Graduate Major in Life Science and Technology

The School of Life Science and Technology nurture students who will be able to contribute to the creation of universal intellectual basis and give it back to the society with an ethical worldview through elucidation of biological mechanisms and through pioneering new engineering applications based on the biological knowledge.

[Master's Degree Program]

1. Outline

By acquiring advanced expertise in the field of "Life Science and Technology", students obtain problem-setting and problem-solving skills contributing to the development of "Life Science and Technology" as well as high ethical standard, which will make them internationally successful science and engineering professionals.

2. Competencies Developed

To achieve the above objectives, this program supports students to acquire the following skills.

- Advanced expertise in "Life Science and Technology"
- Advanced problem-setting and problem-solving skills underpinned by expertise and an ethical worldview
- Advanced sophistication and communicating skills required as international professionals

3. Learning Goals

To acquire the skills listed in "Competencies Developed", students in this program will have the following trainings.

A) Acquiring advanced expertise in the field of "Life Science and Technology"
Acquiring advanced expertise in the research field of "Life Science and Technology" through Research Seminars, Research-Related Courses, and Major Courses

B) Acquiring the knowledge of a broad range of science and technology fields
Learning broad knowledge conducive to the development of science and technology through abundant Major Courses

C) Acquiring research-executing skills, problem-setting skills, problem-solving skills, and innovative creativity
Acquiring research-executing, problem-setting, problem-solving, and academic writing skills as well as innovative creativity through Research Seminars, Research-Related Courses, and exercises and experiments in Major Courses

D) Acquiring international communication skills
Learning advanced communication skills required as international professionals through Humanities and Social Science Courses, Career Development Courses, and Major Courses

E) Cultivating sophistication in relation to bioethics and society
Learning ethical and social values relevant to life and research in "Life Science and Technology" through Humanities and Social Science Courses, Career Development Courses, and exercises and experiments in Major Courses

4. IGP Completion Requirements

The following requirements must be met to complete the Master's Degree Program of this major.

1. Attain a total of 30 credits or more from 400- and 500-level courses.
2. From the courses specified in the Graduate Major in Life Science and Technology curriculum,
    - 8 credits acquired from Research Seminars;
    - 4 credits acquired from Research-Related Courses;
    - a minimum of 8 credits acquired from Major Courses;
    - IGP (C) students are required to acquire Directed Collaboration Works (2 credits);
    - a minimum of 5 credits acquired from Liberal Arts and Basic Science Courses
      (3 credits from Humanities and Social Science Courses of which 2 credits must be from 400-level courses and 1 credit from 500-level courses, and 2 credits from Career Development Courses).
3. Pass the master's thesis review and defense.

Table M1 shows course categories and the number of credits required to complete the Master's Degree Program of this major. It also shows the required minimum credits in each course category and points to be noted when selecting the required courses and electives.

The learning goals to be obtained by students through courses are listed as "associated learning goals". Prior to registering courses, students need to fully understand the course goals.

Table M1. Graduate Major in Life Science and Technology Completion Requirements

Course category		<Required courses> Required credits	<Electives> Minimum credits required	Minimum credits required	Associated learning goals	Comments
Liberal Arts and Basic Science Courses	**Humanities and Social Science Courses**		・2 credits from 400 level ・1 credit from 500 level	5 credits	D,E	
	Career Development Courses		2 credits		D,E	All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)
	Other Courses					
Core Courses	**Research Seminars**	LST Seminar S1 LST Seminar F1 LST Seminar S2 LST Seminar F2 A total of 8 credits, 2 credit each from the above courses.		20 credits from Core Courses of the Graduate Major standard curriculum	A,C	
	Research-Related Courses	MS Qualifying Presentation 1 (1 credit) MS Qualifying Presentation 2 (1 credit) LST Directed Laboratory Work (2 credits) A total of 4 credits			A,C	
	Major Courses	Directed Collaboration Works (2 credits)	6 credits		A,B,C,D,E	
	Major Courses and Research-Related Courses <u>outside</u> the Graduate Major in Life Science and Technology standard curriculum					
Total required credits		**A minimum of 30 credits including those attained according to the above conditions**				
Note		**・Japanese Language and Culture Courses offered to international students can be recognized as equivalent to the Humanities and Social Science Courses of the corresponding course level.** **・For details of the Liberal Arts and Basic Science Courses, please refer to the relevant sections.**				

5. IGP Courses

Table M2 shows the Core Courses of the Master's Degree Program in this major. Graduate Majors listed in the Comments column offer core courses that are recognized as equivalent to the corresponding Major Courses or Research-related Courses in the standard curriculum of this major.

