduate School of Medicine> Medicine, Medical Science, Public Health, Human Health Sciences  
 <Graduate School of Pharmaceutical Sciences> Pharmaceutical Sciences, Biomedical Sciences, Bioinformatics and Chemical Genomics  
 [WISE Cooperating Institutions] 3 Universities, 15 Companies, 8 Research institutes

University of California, San Diego / University of Toronto / National Taiwan University / The FIRC Institute of Molecular Oncology / National Institutes of Health / Max-Planck Institute / NeuroSpin / RIKEN / Institute of Biomedical Research and Innovation, Foundation for Biomedical Research and Innovation at Kobe / Tazuke Kofukai Medical Research Institute Kitano Hospital / Bioorganic Research Institute, Suntory Foundation for Life Sciences / NTT DATA Corporation / Deloitte Tohmatsu Consulting LLC. / mixi, Inc. / KBBM, Inc. / MICIN, Inc. / Eisai Co., Ltd. / Daiichi Sankyo Co., Ltd. / Chugai Pharmaceutical Co., Ltd. / Asahi

Kasei Pharma Corporation / Taisho Pharmaceutical Co., Ltd. / Sumitomo Dainippon Pharma Co., Ltd. / ONO PHARMACEUTICAL CO., LTD. / Mitsubishi Tanabe Pharma Corporation / KYORIN Pharmaceutical Co., Ltd. / Chordia Therapeutics, Inc.

## [Fields of diplomas]

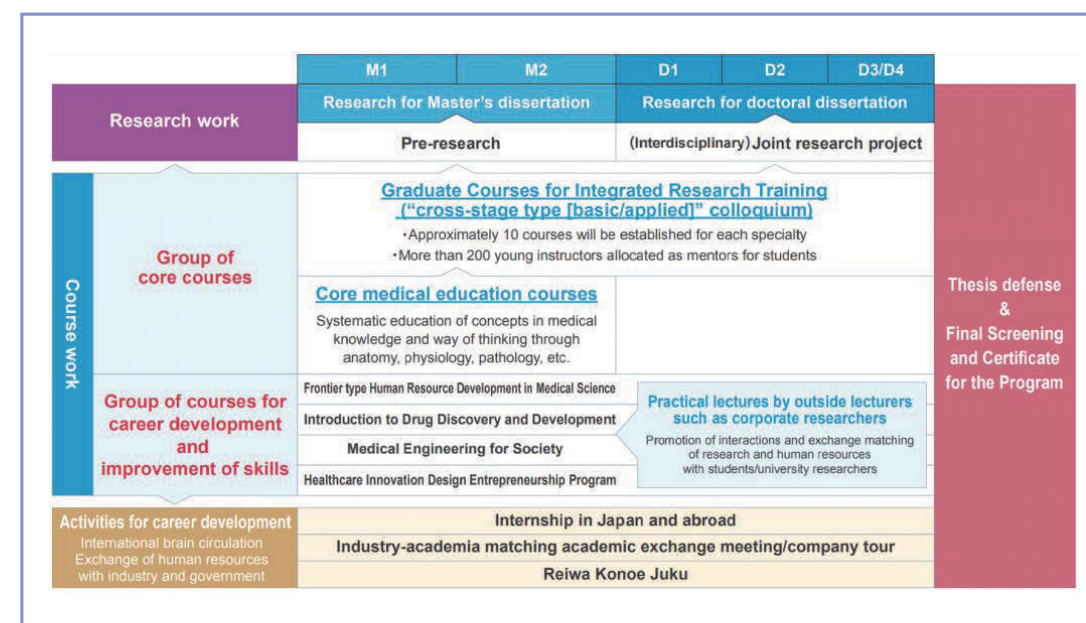
Doctor of Medical Science, Doctor of Public Health, Doctor of Human Health Sciences, Doctor of Pharmaceutical Sciences

Name of the program to be noted: Graduate Program for Medical Innovation

[Office and section in charge] Education Promotion Office, Graduate School of Medicine, Kyoto University

[Inquiries] 075-753-9334

[URL] <https://www.mip.med.kyoto-u.ac.jp/en/>



Curriculum of the Graduate Program for Medical Innovation

- who can conduct research that integrates medicine and informatics
4. To spread the next-generation advanced medical care and develop experts who have medical management ability and can plan and implement policies to solve problems related to an increasingly aging society

## Features of the program

Kyoto University has been pursuing the world's highest level of research and has produced internationally-recognized

researchers including Nobel laureates. Curriculums that take advantage of this research-based strength of the university have been established by the Graduate School of Medicine, Graduate School of Pharmaceutical Sciences, Center for iPS Cell Research and Application (CiRA), and Institute for the Advanced Study of Human Biology (ASHBi), operating under the World Premier International Research Initiative (WPI).

The program aims for students to acquire systematic medical knowledge as well as advanced and creative research capabilities according to their diverse backgrounds and

interests. It also aims to cultivate a comprehensive perspective of the social implementation of next-generation medical treatment by interacting with leading experts in industry, government and academia in Japan and overseas.

[Program Features]

1. The program will build an advanced education and research system through an academic-industrial cooperation that covers everything from basic research to social implementation of the results.

2. To meet the diverse needs of students, a diverse

group of faculty members will be assigned to run the program, and young mentor faculty members will provide detailed research guidance.

3. In collaboration with related departments that have world-class research achievements and long-established expertise in industry-government-academia collaboration, the program will establish a research system that works together with domestic and international research institutions as well as industry and government.

Message from WISE  
Cooperating InstitutionKIRIYAMA Yoko  
Regulatory Affairs, MICIN, Inc.Realize "patient-centered medicine" by  
cutting-edge technologies

Digitalization in medical domain has been significantly accelerated this year, which is largely driven by the outbreak of COVID-19. Variety of digital technologies have been developed and applied to medicine. Even regulatory architecture commences to transform significantly. In order to realize "patient-centered medicine" under this unstabilized circumstances, I hope every student in MIP could obtain a perspective to sharpen up essential medical issues and flexibly but persistently apply or develop technologies to resolve them.

## Student's Voice

HARATA Yutaro  
First-year Master's student,  
Department of Human Health  
Sciences, Graduate School of  
MedicineThe medical talent who supports the future  
with a cross field program

I believe that human resources who will be responsible for future medical care need cross-sectional knowledge of medicine and pharmacy, utilization of big data, and the ability to return research results to society, in addition to deepening one's major. Medical innovation program is developed across fields through collaboration between many institutions and companies. I would like to take a view of how I am involved in medical care from various perspectives and make use of it in my career development by participating in this program.



