Doctoral Program in Bioindustrial Sciences

Doctor of Philosophy in Biotechnology

Program Educational Objectives

Based on bioindustrial sciences, the researchers shall be trained that have a research and development ability that can contribute to creation of novel bioindustry technologies and creation of new technologies and intellectual property rights etc. to ensure/distribute/use bioresources as their materials.
Additionally, also in the social scientific aspects, such as international transaction and various kinds of regulations essential for industrial usage of bioresources and technological support/transfer to the developing countries, correspondence to social acceptance etc., the researchers shall have an ability to aim at solving problems while seeing the relationship with life ethics and protection of biodiversity with bird's eye, and practical intention with international leadership of specialized engineers and policy makers.

Graduate Profile	The desired student shall have a research and development ability that can contribute to creation of novel industry technologies and intellectual property rights etc. to ensure/distribute/use bioresources as their materials from a view of bioengineering and thorough knowledge of life ethics and protection of biodiversity as the factor unique to “life” industry and the situations of various countries relating to various regulations of environmental impact assessment etc. who is of global standard and have leadership that can also respond to practical instruction of technology transfer and international strategy/policy making with their research ability/knowledge.

Diploma Policy

The degree of Doctor of Philosophy in Biotechnology is commenced to those who have fulfilled the requirements for the completion of the Doctoral programs, as set out in the Graduate School Regulations of the University of Tsukuba and related university regulations, and who are deemed to have the following competences.

	Competences	Evaluation perspectives
Knowledge and Skills	1. Knowledge creation competence: Ability to create new knowledge that can contribute to future society	①Are there any research findings that can be considered new knowledge? ②Can we expect you to create knowledge that will contribute to future society?
	2. Management competence: Ability to plan and implement measures to identify and solve challenges from a higher perspective	①Can you make and implement long-term plans for critical challenges? ②Can you identify challenges, even in other areas of expertise, and solve them from a higher perspective?
	3. Communication competence: Ability to express the true nature of academic findings positively and clearly	①Can you explain the true nature of research content and specialized knowledge clearly and logically to researchers from different areas and to people other than researchers? ②Do you proactively share your findings with researchers and experts from your field of expertise and accurately answer questions?
	4. Leadership competence: Ability to have objectives get accomplished under your leadership	①Can you set attractive and compelling goals? ②Are you capable of building systems to realize goals and accomplish objectives as the leader?
	5. Internationality competence: Possession of a high level of awareness and motivation to be internationally active and contribute to international society	①Do you have strong awareness and motivation to contribute to international society and international activities? ②Have you obtained adequate linguistic skills for international information collection and action?
	6. Research ability: high knowledge and ability that can contribute to problem setting and creation of knowledge in bioengineering.	①If having acquired high knowledge in the area of biomaterials and broad basic knowledge in relevant area. ②If conducting problem setting by appropriately grasping R&D trend inside and outside Japan and having ability to be able to contribute to creation of new technologies and intellectual property rights etc.

	Competences	Evaluation perspectives
Knowledge and Skills	7. Adjusting ability: deep understanding of international regulations etc. in the area of bioengineering and ability of problem-solving as the basis.	①If having deeply understood various regulations etc. relating to life ethics and protection of biodiversity in international interaction and correspondence to regulation etc. in the area of biomaterials. ②If having an ability to aim at internationally solving problems while ensuring accountability.
	8. Leadership ability: an ability to take the leading position in industry creation and correspondence to society, and transfer of industry etc. in the area of bioengineering.	①If having acquired the knowledge to be able to ensure social correspondence/accountability relating to ensuring/distributing/using bioresources as the foundation in the area of biomaterials. ②If having an ability to be able to take leading position of engineers and politicians of various countries in creation of industry, technology support/transfer etc.
Guidelines for Assessing Learning Outcomes	The evaluation of learning outcomes is conducted objectively based on the “Competence Sheet”, which assesses the level of attainment corresponding to each stage and verifies the student's competence acquisition as defined in the diploma policy. The stages and methods of the achievement evaluation are outlined below. At the beginning of the spring semester of the second year, a mid-term review is conducted, during which the Advisory Committee carries out the first achievement evaluation based on the established rubric. At the beginning of the fall semester of the third year, a preliminary doctoral dissertation review (closed) and a public presentation are conducted. The second achievement evaluation is undertaken by a Preliminary Review Committee composed of the Advisory Committee plus one additional faculty member randomly appointed by the Degree Program. The committee also provides guidance toward the final achievement evaluation. Following successful completion of the preliminary review, the doctoral dissertation submitted for the final examination is evaluated by a Dissertation Review Committee consisting of the principal examiner and at least three co-examiners. Concurrently with the final dissertation review, the final achievement evaluation is conducted.	

