September, 2017

Education Acedemy of Computational Life Sciences

Program for Leading Graduate Schools

2017 Fall Curriculum Guide



Education Academy of Computational Life Sciences

Program for Leading Graduate Schools

1. Outline of the Program

Life science methodologies are changing drastically with development of information technology and advanced measurement techniques. Currently, new types of specialists are required: specialists who can employ leading-edge computer science approaches, such as data-driven methodologies to derive valuable knowledge from massive data sources and high-speed simulation on supercomputing environments, in life science researches. Responding to these emerging trends, ACLS provides the multidisciplinary education program across multiple fields to produce specialists who possess not only the expertise in their major fields but also the knowledge and experience in their subspecialty fields. Specifically, ACLS produces the following Γ (Gamma) Type specialists:

-Distinguished life science specialists with an ability to utilize leading-edge computer science technologies

-Distinguished computer science specialists with an ability to comprehend life science methodology and concepts

Life sciences and computer science are now progressing rapidly. It is unrealistic for a student to specialize in both fields during his / her graduate school years. In fact, incomplete education in these fields could be even disadvantageous for a student's career path. In this program, we focus on providing our students with solid education in their main areas of expertise in life sciences or computer science to secure their career paths. We then provide them with fundamental knowledge in their secondary specialties and with experiences of collaborative problem solving where students solve complex problems by cooperating with students from a different major.

2. Selection Method

Right after the students of the associated five graduate majors enroll in their graduate schools (in April or October), we conduct a selection interview for the academy focused on first-year master's students in the five associated graduate majors of two schools.

Associated Graduate Majors:

- School of Life Science and Technology
 - > Department of Life Science and Technology
 - ♦ Graduate Major in Life Science and Technology
 - ♦ Graduate Major in Human Centered Science and Biomedical Engineering
- School of Computing
 - > Department of Mathematical and Computing Science

- ♦ Graduate Major in Mathematical and Computing Science
- ♦ Graduate Major in Artificial Intelligence
- > Department of Computer Science
 - ♦ Graduate Major in Computer Science
 - ♦ Graduate Major in Artificial Intelligence
- 3. Curriculum for Foreign Students Majoring in Life & Computer Sciences

1) Students must acquire credits required by each graduate major. [Compulsory]

2) Students must acquire 2 credits of Workshop on Group Problem-Solving (ACLS) and 2 credits of Creative Collaboration Works on Life Sciences (ACLS) in the master's course. They must also acquire 2 credits from fundamental courses, according to each student's major field. [Compulsory]

3) Students must acquire 4 credits of Global Communication on Computational Life Sciences A/B (ACLS) and Global Presentation on Computational Life Sciences A/B (ACLS) in the master's program, and 2 more credits of Global Debate on Computational Life Sciences (ACLS) or Global Writing on Computational Life Sciences (ACLS) in the doctoral program. [Compulsory]

4) Students must acquire 2 credits of a class in the advanced courses of the master's course and 3 more credits of classes in the advanced courses before graduation from the doctoral course. [Compulsory]

5) Students must acquire 1 credit from a Short-term Internship on Computational Life Sciences, a 1- to 2week project at a corporation, a national institute and so on in the master's program (ACLS). [Compulsory]

6) Students must acquire 2 credits from an International Internship on Computational Life Sciences for Doctoral students (ACL.C601) or an International Internship on Computational Life Sciences for Master's students (ACL.C401), a 3-month project at a university, institute, or corporation abroad. [Compulsory]

7) To graduate, doctoral students must present satisfactory midterm progress reports, and then pass a doctoral thesis review in each graduate major, and the final oral examination by ACLS.

Credit requirements for the ACLS program

	Credit requirements at the master's level	Credit requirements at the doctoral level
Courses for the student's graduate major	Credits specified by the student's department for his/her graduate major (this includes conducting master's research)	Credits specified by the student's department for his/her graduate major (this includes conducting doctoral research)
a) Fundamental Courses	A minimum of 4 credits (including 4 credits from the compulsory courses) © ART.T453, © ZBA.A402	A minimum of 6 credits
b) Advanced Courses	A minimum of 2 credits	A minimum of 5 credits
c) Science and Technology Communication Courses	A minimum of 4 credits (including 4 credits from the compulsory courses) < © ZBA.A403, © ZBA.A406> or < © ZBA.A404, © ZBA.A405>	A minimum of 6 credits
d) Internship Courses	A minimum of 1 credit (including 1 credit from the compulsory course) © LST.C505	A minimum of 3 credits © ACL.C601 or ©ACL.C401