Table M2. Core Courses of the Graduate Major in Life and Science Technology

Course category		Course number	Course title			Credits	Competencies	Learning goals	Comments
Research Seminars	400 level	LST.Z491.R	◎	★	LST Seminar S1	0-0-2	1,2,3,4,5	A,C	
		LST.Z492.R	◎	★	LST Seminar F1	0-0-2	1,2,3,4,5	A,C	
	500 level	LST.Z591.R	◎	★	LST Seminar S2	0-0-2	1,2,3,4,5	A,C	
		LST.Z592.R	◎	★	LST Seminar F2	0-0-2	1,2,3,4,5	A,C	
Research-Related Courses	400 level	LST.B401.R	◎	★	MS Qualifying Presentation 1	0-1-0	3,4	A,C	
		LST.B402.R	◎	★	MS Qualifying Presentation 2	0-1-0	2,3,5	A,C	
		LST.B403.R	◎	★	LST Directed Laboratory Work	0-0-2	2,3,4,5	A,C	
Major Courses	400 level	LST.A401.L		★	Molecular and Cellular Biology	2-0-0	3,4	B,D	
		LST.A402.L		★	Organic and Bioorganic Chemistry	2-0-0	3,5	B,D	
		LST.A403.L		★	Biophysics	2-0-0	1,3,4,5	B,D	
		LST.A404.L		★	Cell Physiology	2-0-0	3,4	B,D	
		LST.A405.L		★	Design of Bioactive Molecules	2-0-0	3	B,D	
		LST.A406.L		★	Molecular Developmental Biology and Evolution	2-0-0	2,3,4,5	B,D	
		LST.A407.L		★	Science of Metabolism	2-0-0	3,4,5	B,D	
		LST.A408.L		★	Computational Biology	2-0-0	3	B,D	
		LST.A409.L		★	Physical Biology of the Cell	2-0-0	3	B,D	
		LST.A410.L		★	Advanced Neuroscience	2-0-0	3,5	B,D	
		LST.A411.L		★	Biomolecular Engineering	2-0-0	1,3,5	B,D	

		LST.A412.L		★	Biomaterial Science and Engineering	2-0-0	1,3,4,5	B,D	
		LST.A413.L			Career Development Seminars	2-0-0	2,5	B,D,E	
		LST.A414.L			LST Frontier Seminar 1	1-0-0	3	A,B	
		LST.A415.L			LST Frontier Seminar 2	1-0-0	3	A,B	
		LST.A416.L			LST Academic Writing 1	2-0-0	2,5	C	
		LST.A417.L		★	Advanced Biological Science and Engineering (Tsinghua University)	2-0-0	1,3,4,5	B,D	
		LST.A418.L	◎	★	Directed Collaboration Works	2-0-0	1,2,3,4,5	B,C,D	Required for IGP (C) students
	500 level	LST.A501.L		★	Biomolecular Analysis	2-0-0	3,5	B,D	
		LST.A502.L		★	Science of Biological Resources	2-0-0	3,5	B,D	
		LST.A503.L		★	Environmental Microbiology	2-0-0	1,3,4,5	B,D	
		LST.A504.L		★	Medical Biotechnology	2-0-0	1,3,5	B,D	
		LST.A505.L		★	LST Academic Writing 2	2-0-0	1,2,4,5	C,D	
		LST.A506.L			LST Frontier Seminar 3	1-0-0	3	A,B	
		LST.A507.L			LST Frontier Seminar 4	1-0-0	3	A,B	
		LST.C501.L		★	MS Internship 1	0-1-0	2,3,4,5	D,E	
		LST.C502.L		★	MS Internship 2	0-2-0	2,3,4,5	D,E	
		LST.C503.L		★	MS Internship 3	0-4-0	2,3,4,5	C,D,E	
		LST.C504.L		★	MS Internship 4	0-6-0	2,3,4,5	C,D,E	
		LST.C505.L		★	Short-term Internship on Computational Life Sciences	0-0-1	2,4,5	B,D	
		LST.C506.L		★	Overseas Research Training 1 (Tsinghua University)	0-1-0	1,2,3	B,D	
		LST.C507.L		★	Overseas Research Training 2 (Tsinghua University)	0-1-0	1,2,3	B,D	

