



Graduate School of Science, **Technology and Innovation**



of people who will bring about innovation



Graduate School of Science, Technology and Innovation **Kobe University**

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Acccess Map



Rokkodai Campus



Port Island Campus



From "Sannomiya" station Take the Port Liner bound for "Kobe Airport" to "Keisan Kagaku Center" station (15 minutes).

Kusunoki Campus

Strengths and Unique Features

The Graduate School of Science, Technology and Innovation (STIN) aims to nurture and produce future leaders who combine a science background with entrepreneurship and prepare them for a successful career in the global arena by offering consistent education to acquire a whole set of skills necessary to complete the entire journey from R&D in advanced science and technology to building innovation strategies for translating academic findings into business. STIN positions four natural science fields (namely, Bioproduction, Advanced Membrane Technology, Advanced Information and Communication Technology, and Advanced Medical Science) and social science fields, including entrepreneurship, as the pillars of its education and research. By fusing these fields, we expect to create new fields of science and technology and new disciplines and build an ecosystem that continuously incubates innovations by efficiently combining education, R&D, and business creation. We aim to be a global initiative hub to create innovation in

(1) Bringing Together Cutting-Edge Research Fields

The natural science fields pursued at STIN are Bioproduction, Advanced Membrane Technology, Advanced Information and Communication Technology, and Advanced Medical Science. Kobe University boasts world-class cutting-edge research in these fields, which are producing promising seed technologies with the potential of commercialization. STIN can pursue research in these fields leveraging regional strengths and characteristics, as Kobe is designated as a special zone for advanced medical industries and SPring-8 is situated nearby. Researchers in these fields have come together at STIN to build an education system that offers training from the basics to application of advanced research. We also provide education with an interdisciplinary perspective to allow for the acquisition of knowledge from various fields so that students can acquire a broad perspective in addition to deep expertise.

(2) Education That Integrates Science and Humanities

STIN introduces a novel interdisciplinary research and education system that transcend disciplinary boundaries through organic collaboration between science and humanities, in other words, research and education in advanced science and technology and entrepreneurship. Through this system, STIN cultivates human resources with a science background who can create innovation based on skills for R&D in advanced science and technology fields and design the process for translating academic research findings into business, which ranges from establishing IP rights and developing production technologies to building a go-to-market strategy.

(3) Practical Training

STIN offers practical training through a unique curriculum that includes hands-on practice using a pilot plant and Project-Based Learning (PBL) in which students actually build a business plan. Our instructors include many business practitioners with experience in corporate R&D, new product development, new business development, startup consulting, and investment and incubation of venture firms, as well as law practitioners with expertise in laws and regulations related to intellectual property and venture startup.

Configuration

Bioproduction

By conducting cutting-edge biotechnology R&D, we aim to advance innovation in the biomanufacturing field. including biochemicals. biologics, and biofinechemicals.

Aims

Advanced Information and Communication Technology

Researchers at the frontlines of Internet of Things (IoT) wide area network, AI (Artificial Intelligence) and quantum computers are driving cutting-edge research and development in the field of IT application through technological development and collaboration. We contribute to the realization of Society 5.0 through the creation of innovation.

Strategic Entrepreneurship

Advanced Medical Science

Promotion of the development of new methodologies leading to the novel clinical diagnosis and therapy, by utilizing innovative strategies such as computational simulation, single cell RNA sequencing, and vaccine platform technologies, further using special medical

Admission Policy

Master's course

The Master's Course of the Graduate School of Science, Technology and Innovation aims to foster science-oriented individuals with research capabilities in a broad range of cutting-edge fields and the entrepreneurial skills necessary to design the marketing process of research outcomes such as intellectual property acquisition, production engineering development, and market development. In line with these education and research aims, the Graduate School of Science, Technology and Innovation seeks students with the following qualities:

- 1. Students should have a strong enthusiasm for research and basic research abilities in any of the following fields: engineering, informatics, agriculture, science, medicine, or pharmaceutical science [Required elements: Knowledge / Skills, Thinking / Judgment / Expression, Interest / Motivation]
- 2. In addition to basic research and applied research in their chosen specialist field, students should possess a strong desire to commercialize their research, from production and development to marketing [Required elements: Thinking / Judgment / Expression, Independence / Cooperation, Interest /Motivation]

Various factors, as described above, will be measured during the selection of students based on the diploma and curriculum policies of the Master's Course of the Graduate School of Science, Technology and Innovation. In the recommendation entrance examination, "Knowledge / Skills" will be evaluated based on a document screening process, and "Thinking / Judgment / Expression," "Independence / Cooperation," and "Interest / Motivation" will be evaluated based on an oral examination.