© Compulsory

a) Fundamental Courses

	Codo	Course Title	Crodit	Quartor	Academic unit
	Coue	Course ride	Creat	Qualter	or major
	ΔRT T452	Modeling of Continuous Systems	2	1Q	Artificial
For Life	ART.1452		2		Intelligence
		+ Mathematics of Discrete Systems	2	20	Artificial
Science	AR1.1451	* Mathematics of Discrete Systems		2Q	Intelligence
Students	A D T T 4 5 7		_	20	Artificial
	AR1.1457	Norkshop on Building Advanced Computer Network		ZQ	Intelligence
			_	10	Life Science and
	LST.A203	Biochemistry I		1Q	Technology
For Computer Science Students		★Molecular and Cellular Biology		1Q	Life Science and
	LST.A401				Technology
		Malagular Biology I	2	20	Life Science and
	L31.A200		2	ZQ	Technology
		Molecular Biology II		20	Life Science and
	LST.AZIS			SQ	Technology
		ST.A218 Biochemistry II		4.0	Life Science and
	LST.AZIO			4 Q	Technology
	1 CT A 246	Disinformation (ICT)	2	40	Life Science and
	L31.A240	Bioinformatics (LST)		4Q	Technology
Ear Both		T.T453 (*)Workshop on Group Problem-Solving (ACLS) <compulsory course="" degree="" in="" master's="" program=""></compulsory>		2Q	Artificial
	AK1.1453			(Intensive)	Intelligence
		◎($★$)Creative Collaboration Works on Life Sciences		3~40	Life Science and
	ZBA.A402	(ACLS)	2	(Intensive)	
		<pre></pre>		(Intensive)	rechnology

© Compulsory

- ★taught in English
- Career development courses for School of Life Science and Technology
- career development courses for School of Life Science and Technology / School of Computing

	Code	Course Title	Credit	Quarter	Academic unit
			Credic	Quarter	or major
	CSC T421	★Human Computer Interaction	2	10	Computer
	00011121		-	-2	Science
	MCS T404	Logical Foundations of Computing	2	10	Mathematical and
	1103.1404		2	IQ	Computing Science
	ADT T546	+ Design Theory in Biological Systems	2	20	Artificial
For Life	AR1.1340		2	2Q	Intelligence
For Life Science Students For Computer Science Students		Multimedia Information Processing	2	20	Artificial
	AR1.1347	Multimedia Information Processing		2Q	Intelligence
	MCC T402	★ Statistical Learning Theory		20	Mathematical and
	MC5.1405		2	ŷ	Computing Science
	MCS.T407	★High Performance Computing	2	3 Q	Mathematical and
			2		Computing Science
		Information Organization and Potrioval	2	4.0	Artificial
	AK1.1404				Intelligence
		+Organic and Biographic Chemistry	2	10	Life Science and
	L31.A402			IQ	Technology
			2	20	Life Science and
	LS1.A404	4 ★Cell Physiology	2	2Q	Technology
	LST.A405	05 ★Design of Bioactive Molecules	2	2Q	Life Science and
					Technology
		+ Piemelocular Engineering	2	20	Life Science and
	L51.A411	★Biomolecular Engineering		ZQ	Technology
			2	40	Life Science and
	L31.A410	Auvanceu Neuroscience		4Q	Technology

b-1) Advanced Courses for Life Science or Computer Science Students

© Compulsory

 \star taught in English

- Career development courses for School of Life Science and Technology
- career development courses for School of Life Science and Technology / School of Computing

b-2) Advanced Courses for Both Students

CodeCode in the Code intermCode in the Code intermCode in the Code intermCode in the Code intermOr majorART.T541*Intelligent Systems21Q11 <th></th> <th>Codo</th> <th>Course Title</th> <th>Crodit</th> <th>Quarter</th> <th>Academic unit</th>		Codo	Course Title	Crodit	Quarter	Academic unit
ART.T541 *Intelligent Systems 2 1Q Artificial Intelligence ART.T543 *Bioinformatics 2 1Q Artificial Intelligence ART.T543 *Bioinformatics 2 1Q Artificial Intelligence ART.T543 *Bioinformatics 2 1~2Q Artificial Intelligence ART.T543 *Molecular Simulation 2 2Q 1~2Q Artificial Intelligence ART.T541 Carcer Development Seminars 2 1~2Q Incelligence and Technology and Science and Biomedical Innovation Image: Carcer and Biomedical Innovation Human Center and Technology and Innovation TIM.C515 Biomedical Technology and Social Systems II 1 3Q Technology and Innovation TIM.C514 Biomedical Technology and Social Systems II 1 4Q Technology and Innovation TIM.C515 Biomedical Technology and Social Systems II 1 4Q Technology and Innovation TIM.C514 Topics 1 in Computational Life Sciences (ACLS) 1 1 4Q ACL.A631 Topics 3 in Computational Life Sciences for Doctoral Students 1 1~2Q		Code	Course rice	Credit	Quarter	or major
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		ACL.A634	for Doctoral Students			ACLS