Major Courses and Research-Related Courses outside the Graduate Major in Life Science and Technology standard curriculum	400 level	ZBA.A402			Creative Collaboration Works on Life Sciences (ACLS)	1-1-0	2,3,5	C,D	can be included in the required 30 credits
		ZBA.A403		★	Global Presentation on Computational Life Sciences A (ACLS)	2-0-0	2	D	can be included in the required 30 credits
		ZBA.A404		★	Global Presentation on Computational Life Sciences B	2-0-0	2	D	can be included in the required 30 credits
		ZBA.A405		★	Global Communication on Computational Life Sciences A (ACLS)	2-0-0	1,2	D	can be included in the required 30 credits
		ZBA.A406		★	Global Communication on Computational Life Sciences B (ACLS)	2-0-0	1,2	D	can be included in the required 30 credits
		ZBA.A407			Introduction to Business Plan (ACLS)	1-0-0	3	B,E	can be included in the required 30 credits
		ZBA.A408			Introduction to Bioethics (ACLS)	1-0-0	1,3	B,E	can be included in the required 30 credits
		ZBA.A409			Topics 1 in Computational Life Sciences (ACLS)	1-0-0	3	A,B	can be included in the required 30 credits
		ZBA.A410			Topics 2 in Computational Life Sciences (ACLS)	1-0-0	3	A,B	can be included in the required 30 credits
		ACL.C401		★	International Internship on Computational Life Sciences for Master's Students	0-0-4	1,2,3,4,5	D,E	can be included in the required 30 credits
					Any Major Courses in other Graduate Majors				can be included in the required 30 credits
	500 level	ZBA.A501		★	Global Writing on Computational Life Sciences	2-0-0	1,2	D	can be included in the required 30 credits
		ZBA.A502		★	Global Debate on Computational Life Sciences	2-0-0	2	D	can be included in the required 30 credits
		ZBA.A503			Topics 3 in Computational Life Sciences (ACLS)	1-0-0	3	A,B	can be included in the required 30 credits
		ZBA.A504			Topics 4 in Computational Life Sciences (ACLS)	1-0-0	3	A,B	can be included in the required 30 credits
					Any Major Courses in other Graduate Majors				can be included in the required 30 credits

・ ◎ : Required course, ★ : Course given in English

・ Competencies: 1 = Intercultural skills; 2 = Communication skills; 3 = Specialist skills; 4 = Critical thinking skills; 5 = Practical and/or problem-solving skills

・ The character preceding the three digits in the LST course number denotes the course's subdiscipline (i.e., "D" represents the subdiscipline code in the course number ABC.D400.R): A (Major course), B (Research-related course), C (Internship), Z (Research seminars).

・ Students starting in spring should take MS Qualifying Presentation 1, LST Directed Laboratory Work, and MS Qualifying Presentation 2 in 2Q, 3Q, and 4Q, respectively. Those starting in fall should take MS Qualifying Presentation 1, LST Directed Laboratory Work, and MS Qualifying Presentation 2 in 4Q, 1Q, and 2Q, respectively.

・To sign up for MS Internship 1-4, students must obtain approval from teaching staffs in charge by submitting the application form approximately 2 months prior to the start date of the internship.
・If students complete Introduction to Business Plan (ACLS), Introduction to Bioethics (ACLS), Global Writing on Computational Life Sciences, or Global Debate on Computational Life Sciences, they cannot take Introduction to Business Plan for Doctoral Students, Introduction to Bioethics for Doctoral Students, Global Writing on Computational Life Sciences for Doctoral Students, or Global Debate on Computational Life Sciences for Doctoral Students, respectively, at the 600 level.

6. IGP Courses That Can Be Counted as Humanities and Social Science Courses

None

7. IGP Courses That Can Be Counted as Career Development Courses

In order to fulfill the completion requirements for the master's degree program, students must attain at least 2 credits in Career Development Courses, and should satisfy all of the Graduate Attributes (GA) specified in Table MA-1 of the "Career Development Courses" (Liberal Arts and Basic Science Courses) in the Guide to Graduate Education and International Graduate Program. Students will be evaluated in regards to GA achievements at the time of their degree completion. As to the courses with more than one GA, the number of GA stipulated for the courses is considered to be acquired regardless of the credits received for the courses.

Major Courses that enable students to acquire GA and that are recognized as equivalent to Career Development Courses are listed in Table M3 below.

However, it must be noted that credits attained from these courses cannot be counted more than once as Major Courses or Career Development Courses towards the completion requirements for the master's degree program.

For Graduate Attributes, refer to the Guide to the Career Development Courses.
The Graduate Attributes of the Master's Degree Program are listed in Table MA-1 as follows:
C0M: Able to delineate one's career plan clearly and recognize the skills necessary to materialize the plan, also considering its relations to the society
C1M: Able to utilize its own expertise to the development of academia and technology, and work with others with different expertise to contribute to problem-solving

Table M3. Courses of the Graduate Major in Life Science and Technology recognized as equivalent to Career Development Courses