Evaluation Criteria for Degree Theses/ Dissertations	The thesis that satisfies all the following evaluation items shall be a pass as the thesis for doctoral degree after going through the final examination. The final examination shall be conducted by the thesis examination committee composed of one chief examiner and three or more sub-chief examiners through peer-reviewing of the thesis and oral examination. 1. Title: The research outcomes are appropriately indicated. 2. Research purpose: The relationship with the research tasks after comprehensively grasping the previous research inside and outside Japan is specified, and creativity/progress of research is clearly extracted. 3. Research method: the research method is properly selected and can be verified by the third parties. In the selected research method, various regulations and research ethics are complied with. 4. The research is performed according to research outcomes/ consideration/research methods and clearly presented by charts and tables etc. In light of the conventional knowledge, consistent academic interpretation is provided. In handling the data, various regulations and research ethics are complied with. 5. Conclusions: it is concluded that the contents of the research will bring new development in the said research area. 6. The citation and use of the literature/data is appropriate and the research ethics is complied with.

Curriculum Policy

This Degree Program has the characteristics of its education to train the doctors with practical intention who has thorough knowledge in the aspect of social science such international interaction and correspondence to regulation, social acceptance etc., focusing on “creation of novel bioindustry technologies” and “security” / “distribution” / “use” of bioresources as its material, based on R&D ability that can contribute to creation of new technologies in bio engineering area and intellectual property rights etc.

Curriculum Design Framework	The R&D ability shall be acquired that can contribute to creation of new technologies relating to creation of novel bioindustry technologies and security/distribution/use of bioresources as its material and intellectual property rights etc. Additionally, by setting a part of courses as the required ones, active interaction among students whose mother countries and original organizations are different shall be promoted, and the difference of social conditions and demand by industries, and possessed resources and regulations etc. shall be experienced, and global awareness shall be refined. With the research ability/knowledge acquired through such consistent curriculum, the doctors with international leadership by which problem solving can be aimed at from both aspects of natural science and social science in the area of bioengineering.

Curriculum Design Framework	– By Special Research in Bioindustrial Sciences IA, IB, IIA, IIB, the students shall perform the research activities in the students' own area of expertise, achieve the research outcomes suitable for the doctoral degree, and present their academic thesis. Through these, the students shall have deep knowledge, set the problems after appropriately grasping the trend of R&D inside and outside Japan and acquire a high R&D ability to be able to contribute to creation of new technologies and intellectual property rights etc. – By Bioindustrial Sciences Seminar IA, IB, IIA, IIB, IIIA, IIIB, the students shall deepen the knowledge in the students' own area of expertise and acquire an ability to set the problems after appropriately grasping the trend of R&D inside and outside Japan. Additionally, the students shall have a broad vision in other areas relating to bioindustrial sciences and an ability to be able to flexibly correspond to the problems of the areas other than their specialized ones as well. – By “Advanced International Bioindustrial Science” as the required course, the students shall acquire an ability to aim at internationally solving problems while seeing the relationship with life ethics and protection of biodiversity with bird's eye. Additionally, by setting this course as a required course, active interaction and discussion among students whose mother countries and original organizations and research areas shall be promoted. Through these, the students shall refine global awareness and acquire an ability to be able to flexibly respond to global issues. – By “Regulatory Aspects in Bioindustry” as Foundation Subjects for Major, the students shall understand various regulations etc. essential for industrial use of bioresources more deeply and have an ability to ensure accountability in international transaction and social correspondence etc. and to respond to adjust themselves. – By “ Transfer of Industrial Technique on Life Science” as Foundation Subjects for Major, the students shall deepen their understanding of creation of bioindustry, social correspondence relating to security/distribution/use of bioresources, accountability from scientific knowledge and technological support/technological transfer etc. to developing countries and acquire a management ability to be able to the leading position as professional engineers and policy makers in various countries.