# Multidisciplinary PhD Program for Pioneering Quantum Beam Application

[Program Coordinator] NAKANO Takashi (Director, Research Center for Nuclear Physics, Osaka University)

## Message from the President



NISHIO Shojiro  
President, Osaka University

Accelerating the process of nurturing doctoral students capable of developing new quantum beam applications through the virtuous cycle of the OU Ecosystem

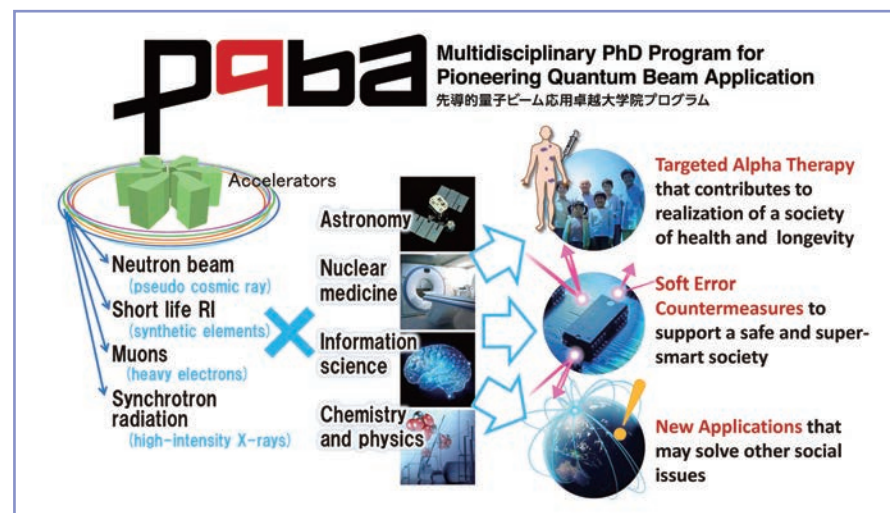
Osaka University has been facilitating the Research and Development Ecosystem, a cycle of implementing distinguished research results in society, analyzing new research topics discovered in the process of implementation, and conducting fundamental research on such topics. The OU Ecosystem expands on the Research and Development Ecosystem to broaden the range of our competences as we aim to become a world-leading innovative university that contributes to social transformation. The combination of quantum beam applications with the results of fundamental research in science, medicine, and information sciences can create new values, such as targeted alpha therapy that contributes to healthy longevity and measures to prevent soft errors for the safety of a super-smart society. With this program, we will nurture doctoral students who can lead the development of new quantum beam applications through the virtuous cycle of the OU Ecosystem.

## Pioneering quantum beam application to solve social issues

Confronted with the reality of rapid aging and a low birthrate, our country must address the urgent tasks to extend the healthy life expectancy and realize a super-smart society with a clear vision of Society 5.0. Academia, including universities, are expected to address this issue and create new value through interdisciplinary cooperation. In this context, quantum beams created by accelerators are being applied in innovative ways to solve problems of modern society. Radioactive isotopes (RIs), which support nuclear medicine, have been essential in cancer research. RIs played a critical role in the rapid evolution of gamma imaging technology and targeted alpha therapy. In addition, cosmic

rays contribute to soft errors, which were originally discussed in devices operating in harsh environments such as space. However,

due to the rapid development of the Internet of Things (IoT), cosmic ray-induced soft errors have also become an issue on the ground.



Characteristic quantum beam and expertise to create new value to solve social issues.

## [Fields of diplomas]

Ph.D. (Physical Science), Ph.D. (Medicine), Ph.D. (Informatics), Ph.D.  
Name of the program to be noted: Completion of Multidisciplinary  
PhD Program for Pioneering Quantum Beam Application

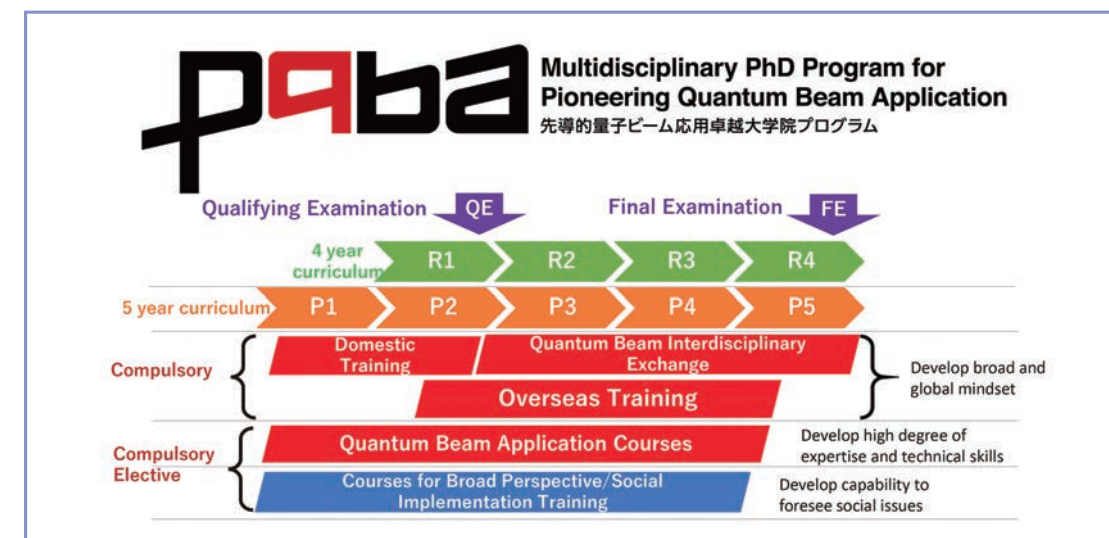
[Office and section in charge] Graduate School of Science,  
Research Center for Nuclear Physics  
[Inquiries] 06-6879-8904  
[URL] <https://www.rcnp.osaka-u.ac.jp/pqba/en/index.html>

Therefore, accelerated testing using quantum beams is urgently needed to evaluate and implement countermeasures.

This program aims to “continuously develop human resources to lead the creation of next-generation quantum beam application technologies” by targeting students mainly in the fields of science, medicine, and information technology in cooperation with domestic and foreign universities, institutions, and companies related to various quantum beams, including radionuclides, neutrons, and muons.

## Curriculum and attributes of individuals in the program

Individuals in the program are expected to become keenly aware of social issues and explore the treasure trove of past research to create innovative key technologies for social implementation of new value. By gaining a high degree of expertise, a broad perspective, and advanced global communication skills, they are expected to thrive as global leaders and “knowledge professionals” within all



We offer a curriculum to acquire a high degree of expertise, an ability to understand from a broad perspective, and global communication skills.

sectors (industry, academia, and government). They will possess the following attributes:

- \* Ability to consider risks in terms of human sustainability
- \* Significant academic and technical knowledge in a specialized field
- \* Ability to consider phenomena on various scales and academic fields
- \* Experience and knowledge of advanced experiments and calculations in different fields
- \* Ability to evaluate risks and benefits of the implementation of advanced technologies
- \* Ability to develop and capitalize on human networks by taking a leadership role in international activities

To educate individuals who possess these attributes, the program offers a curriculum focusing on interdisciplinary and international joint research. In particular, overseas training is mandatory. Training locations include Canada's Particle Accelerator Centre TRIUMF (Canada) and The University of British Columbia (Canada), which shares property boundaries with TRIUMF; University of Queensland (Australia), which has the Center for Advanced Imaging; and Heidelberg University (Germany), which has close collaborative relationships with Osaka University in a variety of fields related to nuclear medicine.