1) for students admitted in AY2015 or before. 2) for students admitted in AY2016 or later

 ${\small \bigcirc \, Compulsory}$

★taught in English

 $\Diamond \mathsf{career}$ development courses for School of Life Science and Technology

♦ career development courses for School of Life Science and Technology ∕ School of Computing

c) Science and Technology Communication Courses

Code	Course Title	Credit	Quarter	Academic unit or major
ZBA.A403	 Compulsory in Master's Degree Program> 	2	1~2Q	Life Science
ZBA.A404	 Compulsory in Master's Degree Program> 	2	3~4Q	Life Science
ZBA.A405	 ♥ ★Global Communication on Computational Life Sciences A (ACLS) <compulsory degree="" in="" master's="" program=""></compulsory> 	2	$1 \sim 2 Q$	Life Science
ZBA.A406	 ♥ ★Global Communication on Computational Life Sciences B (ACLS) <compulsory degree="" in="" master's="" program=""></compulsory> 	2	$3 \sim 4 Q$	Life Science
ZBA.A501	Global Writing on Computational Life Sciences (ACLS)		1~20	Life Science
ACL.A603	\star Global Writing on Computational Life Sciences for Doctoral Students	2	1 2 2	ACLS
ZBA.A502	★Global Debate on Computational Life Sciences (ACLS)	2	3~40	Life Science
ACL.A604	\star Global Debate on Computational Life Sciences for Doctoral Students		5 40	ACLS

%Global Communication A and Global Communication B are identical in content. Global Presentation A and Global Presentation B are identical in content. Students are required to take either A or B.

d) Internship Courses

Code	Course Title	Credit	Quarter	Academic unit or major
LST.C505	Short-term Internship on Computational Life Sciences Compulsory in Master's Degree Program>	1	1Q 2Q 3Q 4Q	Life Science and Technology
ACL.C401 ³⁾	◆International Internship on Computational Life Sciences for Master's students	4	$\frac{1 \sim 2 Q}{3 \sim 4 Q}$	ACLS
ACL.C601	◎ ◆International Internship on Computational Life Sciences for Doctoral Students	4	$\frac{1 \sim 2 Q}{3 \sim 4 Q}$	ACLS

3) The credits of ACL.C401 can be recognized as the credits of ACL.C601.

© Compulsory

★taught in English

- $\Diamond \mathsf{career}$ development courses for School of Life Science and Technology
- ♦ career development courses for School of Life Science and Technology / School of Computing

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6	16:50-18:20									Biomedical Technolo Social System Tamachi CIC 91 Sengoku	
7 8	15:05-16:35			<u>Molecular Biology II</u> H101 Kimura, Ito, et al.					<u>Molecular Biology II</u> H101 Kimura, Ito, et al.		
5	13:20-14:50				 ★Global Presentation on Computational Life Sciences B 1233 Meldrum 						
б С	10:45-12:15		★High Performance Computing H119A Matsuoka, Endo					★High Performance Computing H119A Matsuoka, Endo			
1 2	9:00-10:30	★Statistical Learning Theory G511 Watanabe, Kabashima			 ◆ Global Presentation on Computational Life Sciences B H115 Meldrum 		★Statistical Learning Theory G511 Watanabe, Kabashima				
		For Life Science Students	For Life Science Students	For Computer Science Students	nd Technology cation Courses		For Life Science Students	For Life Science Students	For Computer Science Students	For Both Students	
		Advanced Courses	Advanced Courses	Fundamental Courses	Science a Communi		Advanced Courses	Advanced Courses	Fundamental Courses	Advanced Courses	
		Mon		Tue	1	Wed	Thu	Fri	1	Sat	

2017 3Q (22 September - 28 November)