In the general entrance and the special entrance examination for international students, "Knowledge / Skills" will be evaluated based on a document screening process, essay examination, and English-language examination; "Thinking / Judgment / Expression," "Independence / Cooperation," and "Interest / Motivation" will be evaluated based on an oral examination.

Doctoral course

In order to achieve scientific and technological innovations in diverse fields, the Doctoral Course of the Graduate School of Science, Technology and Innovation aims to produce individuals with the ability to build an innovation strategy. In line with this goal, the Graduate School of Science, Technology and Innovation seeks students with one of the following qualities:

- 1. Students entering from workplaces with diverse backgrounds should intend to acquire entrepreneurship skills and the research capabilities equivalent to those awarded a master's degree in any of the following fields: engineering, informatics, agriculture, science, medicine, or pharmaceutical science [Required elements: Knowledge / Skills, Critical thinking / Judgement / Expression, Independence / Cooperation, Interest / Motivation]
- 2. Students who have obtained a master's degree in the science fields should have a strong desire to achieve scientific and technological innovations through their research capabilities in any of the following fields: engineering, informatics, agriculture, science, medicine, or pharmaceutical science [Required elements: Knowledge / Skills, Critical thinking / Judgement / Expression, Independence / Cooperation, Interest / Motivation]

There will be an entrance examination to select candidates based on the Degree Awarding Policy and Curriculum Policy of the doctoral program of the Graduate School of Science, Technology and Innovation. We will assess "Knowledge / Skills" through document screening and conduct oral examinations to assess the "Critical thinking / Judgement / Expression," "Independence / Cooperation," and "Interest / Motivation" of prospective students.

Advanced Membrane Science and Technology

The goal is to realize a resource-circulating society based on energy-saving and energy-generating processes with water purification and gas separation utilizing the membrane

Bioproduction

By conducting cutting-edge biotechnology R&D, we aim to advance innovation in the biomanufacturing field. including biochemicals, biologics, and biofinechemicals.



Research Strengths and Achievements

- Established the Biorefinery Center (in December 2007) and the Engineering Biology Research Center (in July 2018), the first centers of their kind in Japan
- •Established a variety of cutting-edge research facilities for biomanufacturing, including a pilot plant for biomass fermentation, and a GMP-compliant manufacturing plant for biological pharmaceuticals.
- Engages in numerous programs to establish centers, as well as ambitious projects. These include the following: "Creation of Innovative Bioproduction Kobe; iBioK (MEXT)", "Synthetic Bioengineering Research Center (MEXT)", "Project Focused on Developing Key Technology for Discovering and Manufacturing Drugs for Next-Generation Treatment and Diagnosis (AMED)", and "Development of Production Techniques for Highly Functional Biomaterials Using Smart Cells of Plants and Other Organisms; Smart Cell Project (NEDO)"
- Strongly promotes collaboration between industry, academia and government as well as human resource development by working with the Organization for Engineering Biology (consisting of around 50 participating companies) and the Biologics Center for Research and Training (consisting of around 30 participating companies).
- Conducts cutting-edge research to develop new biotechnologies, cell breeding technologies and bioXdigital hybrid platforms, as well as developing practical application processes through industry-academia-government collaborations.
- •A number of Kobe University-launched startups have been established based on university research achievements, including Bio Palette Co., Ltd. (base editing), Synplogen Co., Ltd. (long-chain DNA synthesis), and Bacchus Bio Innovation Co., Ltd. (biofoundry).

Graduates

Our cutting-edge biotechnology research and entrepreneurship education equips our graduates with an understanding of the biomanufacturing field's needs, trends and success stories, enabling them to develop their own innovations.



Business Creation



Advanced Membrane Science and Technology

The goal is to realize a resource-circulating society based on energy-saving and energy-generating processes with water purification and gas separation utilizing the membrane.

Research Strengths and Achievements

- •The completion of an on-campus research facility of Organization for Membrane and Film Technology (6000 m², February 2015)
- Establishment of Research Center for Membrane and Film Technology (April 2019) (Research collaboration with 14 overseas institutions and membrane research centers)
- The introduction of various membrane technology pilot plants
- •The driving of an industry-academic alliance in cooperation with the Organization for Membrane and Film Technology (80 firms)
- circulating environmental detoxification processes through an industry-academic-government alliance

Graduates

Business Creation

Typical graduates are expected to master comprehensive membrane science and technology which encompasses material development, membrane manufacturing, and membrane application processes and to create technology innovations in the environment/energy areas in order to achieve an eco-friendly society.