## DATA

[Number of scheduled student recruitments] 15  
[Number of anticipated program graduates] 3-15  
[Number of people engaged in the program] 123  
[Students' affiliated schools and departments]  
3 graduate schools, 4 departments  
<Graduate School of Science> Physics, Chemistry  
<Graduate School of Medicine> Medicine  
<Graduate School of Information Science and Technology> Information Systems Engineering  
[WISE Cooperating Institutions]  
3 universities, 13 private sectors, 6 national / local  
research institutes, 2 overseas universities, 1 overseas

research institute  
High Energy Accelerator Research Organization  
Institute of Materials Structure Science / High Energy  
Accelerator Research Organization Institute of  
Particles and Nuclear Studies / National Institutes for  
Quantum and Radiological Science and Technology /  
Cyclotron and Radioisotope Center, Tohoku University /  
Research Center for Electron Photon Science, Tohoku  
University / J-PARC / Kyoto Institute of Technology  
/ Isotope Science Center, The University of Tokyo /  
Kalvi Institute for the Physics and Mathematics of the  
Universe, The University of Tokyo / RIKEN / TRIUMF /

The University of Queensland / Heidelberg University  
Hospital / National Institute of Health Science / ATOX  
/ Telix Pharmaceuticals Japan / SOCIONEXT / Hitachi,  
Ltd. / Nihon Medi-Physics Co., Ltd. / Sumitomo Heavy  
Industries, Ltd. / FUJIFILM Toyama Chemicals Co.,  
Ltd. / Kyoto Medical Technology / EPS Corporation /  
Metal Technology Co. Ltd. / Toshiba Electronic Devices  
& Storage Corporation / Yamato Scientific Co., Ltd.  
/ Japan Radioisotope Association / Anderson Mōri &  
Tomotsune

## Message from WISE Cooperating Institution



SAITO Naohito  
Director, J-PARC Center

## Anticipate polymaths who expedite new value creation with accelerators

Japan has been leading the world with numerous advanced accelerator facilities. Many organizations that own such facilities are participating in the program. Although accelerators hold great promise to solve social issues, their potential is not fully utilized at present. We anticipate cultivating exceptional individuals who can lead the world by creating new value with accelerators.

## Student's Voice



HISAMATSU Mariko  
First year in the Masters  
Course, Physics Department,  
Graduate School of Science

## Building expertise, and interdisciplinary and social interaction skills

I found out about this program while contemplating my future as a researcher after joining an overseas research lab during my undergraduate studies. The contribution of science in today's society requires inputs from a variety of valuable perspectives. Consequently, a single expertise cannot address issues. I believe PQBA is helping me gain diverse expertise regarding quantum beams. I expect to further develop skills to cooperate with and understand connections to society.



## Multi-Scope・Energy WISE Professionals

[Program Coordinator] IHARA Manabu (Professor, School of Materials and Chemical Technology, Tokyo Institute of Technology)

## Message from the President



MASU Kazuya  
President, Tokyo Institute of Technology

## Tokyo Tech Pushes Strategic Promotion of Three Outstanding Graduate School Programs

Tokyo Tech implemented Institute-wide, ambitious reforms in education, research, and governance in 2016, reorganizing its system into the current six schools, Institute of Innovative Research, and Institute for Liberal Arts. Having also identified three strategic fields and three priority fields that are applicable and relevant to all departments, we were selected as a Designated National University (DNU) in March 2018. The three new priority fields – “Next-Generation Element Strategy”, “Integrated Energy Science”, and “Digital Society Devices and Systems” – are the fields in which we will take future initiatives in leading Japan. Under my leadership as president of Tokyo Tech, we have also put forth Institute-wide efforts to promote the funding program for outstanding graduate schools since its start in AY 2018. We have made one proposal every year in the aforementioned priority fields, all of which have been adopted.

## Multi-scope・Energy WISE Professionals shape the future of energy

Supplying sustainable energy while curbing activities that contribute to climate change is an urgent mission for the global community. To build a society suitable for the future of energy, we must transition to a culture of sustainability and carbon neutrality by making the most of big data science, AI analysis and data science, and digitization. Tokyo Tech defines its sought-after “ambient energy society” as one in which the environment and economy coexist without people having to worry about energy sources and protecting the environment. We aim to achieve such a society in cooperation with industries.

The newly established Tokyo Tech Academy of Energy and Informatics program helps students develop into Multi-scope・Energy WISE Professionals who, with a solid basic understanding of energy science,

are capable of applying big data science to the research and development of devices, systems, and scenarios, designing the future of energy, and taking leadership to bring about transformations.

Students are evaluated and awarded diplomas based on their readiness for expected roles in 1) bringing social innovation through new ventures, 2) planning and promoting new businesses in companies, and 3) driving the



There are four InfoSyEnergy courses that train its students to become thriving Multi-scope・Energy WISE Professionals who will take on roles in ventures, companies, and academia to ultimately produce a society of sustainable energy.

## DATA

[Number of scheduled student recruitments] 25-35  
[Number of anticipated program graduates] 25  
[Number of people engaged in the program] 123  
[Students' affiliated schools and departments]

5 schools, 17 departments, 1 professional master's degree program  
<School of Science> Mathematics, Physics, Chemistry  
<School of Engineering> Mechanical Engineering, Systems and Control Engineering, Electrical and Electronic Engineering, Information and Communications Engineering, Industrial Engineering and Economics  
<School of Materials and Chemical Technology> Materials Science and Engineering, Chemical Science and Engineering  
<School of Computing> Mathematical and Computing Science, Computer Science  
<School of Environment and Society> Architecture and

Building Engineering, Civil and Environmental Engineering, Transdisciplinary Science and Engineering, Social and Human Sciences, Innovation Science, Technology and Innovation Management

## [WISE Cooperating Institutions]

1 university, 1 national research and development agency, 1 independent administrative agency, 1 local government, 24 companies, 17 overseas universities  
Hitotsubashi University / AIST / JICA / Kawasaki City / Kawasaki Heavy Industries, Ltd. / Chiyoda Corporation / Toshiba Corporation / Toshiba Energy Systems & Solutions Corporation / Showa Denko K.K. / BROTHER INDUSTRIES, LTD. / Tokyo Electric Power Company Holdings, Inc. / Iwatani Corporation / ENEOS / JFE Engineering Corporation / IHI Corporation / SEKISUI CHEMICAL CO., LTD. / Panasonic Corporation / Sony Corporation / NTT FACILITIES, INC. /

NTT DATA CUSTOMER SERVICE Corporation / NTT DATA BUSINESS SYSTEMS CORPORATION / Deloitte Tohmatsu Consulting LLC / Azbil Corporation / SUMITOMO CORPORATION / Mitsubishi Corporation / Tokuyama Corporation / KAJIMA CORPORATION / Mizuho Information & Research Institute, Inc. / Mitsubishi Electric Corporation / Massachusetts Institute of Technology / Princeton University / Georgia Institute of Technology / University of California, Santa Barbara / University of Cambridge Judge Business School / Imperial College London / INSA Lyon / RWTH Aachen University / University of Stuttgart / Uppsala University / Swiss Federal Institute of Technology in Lausanne / University of New South Wales / Nanyang Technological University / Tsinghua University / Korea Advanced Institute of Science and Technology / Thailand National Science and Technology Development Agency / CEA-Liten

## [Fields of diplomas]

Doctor of Engineering, Doctor of Science, Doctor of Philosophy

The diploma will also certify completion of the Tokyo Tech Academy of Energy and Informatics program.

creation of a future society. Such outstanding professionals, trained through the program's collaborations with companies, are expected to demonstrate excellence across the scopes of multi-disciplinary energy science (profound expertise), big data science (expertise and skills), and social design for the future (expertise and quality as member of society).