Course category	Course number	Course title			Credits	GA*	Learning goals	Comments
Courses that can be counted as Career Development Courses	LST.A413.L			Career Development Seminars	2-0-0	C0M C1M	B,D,E	
	LST.C501.L		★	MS Internship 1	0-1-0	C1M	D,E	
	LST.C502.L		★	MS Internship 2	0-2-0	C1M	D,E	
	LST.C503.L		★	MS Internship 3	0-4-0	C1M	C,D,E	
	LST.C504.L		★	MS Internship 4	0-6-0	C1M	C,D,E	
	LST.C505.L		★	Short-term Internship on Computational Life Sciences	0-0-1	C0M	B,D	
	LST.C506.L		★	Overseas Research Training 1 (Tsinghua University)	0-1-0	C1M	B,D	

	LST.C507.L		★	Overseas Research Training 2 (Tsinghua University)	0-1-0	C1M	B,D	
	ACL.C401		★	International Internship on Computational Life Sciences for Master's Students	0-0-4	C1M	D,E	Course in ACLS
	HCB.C432			Fundamentals of Research Application for Life Innovation	1-1-0	C0M C1M	A,D	Course in HCB
	HCB.C431			Off Campus Training I	0-0-1	C1M	D	Course in HCB
	HCB.C531			Off Campus Training II	0-0-2	C1M	D	Course in HCB
	HCB.C532			Off Campus Training III	0-0-4	C1M	D	Course in HCB

・★: Course given in English

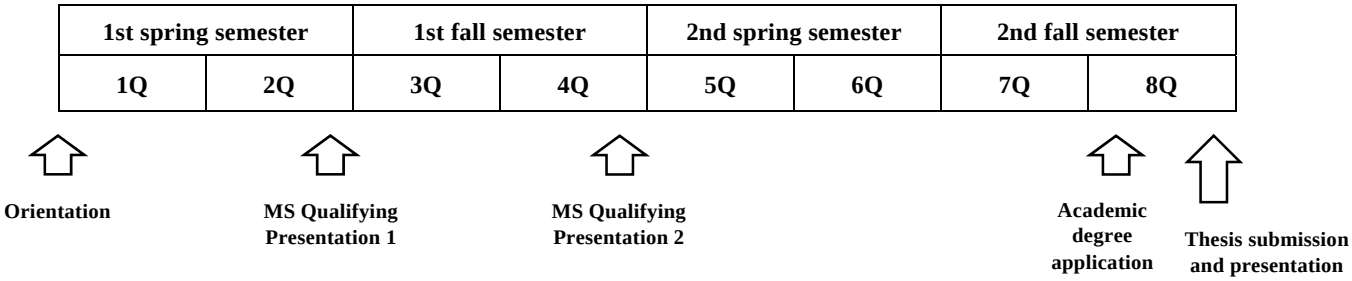
・Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.

・When signing up for the courses in HBC, students should obtain approval from HBC in advance.

・GA*: Graduate Attributes; ACLS: Education Academy of Computational Life Sciences; HCB: Graduate Major in Human Centered Science and Biomedical Engineering

8. Research Related to the Completion of Master Theses

In master's thesis research, students improve their problem-setting, problem-solving, and communication skills through a series of research activities. A relevant research time line is shown in the following diagram.



- **Research concept presentation, interim research presentation**
  In order to be conscious of the background and goals of their own master's thesis research, students make a "research concept presentation" (MS Qualifying Presentation 1), where they submit a program for their entire research in 2Q. In 4Q, they make the "interim research presentation" (MS Qualifying Presentation 2). After the research concept presentation, if the major approves it, students may take 600-level Major Courses (with the exception of Humanities and Social Science Courses and Career Development Courses). However, keep in mind that these may not be counted as a requirement for master's program completion.

- **Thesis examination criteria**
  1) The self-written paper in the field of "Life Science and Technology" must include novel and original observations and insights, and describe own discussions.
  2) Existing research related to the paper's topic must be appropriately and systematically reviewed.
  3) The degree-seeking student must understand the results and significance of the research sufficiently.
  4) The main part must have been presented at an academic conference related to "Life Science and Technology", or the content must be at an equivalent level.

- **Procedure for thesis examination**
  The examination committee is comprised of 3 or more referees (2 or more teaching staffs in charge of the Life Science and Technology major). After the peer review by referees done in advance, an oral presentation is made and a final examination and evaluation are performed. Examinations of candidates for the doctor's program are performed by 5 or more referees (3 or more teaching staffs in charge of the Life Science and Technology major).

[Doctoral Degree Program]

1. Outline

With high ethical standard and a broad range of exceptional expertise centered on the “Life Science and Technology” field, professional talents for science and technology are cultivated with skills to advance world top level research and development, create new technologies, and exhibit leadership on the international stage.

2. Competencies Developed

In this program, students aim to acquire the following skills at a level higher than in the Master’s Degree Program in order to achieve the above objectives.