Teaching and Learning Methods	The advisory committee composed of three or more instructors shall be established for each student upon enrollment and continuously provide education/research instructions until completion of the degree course. The advisory committee shall conduct the interim evaluation held in the 2nd year in order to confirm the progress status of research and degree of learning achievement. Additionally, as necessary, it shall indicate additional registration of courses. The advisory committee shall participate in other master' programs, as necessary. – At the time of enrollment, the students shall learn Advanced International Bioindustrial Science, in which they can acquire an ability to adjust/instruct to aim at problem solving relating to international industry use of bioresources and active exchange and discussion with various human resources in various countries shall be promoted. – By having students register the seminars systematically from the 1st year to 3rd year, the specialized knowledge/ability required for degree awarding shall be acquired in order. – By confirming the degree of learning achievement in accordance with the interim evaluation and preliminary examination etc., and providing advice, the students shall be trained in order to be consistent with the human resources who are required for degree awarding of this Program.

Admission Policy

Desired Student Profile	The desired students shall have the specialization in the area of bioengineering as a matter of course, a broad culture, the intention to internationally proceed research/work, and desire to have foreign language skills and communication skills that enable sufficient communication within international research groups and organizations. As for working individuals, the desired persons shall have international leadership in addition to enhancement of specialization and seek for communication skills and management ability to be able to take leading position of engineers and politicians of various countries. For the purpose of severe selection of the capacities of entrants, the oral examination by “interview form of “task presentation type” shall be focused on. Additionally, in order to check English ability, the oral presentation in English shall be set. While focusing on if the intention/ability of the student is consistent with the human resources training policy in this Program, the human resources shall be selected according to the purpose of this Specialized Course.
Student Selection Process	– The following shall be measured: if the student can logically, accurately and clearly explain the research contents conducted so far and the actual results of business practices etc. such as the master's course with the fixed time. Additionally, if the questions and answers are appropriate. – Regarding the research policy after enrolling the doctoral course, the following shall be measured: if the academic significance of the research, its detailed methods, and its expected results shall be able to be explained, based on the relationship with the relevant research. – Through questions and answers, consistency between intention/ability of the examinee and the human resources training policy in this Program, his/her motivation, his/her basic academic skills, English ability and balance in personality etc. shall be comprehensively measured.

Learning Support Framework

Academic Support	In addition to guidance provided as needed by the Advisory Committee, a “Presentation Skills Improvement Course” is offered to enhance English presentation skills, as part of the Japan-China-Korea International Postgraduate Academic Forum organized by the Degree Programs.
Opportunities for Peer Interaction	In the compulsory lecture course ""Advanced International Bioindustrial Science", group presentations and Q&A sessions are incorporated to foster interaction among students. Doctoral dissertation defense sessions are held publicly, encouraging active participation from students and faculty beyond the degree program. In addition, in the the Japan-China-Korea International Postgraduate Academic Forum organized by the Degree Programs, students themselves plan and manage the event, thereby gaining opportunities for international exchange with students both inside and outside the university.
Opportunities for Student–Faculty Interaction	Orientation sessions for new students and dissertation briefing sessions for final-year students are held to promote interaction. In addition to interactions with the Advisory Committee as needed, opportunities for faculty-student engagement are provided through required lecture courses such as "Advanced International Bioindustrial Science" (team-taught by multiple faculty members) and joint seminars held by multiple laboratories. Furthermore, in the “Presentation Skills Improvement Course” conducted as part of thethe Japan-China-Korea International Postgraduate Academic Forum, faculty members from the Degree Programs serve as advisors, offering guidance and advice. These initiatives provide opportunities for interaction with faculty beyond the framework of the degree program.

Approaches to Assuring and Enhancing Educational Quality

- At the beginning of each academic year, the Education Committee evaluates students' learning outcomes and examines the appropriateness of the curriculum and the effectiveness of instruction.
- An agenda item titled “Faculty Development (FD)” is included in the deliberations of the Education Committee. Faculty members who participated in university-wide or School/Cluster-organized FD seminars provide feedback to the committee. In addition, course evaluations are conducted each semester for all subjects, and the results are shared as indicators for improving course content. Through these continuous processes of review and improvement of all educational activities, the program ensures the quality of education and strengthens the organizational framework necessary to achieve the objectives of the Degree Program.