## Liaison with InfoSyEnergy Research and Education Consortium

Prior to the establishment of the Academy of Energy and Informatics program, Tokyo Tech launched the InfoSyEnergy Research and Education Consortium in November 2019 as an industry liaison hub for research and education. “InfoSyEnergy” was coined from “Informatics,” “Synergy,” and “Energy.” The consortium functions as a framework to support feasibility and continuity of the program in its mission to train Multi-scope・Energy WISE Professionals.

Joint research projects between industry and academia have typically been between one lab and one company. But through this program, we aim to build a platform where proposing and implementing a number of collaborations of various scales and levels are possible. A major feature of this program is the close cooperation with the consortium. All consortium member organizations select representatives to work with Tokyo Tech faculty members to promote the program. By inviting renowned researchers from overseas institutions – including the world's

## Message from WISE Cooperating Institution



ISHII Hideaki  
Executive Officer, Corporate Vice President, Toshiba Corporation

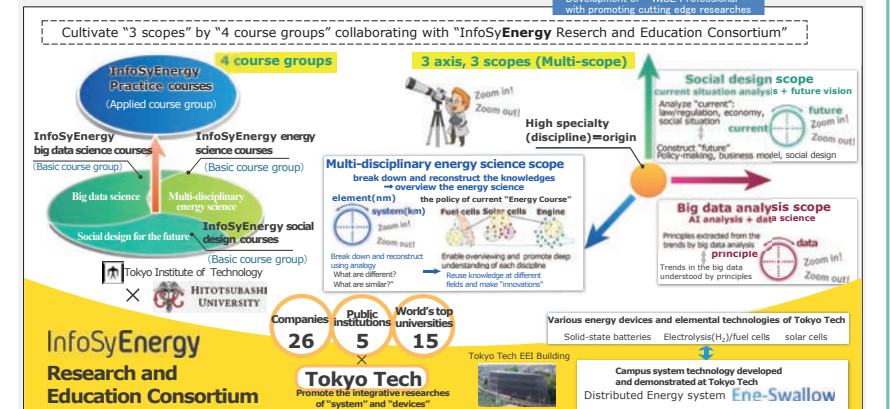
## Fostering high-level professionals who will lead a sustainable, carbon-free future society

In transitioning to a carbon-free society, the forms of energy resources are beginning to change dramatically. There is an ever-increasing demand for new technologies to coincide with the changes in our society. These technologies range from renewable baseload power sources, hydrogen energy storage and storage battery systems, and power systems control using advanced supply-and-demand forecasts and sophisticated devices for fuel cells that are essential for supporting such foundations, to energy management leveraging the available big data thereof. We have high expectations that the program will contribute to research and development and rapidly lead to game-changing innovation and the development of high-level professionals who will lead the future of society and industries on a global scale.

## Multi-scope・Energy WISE Professionals

“Professionals” of “Multi-disciplinary energy science” who can design a new sustainable energy society with mastering “big data science” and “social design”

Lead the transformation into a “human-centered, sustainable energy society” which is free from the restrictions such as energy costs or CO<sub>2</sub> emissions with managing energy smartly by “AI analysis of big data”



Alongside Tokyo Tech's InfoSyEnergy Research & Education Consortium, its first to place joint research at the forefront, we contribute to excellent human resource development, application of research to industry, and project sustainability.

top 15 universities – as well as business mentors from member companies to report on research outcomes and conduct discussions, the consortium aims to strengthen the feasibility of the program's concept, enhance graduate education, and improve continuity of the program with additional financing from corporate members. The program will also provide doctoral students with research opportunities and financial support though joint research projects with companies, so that the students can become financially independent and concentrate on their studies.

In addition, the program will launch courses – through which students are expected to acquire or enhance their basic knowledge in social sciences – in new business creation, energy policy planning, and energy econometrics with the full support of Hitotsubashi University. Multi-scope・Energy WISE Professionals, as they complete these studies and projects, will contribute to bringing about the desired shift to a society of sustainable energy free from restrictions on the use of energy such as cost and carbon emissions.



## Graduate Program for Lifestyle Revolution based on Transdisciplinary Mobility Innovation

[Program Coordinator] KAWAGUCHI Nobuo (Professor, Institutes of Innovation for Future Society, Nagoya University)



名古屋大学  
NAGOYA UNIVERSITY

[Office and section in charge] Office of TMI  
[Inquiries] 052-788-6114  
[URL] <https://www.tmi.mirai.nagoya-u.ac.jp>

### Message from the President



MATSUO Seichi  
Nagoya University President

### Fostering human resources for social change who will lead lifestyle revolution

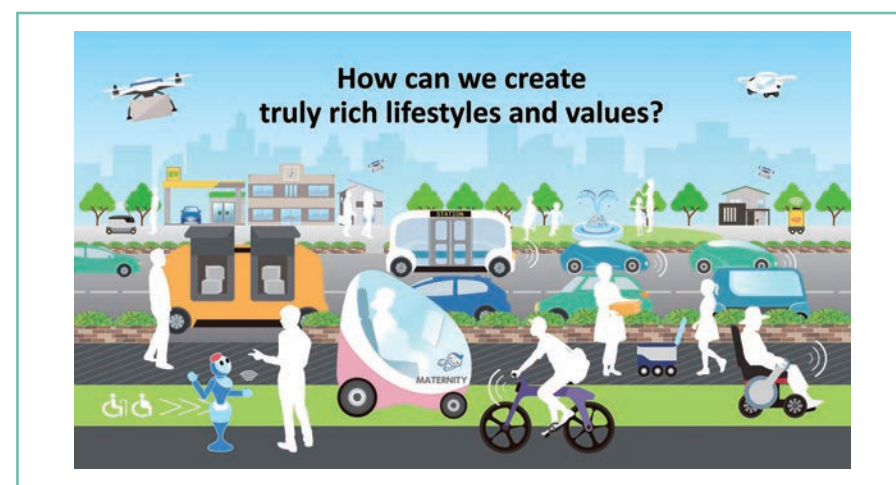
Recent technological innovations in information and mobility have minimized the cost of traveling in time and space and have created major changes since the Industrial Revolution. On the other hand, due to global issues such as pandemics, resource depletion and climate variability, complication of social issues such as declining birthrate and aging population, and diversification of values such as diversity and inclusion, the conventional technology-led approach to "realize a rich lifestyle" is becoming difficult. In order to lead a "lifestyle revolution" where people can freely choose various ways of life, it is necessary to have specialized human resources who can collaborate with different fields. Through this program, students with diverse specialties will work hard toward the goal of mobility innovation. I sincerely expect the nurturing of human resources will lead social change through research results, and I will do my utmost to promote the program.