Gas separation Water treatment Organic solvent filtration 6 6 6 6 6 Functional Stacked nanosheet Ceramic Membranes Computer-assisted Water purification Seawater desalination Applicable Processes Water treatment Concentration of valuables **Energy-saving process** Organic solvent filtration Innovative ЬØ Processes \rightarrow Water business creation Impact Establishing resource-circulating society



•The development of energy-saving water treatment and gas separation process, membrane based energy generating process, and





Advanced Information and Communication Technology

Researchers at the frontlines of Internet of Things (IoT) wide area network, AI (Artificial Intelligence) and guantum computers are driving cutting-edge research and development in the field of IT application through technological development and collaboration. We contribute to the realization of Society 5.0 through the creation of innovation.



Research Strengths and Achievements

- Practical research and development (R&D) through industry, academia and government collaboration by front-line researchers covering the search for advanced electronic materials, semiconductor device design methods and IoT system implementation techniques
- Leader in the creation and development of academic areas related to hardware security and safety.
- •Multifaceted and practical approach to R&D in areas related to noise problems in semiconductor and electronic devices through industry-academia and international collaboration.
- Development of ultra-low power IoT sensor nodes and digital healthcare devices.
- Collaborative development with industry on cryogenic device technology for fault-tolerant quantum computers.

Graduates

Development of human resources who can bridge the search for advanced electronic materials and the creation of information and communication technology, and demonstrate leadership in predicting effects through multidimensional simulations and designing semiconductor application systems



Business Creation



Advanced Medical Science

Promotion of the development of new methodologies leading to the novel clinical diagnosis and therapy, by utilizing innovative strategies such as computational simulation, single cell RNA sequencing, and vaccine platform technologies, further using special medical industry zone in Kobe.

Research Strengths and Achievements

- Research and development of novel oral vaccine platform using bifidobacteria, and the clinical development of oral hepatitis C vaccine, and oral cancer vaccine
- (molecular targeted anti-cancer drug candidates) with synthetic chemistry manufacture in Kobe realized the licensing out of the compound patent to the domestic pharmaceutical company.
- Survey of gut microbiota in cardiovascular and lifestyle-related disease patients and development of live biotherapeutic products.
- •The industry-academic alliance leveraging the special medical industry zone and the research-friendly environment with regards to pharmaceutical regulations.

Graduates

Typical graduates are expected to be equipped with high level of management skills, based on the specialized knowledge and skills of life science, to address unmet medical needs and to create cutting-edge medical technologies i.e., novel medicine, diagnosis, cell- and tissue-based medical products and devices

Business Creation





• Establishment of drug discovery system utilizing SPring-8, SACLA and computer simulation. The joint research in developing Ras inhibitors

•Search for novel therapeutic targets for cardiovascular diseases via performing single cell RNA sequencing analysis of clinical specimens.



Strategic Entrepreneurship

The goal is to nurture and produce entrepreneurs with a natural science background who will create innovations (creation of social and economic values) that are competitive on a global level, based on promising research findings (seeds) in advanced science and technology.



For an education in natural science, students are required to pursue ingenious research by studying thoroughly in their specialized areas. On the other hand, many companies are looking for talents who can create social and economic values by translating breakthrough which arises from natural science to innovative results. Especially in Japan, people who have those expertise are being needed for realizing economic growth.

STIN's educational goal is to develop talented people who have knowledge such as entrepreneurship, strategy, finance, and IP rights, which are essential for achieving innovation, as well as expertise in Bioproduction, Advanced Membrane Science and Technology, Advanced Information and Communication Technology, and Advanced Medical Science.

Education and Research Strengths

In promising startup companies in a global market, people who have both natural science degree such as biology, chemical and engineering, and social science degree such as MBA, are playing active roles.

In a global competitive market, talents who understand entrepreneurship, science and technology have been increasingly regarded important.

Our Strategic Entrepreneurship Program is designed for students who have natural-science undergraduate degree to be able to acquire business knowledge, skills, and experience in real fields. Though education in natural science and one in social science are distinguished strictly in Japanese academic areas, we believe that STIN's integrated education system is beneficial for business society which is looking for people of practical ability.



Outline of Subjects

Entrepreneurship

Entrepreneurs should have vision and innovation ideas for solving social issues which can develop into a promising business plan. Students can learn a process how to create a business based on innovation idea through lecture, case study, group project, and project-based learning.