- Broad, exceptional expertise centered on the “Life Science and Technology” field
- Exceptional problem-setting and problem-solving skills underpinned by expertise and high ethical standard, as well as the innovative creativity to pioneer new theoretical paradigms and technologies
- Exceptional sophistication and communicating skills for exhibiting leadership on the global stage

3. Learning Goals

In order to acquire the skills listed in “Competencies Developed”, students in this program will have the following trainings.

A) Acquiring exceptional expertise centered on the “Life Science and Technology” field
Advancing expertise in the research field of “Life Science and Technology” and ability to evaluate research in that field through Research Seminars, Research-Related Courses, and exercises and experiments in Major Courses

B) Acquiring research-executing skills, problem-setting skills, problem-solving skills, and innovative creativity
Acquiring exceptional research-executing skills, problem-setting skills, problem-solving skills, and academic writing skills, as well as the innovative creativity to pioneer new theoretical paradigms and technologies through Research Seminars, Research-Related Courses, and exercises and experiments in Major Courses

C) Acquiring international communication skills
Learning exceptional communication skills for exhibiting leadership on the global stage through Humanities and Social Science Courses, Career Development Courses, and exercises and experiments in Major Courses.

D) Acquiring research-planning and -organizing skills and leadership
Learning skills to plan and lead advanced research as a next-generation leader through Career Development Courses, Research Seminars, and exercises and experiments in Major Courses

E) Nurturing sophistication in relation to bioethics and society
Developing strong ethical and social views towards life and research in “Life Science and Technology” through Humanities and Social Science Courses, Career Development Courses, and exercises and experiments in Major Courses

4. IGP Completion Requirements

The following requirements must be met to complete the Doctoral Degree Program of this major.

1. Attain a total of 24 credits or more from 600-level courses.
2. From the courses specified in the Graduate Major in Life Science and Technology curriculum,
    - 12 credits acquired from Research Seminars;
    - 4 credits acquired from Research-Related Courses;
    - IGP (C) students are recommended to acquire IGP Off-Campus Training I or II (1 credit each);
    - a minimum of 6 credits acquired from Liberal Arts and Basic Science Courses
      (2 credits from 600-level Humanities and Social Science Courses, and 4 credits from 600-level Career Development Courses).
3. Pass the doctoral thesis review and defense.

Table D1 shows course categories and the number of credits required to complete the Doctoral Degree Program of this major. It also shows the required minimum credits in each course category and points to be noted when selecting the required courses and electives.

The learning goals to be obtained by students through courses are listed as “associated learning goals”. Prior to registering courses, students need to fully understand the course goals.

Table D1. Graduate Major in Life Science and Technology Completion Requirements

<table>
<tr><th colspan="2">Course category</th><th><Required courses>
Required credits</th><th><Electives>
Minimum credits required</th><th>Minimum credits required</th><th>Associated learning goals</th><th>Comments</th></tr>
<tr><td rowspan="3">Liberal Arts and Basic Science Courses</td><td>Humanities and Social Science Courses</td><td></td><td>2 credits</td><td rowspan="3">6 credits</td><td>C,E</td><td></td></tr>
<tr><td>Career Development Courses</td><td></td><td>4 credits</td><td>C,E</td><td>All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)</td></tr>
<tr><td>Other Courses</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Core Courses</td><td>Research Seminars</td><td>LST Seminar S3
LST Seminar F3
LST Seminar S4
LST Seminar F4
LST Seminar S5
LST Seminar F5
A total of 12 credits, 2 credits each from the above courses.</td><td></td><td rowspan="3">16 credits from Core Courses of the Graduate Major standard curriculum</td><td>A,B,C,D</td><td></td></tr>
<tr><td>Research-Related Courses</td><td>PhD Qualifying Presentation 1
PhD Qualifying Presentation 2
A total of 4 credits, 2 credits each from the above courses.</td><td></td><td>A,B</td><td></td></tr>
<tr><td>Major Courses</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Total required credits</td><td colspan="5">A minimum of 24 credits including those attained according to the above conditions</td></tr>
<tr><td colspan="2">Note</td><td colspan="5">・Japanese Language and Culture Courses offered to international students can be recognized as equivalent to the Humanities and Social Science Courses of the corresponding course level.
・For details of the Liberal Arts and Basic Science Courses, please refer to the relevant sections.</td></tr>
</table>

5. IGP Courses

Table D2 shows the Core Courses of the Doctoral Degree Program of this major. Graduate Majors listed in the Comments column offer core courses that are recognized as equivalent to the corresponding Major Courses or Research-related Courses in the standard curriculum of this major.