### Cultivating transdisciplinary human resources to lead lifestyle revolution

In recent years, technological innovation also known as "mobility revolution" has created social change since the Industrial Revolution that minimizes the cost of traveling in time and space. However, as social issues become more complex and value standards diversify, technology-led "realization of rich lifestyles" is becoming difficult. To drive lifestyle revolution, transdisciplinary human resources are required to team up with experts from different fields (multidisciplinary) such as humanities, social sciences, engineering, informatics, and environmental science, to understand and respect each other's specialties, to create diverse values (value creation) for lifestyle, and to translate those values to society by building the "technology and methodology". In this program, in addition

to "Industry-Academia Co-Creation Education" in which the university collaborates with private companies, 6 graduate schools and 7 centers are structuring an outstanding

curriculum that cultivates transdisciplinary collaboration by expert teams. In this way, we will train "Transdisciplinary Mobility Innovation (TMI) human resources" who can



Mobility innovation will bring about major changes in society. In order to create truly rich lifestyles and values, not only technology but also deep understanding of people and society and "transdisciplinarity" are required.

### [Fields of diplomas]

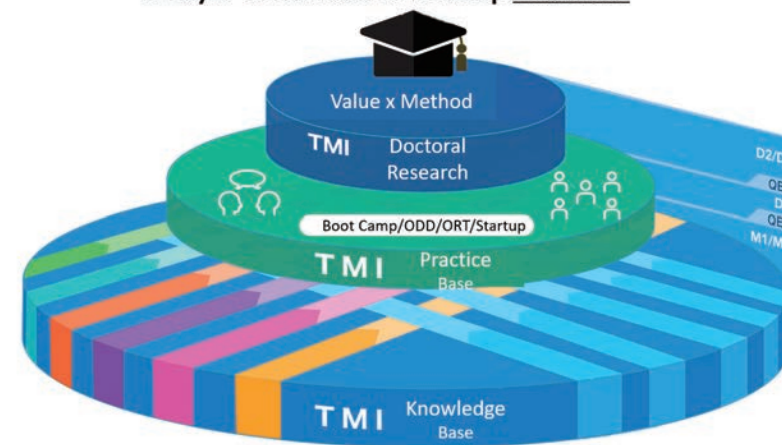
Doctor of Engineering, Doctor of Informatics, Doctor of Environmental Studies, Doctor of Economics, Doctor of Laws, Doctor of Architecture, Doctor of Sociology, Doctor of Geography, Doctor of Science  
Name of the program to be noted: Completed the Transdisciplinary Mobility Innovation Graduate Program

contribute to efforts to create "mobility" with high social values. Through the curriculum, program students will develop five abilities that make up transdisciplinary collaborative ability. The five abilities are "Specialized Research Ability" in one's own field, "Broad View/Problem Finding Ability" necessary to elevate value in the social system, "Value Co-Creation Ability" to create value through communication among experts in different fields, "Challenge/Resilience" to boldly implement measures in society and overcome difficulties, and "International Outlook" to play an active role in the international community. TMI human resources who complete this program are expected to play active roles as professionals such as researchers, engineers, entrepreneurs, businesspersons, and government officials for lifestyle revolution in a wide range of fields of society.

### Collaboration with private companies and 3-layer curriculum structure

In this program, the knowledge and practice necessary for conducting Transdisciplinary Mobility Innovation (TMI) through transdisciplinary collaboration is structured as a 3-layer transdisciplinary curriculum. The most basic "TMI Knowledge Base" can be selected according to the backgrounds of the students, and consists of: "Coursework" in which basic knowledge necessary for transdisciplinary collaboration is learned through courses in specialized fields and

### 3-Layer Curriculum to Develop 5 Abilities



This program adopts a 3-layer curriculum composed of a "TMI Knowledge Base" consisting of coursework, a "TMI Practice Base" consisting of a boot camp, testbed construction, venture catapult, etc., and "TMI Doctoral Research".

courses in multidisciplinary fields that connect different fields, "Transdisciplinary Faculty Discussion Lecture" to learn different viewpoints from lecturers in different fields, and "Mobility Innovation Common Lectures" to learn basic knowledge about mobility. The "TMI Practice Base" consists of: "Boot Camp" that fosters transdisciplinary collaboration through close team-type collaboration in a training camp format, "On-site Research Training (ORT)" in which site surveys are conducted on sites such as local governments, "Testbed Design and Development (TDD)" in which students collaborate with corporate mentors to design and develop a "testbed" as a basis of demonstration experiments, and

"Venture Catapult" through which students plan and practice the establishment of a venture by forming a team among students. In "TMI Lifestyle Revolution Doctoral Research", in addition to a student's own specialized field, students conduct doctoral dissertation research focusing on "value creation" and "methodology" in lifestyle revolution based on transdisciplinary collaboration such as industry-academia co-creation research. In particular, in the "Industry-Academia Co-Creation Education" promoted by the university, "intellectual professional" ability will be cultivated through joint research with private companies.

### DATA

[Number of scheduled student recruitments] 12  
[Number of anticipated program graduates] 12  
[Number of people engaged in the program] 83  
[Students' affiliated schools and departments]  
6 graduate schools, 20 departments  
<Graduate School of Humanities> Humanities  
<Graduate School of Law> Combined Graduate Program in Law and Political Science  
<Graduate School of Economics> Socio-Economic System, Industrial Management System  
<Graduate School of Informatics> Mathematical Informatics, Complex Systems Science, Social Informatics, Cognitive and Psychological Sciences,

Computing and Software Systems, Intelligent Systems  
<Graduate School Engineering> Electrical Engineering, Electronics, Information and Communication Engineering, Mechanical Systems Engineering, Micro-Nano Mechanical Science and Engineering, Aerospace Engineering, Civil and Environmental Engineering  
<Graduate School of Environmental Studies> Earth and Environmental Sciences, Environmental Engineering and Architecture, Social and Human Environment  
[WISE Cooperating Institutions]  
8 universities, 14 enterprises  
Gifu University / University of Michigan / Virginia Institute of Technology / The Ohio State University /

Chalmers Institute of Technology / National University of Singapore / Chulalongkorn University / Hanoi University of Science and Technology / WHILL Inc. / MTG Ventures / KDDI Research, Inc. / 01Booster, Inc. / Sohgo Security Services Co., Ltd. / Sompo Japan Insurance Inc. / Central Japan International Airport Co., Ltd. / Tier IV, Inc. / Denso Corporation / Toyota Motor Corporation / Toyota Technical Development Corporation / Sumitomo Mitsui Banking Corporation / Yahoo Japan Corporation / Yamaha Motor Co., Ltd.

### Message from WISE Cooperating Institution



GODA George  
01Booster Inc. Co-founder

### Expecting to create startups that will advance the world through transdisciplinary mobility innovation

Innovation is truly the result of a new combination of different talents. This initiative brings together a diverse group of students and companies from six different graduate schools under the theme of transdisciplinary mobility innovation that will revolutionize the world. It is highly desirable for Japan that these people co-create businesses and launch new startup companies. I'm proud to be a part of it and very much looking forward to collaborating with these activities.

### Message from WISE Cooperating Institution



FUKUOKA Muneaki  
WHILL Inc. Director/CTO

### Expecting transdisciplinary perspectives on mobility innovation in which coexistence with diverse robots and mobility is realized

WHILL has already put autonomous driving personal mobility into practical use at airports and other places. However, in the future, coexistence with a wider variety of robots and mobility is desired. This is a field that requires new perspectives, such as proposals for social etiquette based on robots, as well as technical perspectives. I look forward to diverse and flexible ideas of the students in this program.