			1 2	3 4	5 6	7 8	9 10
			9:00-10:30	10:45-12:15	13:20-14:50	15:05-16:35	16:50-18:20
Mon	Advanced	For Life Science Students			<u>Information Organization</u> and Retrieval W611 Fujii, Tokunaga		
	courses	For Computer Science Students	★Advanced Neuroscience J221, W831 Ichinose, Suzuki, et al.				
	Fundamental Courses	For Computer Science Students			Bioinformatics (LST) H101 Ito, Kurokawa, et al.	<u>Biochemistry II</u> H101 Komada, Wachi, et al.	
Tue	Science a Communi	and Technology ication Courses					
Wed							
Thu	Advanced	For Life Science Students			<u>Information Organization</u> and Retrieval W611 Fujii, Tokunaga		
		For Computer Science Students	★Advanced Neuroscience J221, W831 Ichinose, Suzuki, et al.				
Fri	Fundamental Courses	For Computer Science Students			Bioinformatics (LST) H101 Ito, Kurokawa, et al.	<u>Biochemistry II</u> H101 Komada, Wachi, et al.	
Sat	Advanced Courses	For Both Students					Biomedical Technology and Social System II Tamachi CIC 913 Sengoku
							★taught in English

2017 4Q (29 November - 10 February)

AY 2017 3-4Q (22 September, 2017 - 10 February, 2018) Intensive Courses Schedule

	Ito, et al.
	Choose 2 themes from below
	①Theme E: 8/28-9/1
Fundamental	Seio, Yano
Courses	@Theme F: 9/15, 9/19-9/22
	Nakamura, Kamachi, Ito
	③Theme B : <wet①>10/12, 10/13</wet①>
	<wet2>10/18, 10/19</wet2>
	<dry>TBA</dry>
	Iwasaki, Ito, Yamada, Kurokawa
	@Theme D : 12/18-12/22
	Akiyama, Konishi, Matsuzaki

	Introduction to Business Plan (ACLS) ♦Introduction to Business Plan for Doctoral Students	 ★Introduction to Bioethics (ACLS) ★ ◆Introduction to Bioethics for Doctoral Students 	Topics 2 in Computational Life Sciences (ACLS) Topics 2 in Computational Life Sciences for Doctoral Students
	Tokunaga, Uchikoga	Tokunaga, et al.	Konagaya, Yamamura
	1-4J232、Main Bldg., B04 ⑤⑦J232	 ①J3-405, Main Bldg., B04 ②J233, Main Bldg., B04 ③J233, W8E-1003L 	
	10/20(Fri) 13:20-14:50	①11/16(Thu) 13:20-16:35	Kaoru Mogushi,
	Daisuke Katagiri,	Mutsuaki Suzuki,	Juntendo University
	Amine Pharma Reseach Institute	National Institute of Genetics	
	Co., Ltd.	@12/14(Thu) 13:20-16:35	Schedule: TBA
	210/20(Fri) 15:05-16:35	31/11(Thu) 13:20-16:35	
	Takafumi Yamamoto,	Masui Tohru,	
	TODAI TLO, Ltd.	Keio University	
	(3)10/27(Fri) 13:20-14:50		
	Shoko Takahashi		
Advancod	Generalest Inc		
Courses	@10/27(Fri) 15:05-16:35		
courses	Kazumasa Ohta		
	Hamagin Research Institute 1td		
	©11/17(Fri) 15:05-16:35		
	©11/17(Fri) 15:05-16:35		
	@12/ 8(Fri) 15:05-16:35		
	Nava CPA Office		
	Kazumaca Ohta		
	Hamagin Research Institute 1td		
	Hamagin Research Institute, Etc.		
	Topics 4 in Computational Life Sciences (ACLS) Topics 4 in Computational Life Sciences for Doctoral Students	Directed Collaboration Works	
	Ito	Kajiwara, Mihara	
	Schedule. TBA	Schedule. TDA	
Science and		★Global Debate on Computational	
Technology	© ★Global Communication B on	Life Sciences	
Communication	Computational Life Sciences	★ Global Debate on Computational Life	
Courses	Vamagushi at al	Sciences for Doctoral Students	
<u> </u>	failiaguciii, et al.	fanlagueni, et al.	1
		◆International Internship on	○ ♦ International Internship on
Internship	© ⇔Snort-term Internship on	Computational Life Sciences	Computational Life Sciences
Courses	Computational Life Sciences	for Master's Students	for Doctoral Students
	Kajiwara	Kajiwara	Kajiwara

Note: This brochure is focused on providing overall information on ACLS curriculums.

For registration, students are suggested to refer to "Graduate school program list of syllabus " issued by the university.



Ver. 2017.10.17