Table D2. Core Courses of the Graduate Major in Life Science and Technology

Course category		Course number			Course title	Credits	Competencies	Learning goals	Comments
Research Seminars	600 level	LST.Z691.R	◎	★	LST Seminar S3	0-0-2	1,2,3,4,5	A,B,D	
		LST.Z692.R	◎	★	LST Seminar F3	0-0-2	1,2,3,4,5	A,B,D	
		LST.Z693.R	◎	★	LST Seminar S4	0-0-2	1,2,3,4,5	A,B,D	
		LST.Z694.R	◎	★	LST Seminar F4	0-0-2	1,2,3,4,5	A,B,D	
		LST.Z695.R	◎	★	LST Seminar S5	0-0-2	1,2,3,4,5	A,B,D	
		LST.Z696.R	◎	★	LST Seminar F5	0-0-2	1,2,3,4,5	A,B,D	
Research-Related Courses	600 level	LST.B601.R	◎	★	PhD Qualifying Presentation 1	0-2-0	2,3,5	A,B	
		LST.B602.R	◎	★	PhD Qualifying Presentation 2	0-2-0	2,3,5	A,B	
Major Courses	600 level	LST.B603.L		★	LST Bioleader Training 1	0-2-0	2,3,4	B,D	
		LST.B604.L		★	LST Bioleader Training 2	0-2-0	2,3,5	B,D	
		LST.C601.L		★	PhD Internship 1	0-1-0	2,3,4,5	A,C,E	
		LST.C602.L		★	PhD Internship 2	0-2-0	2,3,4,5	A,C,E	
		LST.C603.L		★	PhD Internship 3	0-4-0	2,3,4,5	A,B,C,E	
		LST.C604.L		★	PhD Internship 4	0-6-0	2,3,4,5	A,B,C,E	
		LST.C605.L			Career Development in Industry	0-0-4	2,3,4,5	A,B,C,E	Course in the Graduate Program for Working Adults
		LST.C607.L		★	IGP Off-Campus Training I	0-1-0	1,2,4,5	A,C,E	Recommended for IGP (C) students
		LST.C608.L		★	IGP Off-Campus Training II	0-1-0	1,2,4,5	A,C,E	Recommended for IGP (C) students

Major Courses and Research-Related Courses outside the Graduate Major in Life Science and Technology standard curriculum	600 level	ACL.A601			Introduction to Business Plan for Doctoral Students	1-0-0	4,5	B,E	can be included in the required 24 credits
		ACL.A602			Introduction to Bioethics for Doctoral Students	1-0-0	3,4,5	B,E	can be included in the required 24 credits
		ACL.A603		★	Global Writing on Computational Life Sciences for Doctoral Students	2-0-0	1,2,4,5	C	can be included in the required 24 credits
		ACL.A604		★	Global Debate on Computational Life Sciences for Doctoral Students	2-0-0	1,2	C	can be included in the required 24 credits
		ACL.A631			Topics 1 in Computational Life Sciences for Doctoral Students	1-0-0	3,4,5	A,B	can be included in the required 24 credits
		ACL.A632			Topics 2 in Computational Life Sciences for Doctoral Students	1-0-0	3,4	A,B	can be included in the required 24 credits
		ACL.A633			Topics 3 in Computational Life Sciences for Doctoral Students	1-0-0	3	A,B	can be included in the required 24 credits
		ACL.A634			Topics 4 in Computational Life Sciences for Doctoral Students	1-0-0	3,4,5	A,B	can be included in the required 24 credits
		ACL.C601		★	International Internship on Computational Life Sciences for Doctoral Students	0-0-4	1,2,3,4,5	A,C,E	can be included in the required 24 credits
					Any Major Courses in other Graduate Majors				can be included in the required 24 credits

・ ◎ : Required course, ★ : Course given in English
・ Competencies: 1 = Intercultural skills; 2 = Communication skills; 3 = Specialist skills; 4 = Critical thinking skills; 5 = Practical and/or problem-solving skills
・ The character preceding the three digits in the LST course number denotes the course's subdiscipline (i.e., "D" represents the subdiscipline code in the course number ABC.D400.R): A (Major course), B (Research-related course), C (Internship), Z (Research seminars).
・ Students starting in spring should take PhD Qualifying Presentation 1 and 2 in 4Q, while those starting in fall should take them in 2Q.
・ Students should sign up for LST Bioleader Training 1 and 2 in 1Q.
・ To sign up for PhD Internship 1-4, students must obtain approval from teaching staffs in charge by submitting the application form approximately 2 months prior to the start date of the internship.
・ Students cannot sign up for Introduction to Business Plan for Doctoral Students, Introduction to Bioethics for Doctoral Students, Global Writing on Computational Life Sciences for Doctoral Students, or Global Debate on Computational Life Sciences for Doctoral Students if they have completed Introduction to Business Plan (ACLS), Introduction to Bioethics (ACLS), Global Writing on Computational Life Sciences, or Global Debate on Computational Life Sciences, respectively, at the 400-500 levels.