# Distinguished Doctoral Program of Platform Studies for Activating Society

[Program Coordinator] HARADA Hiroshi (Professor, Department of Communications and Computer Engineering, Graduate School of Informatics, Kyoto University)

## Message from the President



MINATO Nagahiro  
President, Kyoto University

Through the WISE Program, Kyoto University seeks to cultivate advanced “knowledge professionals” who will play key roles in industry, academia, and government

In 2017, Kyoto University was granted Designated National University Corporation (DNU) status by the Japanese government. One of the four pillars of the university's DNU strategy is “fostering the next generation of researchers and promoting the international mobility of young researchers.” Under the DNU initiative, the university is making efforts to further internationalize its education, foster diverse human resources, and recruit excellent human resources in order to generate a high-level flow of talent.

In line with its DNU strategy, the university continues to provide unique high-quality programs under the government's Doctoral Program for World-leading Innovative & Smart Education (WISE Program). The programs are provided in close cooperation with leading companies and world-class research institutes in Japan and leading universities around the world with the aim of cultivating advanced “knowledge professionals” and promoting the reform of the university's graduate schools.

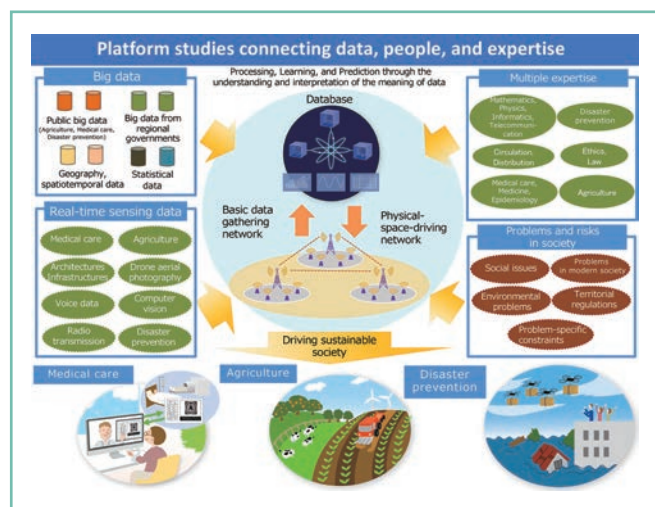
## Platform Studies: A new academic field to advance society

To reduce the social risks involved in various fields such as agriculture, medical care, and natural disasters, the “platforms” plays an increasingly important role in our society. The platforms use information and communication technologies to categorize, analyze, and share digital data obtained from various information sources that are non-uniformly spread throughout our society, which are collected and stored in the form of big data. A platform consists of three components: a basic data gathering network composed of various sensors, information terminals, and information communication networks; a database that carries out tasks such as feature extraction and prediction utilizing machine learning and/or deep learning; and a

physical-space-driving network that feeds back the processed results into physical space (actual society) and controls various devices.

Currently, the collection and processing of extensive data by platforms entails high power consumption and computer resources. However, we can reduce the power consumption and cost if we consider the processes involved in decentralization, safety, and speed in the data generation and collection process. This, however, requires knowledge of informatics. Deep learning and

machine learning have become standard techniques nowadays but often end up being black boxes. It is possible to improve the output while reducing costs by understanding



Mission of distinguished doctoral program

## DATA

[Number of scheduled student recruitments] 15  
[Number of anticipated program graduates] 3-12  
[Number of people engaged in the program] 95  
[Students' affiliated schools and departments]

2 graduate schools, 11 departments  
<Graduate School of Informatics> Intelligence Science and Technology, Social Informatics, Advanced Mathematical Sciences, Applied Mathematics and Physics, Systems Science, Communications and Computer Engineering  
<Graduate School of Agriculture> Agronomy and Horticultural Science, Forest and Biomaterials Science, Applied Biosciences, Environmental Science and Technology, Natural Resource Economics

### [WISE Cooperating Institutions]

17 universities, 16 business enterprises, 5 National Research and Development Institutes, 1 incorporated association, 2 judicial foundations  
Jichi Medical University / The Institute of Statistical Mathematics / Toyota Motor Corporation / NTT Communication Science Laboratories / Meteorological Engineering Center / Agricultural and Rural Development Information Center / The Research Institute for Humanity and Nature / Mitsubishi UFJ Research and Consulting / RIKEN / Yahoo! JAPAN Research / System Platform Research Laboratories / Advanced Telecommunications Research Institute International / Nippon Telegraph and Telephone West Corporation / KDDI Research, Inc. / KADOKAWA ASCII Research Laboratories, Inc. / Ruby Association / Tripadvisor

LLC / Anritsu Corporation / Institute for Health Economics and Policy / National Institute of Information and Communications Technology / National Fisheries University / Japan Agency for Marine-Earth Science and Technology / The National Agriculture and Food Research Organization / wenovator LLC / Mitsubishi Electric Corporation Information Technology R&D Center / Sony R&D Center/University of Chicago / University of Illinois / Vienna University of Technology / University of Potsdam / Delft University of Technology / Technical University of Berlin / Aalborg University / Huazhong Agricultural University / National Chung Hsing University / National Taiwan University / University of Florida / Technical University of Munich / Sorbonne University / The French National Centre for Scientific Research / Institute for Infocomm Research, Agency for Science, Technology and Research (A\*STAR)

### [Fields of diplomas]

Doctor of philosophy, or Doctor of Informatics, Doctor of Agricultural Science

Name of the program to be noted for the student granted a Doctor of Informatics or a Doctor of Agricultural Science : Distinguished Doctoral Program of Platforms

[Office and section in charge] Office of School of Platforms

[Inquiries] +81(0) 75-753-3299

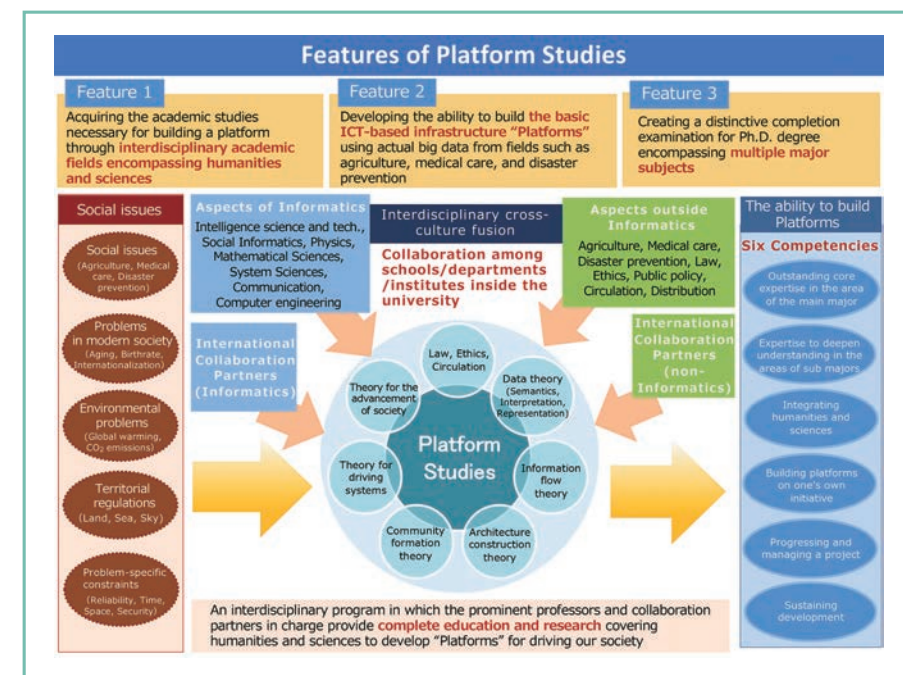
[URL] <http://www.ceppings.kyoto-u.ac.jp/en/>