[Subject] • Startup Science • Design Thinking / System Thinking Business Planning

Strategy

Entrepreneurs require not only entrepreneurship but also strategic thinking to minimize the risks involved in starting a business and maximize value creation. Strategy theories required in innovation creation are continuously evolving, widely ranging from competition strategy and resource-based view to innovation strategy and marketing management.

Students learn the outlines of these theories, such as through lectures, case studies, and group work.

[Subject] •Business Strategy •Innovation Strategy

Finance

Students study basic corporate finance, making of financial plan, corporate valuation, and design of deal structure, and further master execution skills of finance in enterprise creation thorough case studies and exercises.

[Subject] •Corporate Finance •Entrepreneurial Finance

Doctoral Program

The doctoral program aims to nurture and produce science and technology entrepreneurs who can achieve breakthroughs in advanced science and technology fields (such as Bioproduction, Advanced Membrane Science and Technology, Advanced Information and Communication Technology and Advanced Medical Science, and interdisciplinary fields) and at the same time build a concrete innovation strategy based on such breakthroughs.

Here, the term entrepreneur refers to the following human resources:

- Independent entrepreneurs who start venture firms and lead an active career while exerting a significant impact on society
- Corporate entrepreneurs who launch new businesses within an existing organization by leveraging advanced science and technology
- 8 Researchers and educators who practice research and education on science and technology innovation from an interdisciplinary perspective integrating science and humanities

The STIN doctoral program offers education in line with the career path each student wishes to pursue (i.e.,., independent entrepreneur, corporate entrepreneur, or researchers and educators) through a curriculum designed to cultivate the three main skill sets necessary for science and technology entrepreneurs (skill sets to carry out advanced R&D, identify opportunities, and build strategies) under an interdisciplinary system integrating science and humanities.

Advanced Science and Technology Research Courses (Cultivation of skills to carry out advanced R&D)

Cultivates the skills required to identify important issues in science and technology, to set a specific problem, to achieve breakthroughs (discovery or invention) to solve that problem, and to write and submit academic papers and make presentations

[Subject] •Advanced Science and Technology Research

Research on Science, Technology and Innovation Courses (Cultivation of skills to identify opportunities)

Cultivates the skills required to utilize advanced scientific and technological breakthroughs and build ideas for translating them into products and services that create economic and social values. Furthermore, cultivates the skills required to build an innovation idea by leveraging systems and design thinking to translate ideas into products and services.

[Subject] •Research on Science, Technology and Innovation 1 •Research on Science, Technology and Innovation 2

Master's Program Entrepreneurship Courses taught in the master's program cover the following five areas: Entrepreneurship, Strategy, Finance, IP Rights, and Project-Based Learning (PBL).

> Unlike business schools (graduate schools of business administration) in general, our program is designed to ensure that students who have natural science background can efficiently acquire knowledge that is necessary for the creation of innovation (creation of social and economic values).

Intellectual property strategy

Entrepreneurs should understand Intellectual Property (IP) Strategy when they try to realize innovation by using scientific breakthrough. Students learn patent law, copyright law, and process how to acquire, utilize,

and protect various IPs, which are necessary in realizing above mentioned innovation.

[Subject] •Legal & IP Strategy

Project Based Learning: PBL

Students engage in group work in the first year of the master's program. Students choose an existing science and technology venture firm, such as a biotech spinoff from STIN, and conduct detailed research and analysis into the firm's technology, IP rights, strategy, and finance. They will also think of a new business that they wish to propose to the firm and prepare a business plan through lectures and group work. A presentation workshop will be held at the end of the course for each group to present their business plan.

In the second year, each student will select one of the scientific themes pursued in the research lab they belong to and analyze what new business could be created from that theme. Finally, they will put together an innovation idea report. Multiple instructors will be involved in the process to provide advice from natural science, technology, IP rights, strategy, and finance perspectives.

[Subject] • Project-Based Learning of Entrepreneurship in Science and Technology

Science and Technology Entrepreneurship Courses (Cultivation of skills to build strategies)

Offers education on IP rights, strategy, and finance necessary for translating an innovation idea into products and services according to the student's level of experience in practical business management. Through this process, students will cultivate practical skills on innovation strategies.

Furthermore, under an interdisciplinary system integrating science and humanities, students will deeply explore innovation ideas that will lead to the creation of economic and social values and promote R&D projects that translate science and technology breakthroughs into innovative products and services. Students will put their research findings together in an innovation strategy research report.

[Subject] •Science and Technology Entrepreneurship

• Science, Technology and Innovation Strategy Project Research