6. IGP Courses That Can Be Counted as Humanities and Social Science Courses

None

7. IGP Courses That Can Be Counted as Career Development Courses

In order to fulfill the completion requirements for the doctoral degree program, students must attain at least 4 credits in Career Development Courses, and should satisfy all of the Graduate Attributes (GA) specified in Table A-1 or A-2 of the "Career Development Courses" (Liberal Arts and Basic Science Courses) in the Guide to Graduate Education and International Graduate Program. Students will be evaluated in regards to GA achievements at the time of their degree completion. As to the courses with more than one GA, the number of GA stipulated for the courses is considered to be acquired regardless of the credits received for the courses.

Major Courses that enable students to acquire GA and that are recognized as equivalent to Career Development Courses are listed in Tables D3-1 and D3-2 below.

However, it must be noted that credits attained from these courses cannot be counted more than once as Major Courses or Career Development Courses towards the completion requirements for the doctoral degree program.

For Graduate Attributes, refer to the Guide to the Career Development Courses.
The Graduate Attributes of the Academic Leader Program (ALP) are listed in Table A-1 as follows:

- A0D: You will be able to precisely draw your own career plan and self-train yourself to acquire the skills required for attaining your goals in the academic field
- A1D: You will be able to ascertain the true nature of phenomena, master the secret of learning, and lead the pioneering of a new academic discipline or research area
- A2D: You will be able to understand the position of academia in society, and adequately explain the academic progress to members of society, which is the stakeholder
- A3D: You will be able to nurture junior students in educational institutions, inculcating in them an interest in academics and enabling them to later join in the pioneering of new academic disciplines or research areas

The Graduate Attributes of the Productive Leader Program (PLP) are listed in Table A-2 as follows:

- P0D: You will be able to precisely draw your own career plan and self-train yourself to acquire the skills required for attaining your goals in the industry, etc.
- P1D: You will be able to precisely grasp the needs of society and detect its problems, and lead the future developments in science and technology
- P2D: While leading teams consisting of members with varied specialties and value systems, you will be able to create products and enterprises that bring forth new values in the society
- P3D: Through the project, you will be able to nurture junior students, enabling them to later join in the development of next generation society and industry

Table D3-1 Courses of the Graduate Major in Life Science and Technology recognized as equivalent to Career Development Courses in the Academic Leader Program (ALP)

Course category	Course number	Course title			Credits	GA*	Learning goals	Comments
Courses that can be counted as Career Development Courses	LST.C601.L		★	PhD Internship 1	0-1-0	A1D A2D A3D	A,C,E	
	LST.C602.L		★	PhD Internship 2	0-2-0	A1D A2D A3D	A,C,E	
	LST.C603.L		★	PhD Internship 3	0-4-0	A1D A2D A3D	A,B,C,E	
	LST.C604.L		★	PhD Internship 4	0-6-0	A1D A2D A3D	A,B,C,E	
	LST.C605.L			Career Development in Industry	0-0-4	A2D A3D	A,B,C,E	Course in the Graduate Program for Working Adults

	LST.C607.L		★	IGP Off-Campus Training I	0-1-0	A1D A2D A3D	A,C,E	
	LST.C608.L		★	IGP Off-Campus Training II	0-1-0	A1D A2D A3D	A,C,E	
	ACL.A601			Introduction to Business Plan for Doctoral Students	1-0-0	A0D	B,E	Course in ACLS
	ACL.A602			Introduction to Bioethics for Doctoral Students	1-0-0	A0D	B,E	Course in ACLS
	ACL.C601		★	International Internship on Computational Life Sciences for Doctoral Students	0-0-4	A1D A2D A3D	A,C,E	Course in ACLS
	HCB.C631		★	HCB International Internship	0-0-4	A2D A3D	B,C,D	Course in HCB
	HCB.C632			Research Working in Company	0-2-2	A2D A3D	B,C,D	Course in HCB

・★:Course given in English

・Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.

・When signing up for the courses in HBC, students should obtain approval from HCB in advance.