(The Center for Educational Program Promotion in Graduate School)

and interpreting the data's meaning in each specific field properly and by optimizing the data. To achieve this, informatics must be combined with knowledge of other disciplines such as agriculture, medical care, and disaster prevention. The emergence of cloud computing and communication networks developed in other countries challenges Japan. It is not sufficient for engineers to be only involved in platform development. They also need to consider the business as well as the standardization from an international perspective. Indeed, such platform developments with a broader world perspective require the knowledge of laws, ethics, public policy, distribution, and other human studies. We believe this kind of comprehensive expertise helps engineers implement new collective decision-making mechanisms on platforms supplied by Japan's unique outlook on social ethics and fairness. In this program, we name this new interdisciplinary academic field “Platform Studies” and we propose to develop the required skills with our five-year doctoral program.

## The six competencies to be developed, and program features

In this program, we will develop the ability to build the basic infrastructure of platforms using actual big data from agriculture, medical care, disaster prevention, among others. Then, according to the students' backgrounds and orientations, we will develop an educational



Features of distinguished doctoral program

system that helps them acquire the knowledge of Platform Studies, encompassing multiple major subjects and advanced, original research capabilities across the following six competencies.

- (1) Outstanding core expertise in the area of the primary major
- (2) Expertise to deepen understanding in the areas of sub majors
- (3) Integrating humanities and sciences, including subjects such as law, ethics, and distribution that are required to build a platform

- (4) Building platforms on one's own initiative
  - (5) Progressing and managing a project and operating and expanding the results globally
  - (6) Sustaining development through standardization and social implementation
- To demonstrate and implement the platforms built in this program, we will create an environment in which students can access a wealth of actual data and have opportunities to interact with front-line professionals from industry, government, and academia in Japan and overseas.

## Message from WISE Cooperating Institution



KOJIMA Fumihide  
Director, Wireless Systems Laboratory,  
Wireless Networks Research Center,  
NICT

## Hope for an outstanding, all-in-one graduate school program that will develop world-leading platform builders in Japan

In recent years, social risks such as infectious diseases and natural disasters have become large scale and extensive, and there are needs to build platforms that can quickly respond to them. However, existing platforms are too specialized toward each target area and application; compatibility between different areas is lacking and platforms are not equipped with optimized information and communication technologies.

Thus, there is an urgent requirement to develop human resources capable of building optimized platforms in complex areas and using them to conduct research and development at a doctoral level. I am confident that this program will surely develop such human resources and they will have immediate and vital impacts on both existing companies and new venture businesses. I will support the program in the hope that existing worldwide limitations on platforms will disappear as Japanese human resources contribute to responding to real-world social risks and develop businesses.



## Graduate Program of Mathematics for Innovation

[Program Coordinator] SAEKI Osamu (Director, Institute of Mathematics for Industry, Kyushu University)

## Message from the President

ISHIBASHI Tatsuro  
President, Kyushu University

## Nurturing "Excellent Doctoral Talents in Mathematics" who can develop new interdisciplinary fields and create innovation

With the aim to create and develop "new interdisciplinary fields", Kyushu University has built a framework for a Cross-Disciplinary Integrated Masters-Doctoral Program called the "Da Vinci Program", and the Graduate Program of Mathematics for Innovation is the first and leading pilot program. In this program, we will nurture "Excellent Doctoral Talents in Mathematics" who can develop new interdisciplinary fields and create innovation by making full use of the "modeling ability" based on excellent "mathematical ability", and "co-creation ability" that can cross the boundaries of organizations and fields. In addition, through this most important graduate school program in Kyushu University, we will "promote and lead graduate school reform in Japan" and "develop and lead the world's society and industry by drawing out the potential of industrial mathematics."

## Mathematical Modeling Talents with Mathematics Five Forces

In the super-smart society that Japan aims at, Artificial Intelligence technology and data analysis are essential, but they have certain limits. The versatility and rigor of Mathematics have received attention as a way to break the limits and change our future business and life dramatically.

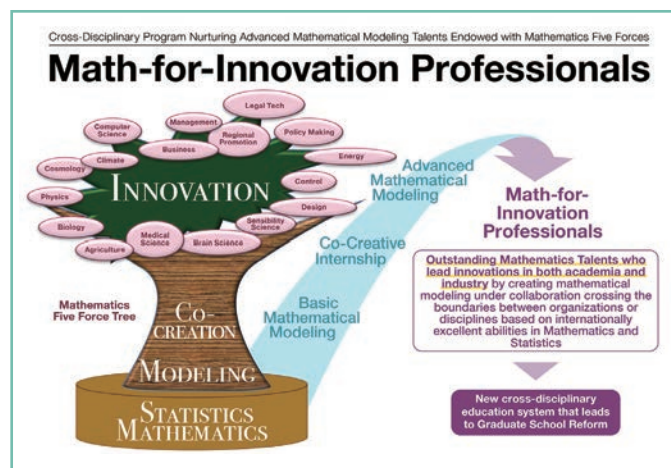
Mathematics can make great contributions to innovation. For example, in the United States GAFA is making a big impact on the world by utilizing mathematical modeling.

On the other hand, the strength of Japanese industries lies in precision and high quality, so we can make a leap forward by using Mathematics resources. We have the potential to lead the world: unfortunately, we have not been able to do so because Mathematics has not actively collaborated

with other fields, and other fields have not been fully utilizing Mathematics. In order to overcome the situation, we need new doctoral talents in Mathematics, so to speak, "mathematical modeling talents".

Therefore, we envisioned "the Graduate Program of Mathematics for Innovation." The five skills that this program aims to cultivate are shown in the Mathematics Five Force Tree. (Figure 1) Having excellent mathematical and statistical skills is the basis and represents

the soil, and by utilizing the mathematical modeling power and the power to co-create across organizations and fields, it fertilizes the lush leaves to create innovation and blooms flowers in each field, in turn cultivating



(Figure 1) Mathematics Five Force Tree &amp; Math-for-Innovation Professionals

## DATA

[Number of scheduled student recruitments] 14-18  
[Number of anticipated program graduates] 14-18  
[Number of people engaged in the program] 76  
[Students' affiliated schools and departments] 3 graduate schools, 5 departments  
<Graduate School of Mathematics> Mathematics  
<Graduate School of Information Science and Electrical Engineering> Informatics, Advanced Information Technology, Electrical and Electronic Engineering  
※The Department of Informatics and the Department of Advanced Information Technology will be combined to form the Department of Information Science and

Technology in April, 2021.  
<Graduate School of Economics> Economic Engineering  
[WISE Cooperating Institutions] 7 universities, 3 public research institutes, 5 companies, 1 local public body  
The Institute of Statistical Mathematics / RIKEN (Center for Advanced Intelligence Project / Interdisciplinary Theoretical and Mathematical Sciences Program) / FUJITSU LABORATORIES LTD. / Beautiful Mind / Mazda Motor Corporation / Sumitomo Electric Industries, Ltd. / The National Institute of Advanced Industrial Science and Technology / Itoshima City (A

planning department, Regional Promotion Division) / NIPPON TELEGRAPH AND TELEPHONE CORPORATION / Department of Mathematics, University of Illinois at Urbana-Champaign / Department of Mathematics, University of California, San Diego / Department of Mathematics and Statistics, La Trobe University / Department of Mathematics, National University of Singapore / Department of Mathematics, National Taiwan Normal University / Mathematical Institute, Leiden University / Zuse Institute Berlin

## [Fields of diplomas]

Doctor of Philosophy, Doctor of Philosophy [Mathematics], Doctor of Functional Mathematics, Doctor of Information Science, Doctor of Science, Doctor of Engineering, Doctor of Economics  
Name of the program to be noted: Graduate Program of Mathematics for Innovation

KYUSHU  
UNIVERSITY

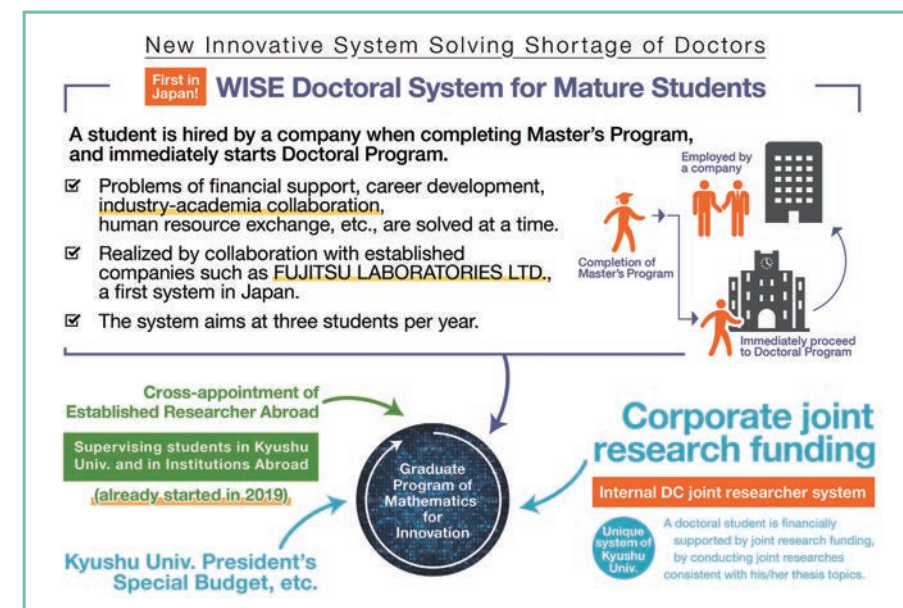
[Office and section in charge] WISE Program Support Section, The Graduate Program of Math-for-Innovation  
[Inquiries] 092-802-4355  
[URL] <https://www.gpmi.kyushu-u.ac.jp>

"Math-for-Innovation Professionals". In the Master's Program, students join the labs of faculty members of other fields as "Basic Mathematical Modeling". In the Doctoral Program, we have three "Co-Creative Internships", i.e. industrial, interdisciplinary, and international ones, as well as "Advanced Mathematical Modeling", in which students teach mathematical modeling to researchers in other fields as reverse mentors.

## Kyushu University's Distinctive Initiatives

The main reason for proposing this WISE program at Kyushu University is that we have a proven track record of contributions to society by Mathematics and have a strong determination to take on that responsibility. The University has established an excellent organizational structure for this purpose.

The educational organization consists of three main graduate schools: Mathematics, Information Science and Electrical Engineering, and Economics. In particular, the Graduate School of Mathematics offers long-term internship training, and is one of the two organizations that have earned the highest result in the second-term corporate evaluation by MEXT, Japan. As research organizations, we have the Institute of Mathematics for Industry (IMI) and the Pan-Omics Data-Driven Research Innovation Center. The IMI is Japan's unique joint usage / research center for industrial Mathematics, and is



(Figure 2) WISE Doctoral System for Mature Students solves multiple problems at once, such as financial support, career development, etc.

actively engaged in the mission to develop "Mathematics for Industry", a new research area of Mathematics born from dialogues with industry. We will take on the responsibility of the University through this Interdisciplinary degree program, designed by various departments and faculty members.

One of the most distinctive initiatives in this plan is to establish the WISE Doctoral System for Mature Students. (Figure 2) This means that companies hire excellent Master's graduates, and at the same time, the students are admitted to the doctoral program as mature students, and they return to the company after

obtaining their doctoral degrees. This allows us to solve various problems at once, such as financial support, career development, and strengthening industry-academia collaboration. Preparations have already been made at Fujitsu Laboratories Ltd., our partner organization, and will be implemented immediately after the start of the program. We would like to extend this system to other companies, increase the dwindling number of doctoral students in Japan, as well as to contribute to the active exchange of industry-academia human resources.

## Message from WISE Cooperating Institution

ANAI Hirokazu  
Senior Manager, Artificial Intelligence Laboratory of FUJITSU LABORATORIES LTD.

## Artificial Intelligence &amp; Mathematical Science that form the basis of new business models

As the amount of data explodes in various areas of society and industry, digital technology is rapidly developing, solving social issues and developing new business models.

There are an increasing number of cases where social / life style and business processes that have been taken for granted are transformed into something different by utilizing digital technology, and it can be said that the present age is the era of digital transformation. Artificial Intelligence and Mathematical Science are attracting attention as digital technologies that create value by utilizing data. Therefore, there is an increase in interest for Mathematical Science talents.

This program is unique and contributes to the development of talents who have mathematical foundations and can practice co-creation with society and create innovation. This offers the first initiative of the WISE Doctoral system for mature students and we are glad to be a part of it.



► **For inquiries about the overall WISE Program**

**University Promotion Division, Higher Education Bureau  
Ministry of Education, Culture, Sports, Science and Technology (MEXT)**

3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo 100-8959, JAPAN  
Phone : +81-3-5253-4111 (ext.3357)

[https://www.mext.go.jp/a\\_menu/koutou/kaikaku/  
takuetudaigakuin/index.htm](https://www.mext.go.jp/a_menu/koutou/kaikaku/takuetudaigakuin/index.htm)  
(Japanese Only)



► **For inquiries about screening and evaluation under the Program**

**Secretariat of the Program Committee  
University Cooperation Program Division, Human Resource Development  
Program Department, Japan Society for the Promotion of Science (JSPS)**

Kojimachi Business Center 6F, 5-3-1 Kojimachi, Chiyoda-ku, Tokyo 102-0083, JAPAN  
Phone : +81-3-3263-0979

<https://www.jsps.go.jp/j-takuetsu-pro/index.html>  
(Japanese Only)



► **WISE Program information from MEXT: Please see MEXT Facebook page.**

**Facebook page of University Promotion Division,  
Higher Education Bureau Ministry of Education, Culture,  
Sports, Science and Technology (MEXT)**