・GA*: Graduate Attributes; HCB: Graduate Major in Human Centered Science and Biomedical Engineering

Table D3-2 Courses of the Graduate Major in Life Science and Technology recognized as equivalent to Career Development Courses in the Productive Leader Program (PLP)

Course category	Course number	Course title			Credits	GA*	Learning goals	Comments
Courses that can be counted as Career Development Courses	LST.C601.L		★	PhD Internship 1	0-1-0	P1D P2D P3D	A,C,E	
	LST.C602.L		★	PhD Internship 2	0-2-0	P1D P2D P3D	A,C,E	
	LST.C603.L		★	PhD Internship 3	0-4-0	P1D P2D P3D	A,B,C,E	
	LST.C604.L		★	PhD Internship 4	0-6-0	P1D P2D P3D	A,B,C,E	
	LST.C605.L			Career Development in Industry	0-0-4	P2D P3D	A,B,C,E	Course in the Graduate Program for Working Adults
	LST.C607.L		★	IGP Off-Campus Training I	0-1-0	P1D P2D P3D	A,C,E	
	LST.C608.L		★	IGP Off-Campus Training II	0-1-0	P1D P2D P3D	A,C,E	

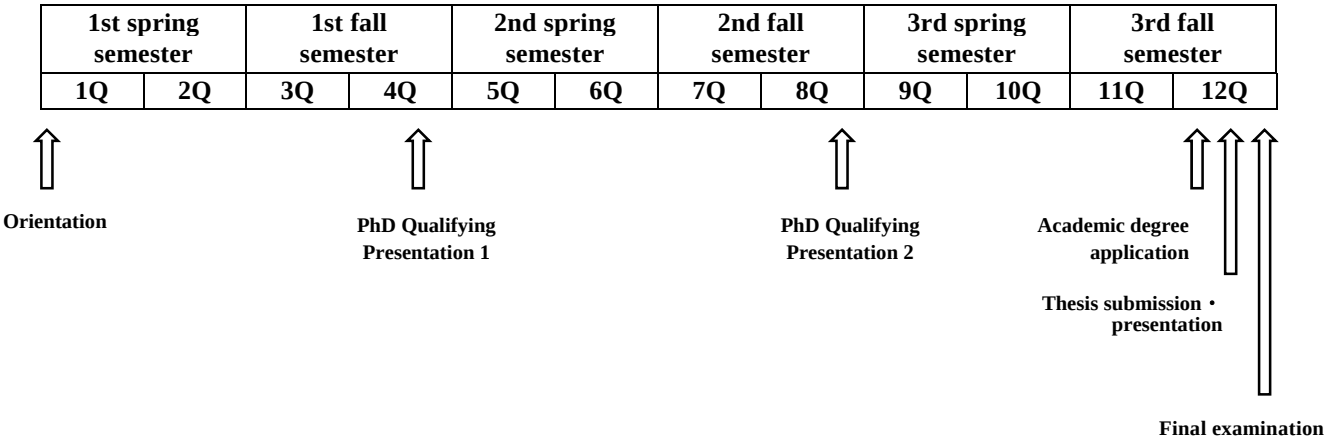
	ACL.A601			Introduction to Business Plan for Doctoral Students	1-0-0	P0D	B,E	Course in ACLS
	ACL.A602			Introduction to Bioethics for Doctoral Students	1-0-0	P0D	B,E	Course in ACLS
	ACL.C601		★	International Internship on Computational Life Sciences for Doctoral Students	0-0-4	P1D P2D P3D	A,C,E	Course in ACLS
	HCB.C631		★	HCB International Internship	0-0-4	P2D P3D	B,C,D	Course in HCB
	HCB.C632			Research Working in Company	0-2-2	P2D P3D	B,C,D	Course in HCB

・★:Course given in English
・Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.
・When signing up for the courses in HBC, students should obtain approval from HCB in advance.
・GA*: Graduate Attributes; HCB: Graduate Major in Human Centered Science and Biomedical Engineering

Students enrolled in the educational program for leading graduate schools may be offered courses recognized as equivalent to Career Development Courses besides those listed as such in the “Liberal Arts and Basic Science Courses” in the Guide to Graduate Education and International Graduate Program. For details about available courses or completion requirements, please refer to the Study Guide of the Academy that offers the relevant program.

8. Research Related to the Completion of Doctoral Theses

In doctoral dissertation research, students cultivate their problem-setting and problem-solving skills, and improve their English communication skills through a series of research processes. A relevant dissertation research time line is shown in the following diagram. In 4Q and 8Q, students make the interim presentation (PhD Qualifying Presentation 1 and 2). Continuing on, they submit and present their thesis in 12Q.



- **Doctoral dissertation examination criteria**

  1) The self-written paper in the field of “Life Science and Technology” must be novel and original, with sufficient academic significance.
  2) The main part must have been published or be accepted for publication in an international, peer-reviewed academic journal, with the degree-seeking student as a mainly-contributing author.
  3) The degree-seeking student must have sufficient linguistic skills to carry out research internationally.

- **Procedure for doctoral dissertation examination**

  The examination committee is comprised of 5 or more referees (3 or more teaching staffs in charge of the Graduate Major in Life Science and Technology). After an oral presentation and peer review by the referees, a final examination and evaluation, including those of linguistic skills, are performed.