

Graduate School of Agricultural and Life Sciences / Faculty of Agriculture

The University of Tokyo
2015 - 2016



Academic Affairs Division
Graduate School of Agricultural and Life Sciences / Faculty of Agriculture
1-1-1, Yayoi, Bunkyo-ku, Tokyo 113-8657
Email : ryugaku@ofc.a.u-tokyo.ac.jp
<http://www.a.u-tokyo.ac.jp/english/index.html>

Art Director: Masami Furuta (opportune design inc.)
Designer: Yuka Uchida (opportune design inc.)
Photographer: Hiroyuki Shima (Cover, P07) <https://hiroyukishima.squarespace.com/>

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**Overview of
the Graduate School / Faculty**

Message from the Dean

Takeshi Tange, Ph.D.

Dean of the Graduate School of Agricultural and Life Sciences and Faculty of Agriculture



Our lives are dependent on organic matter produced by plants through photosynthesis. Agricultural science has developed as an academic discipline not only to meet the demands for bio-resources by growing human population, but also to support the sustainability in bio-resource production. Underpinned by growth in agricultural science, primary industry mainly focuses on growing organisms in natural environments. It is therefore necessary to understand the ecological and biological properties of rearing organisms as well as the natural mechanisms governing the growth and biomass production. As agricultural science also necessitates the alteration and use of vast tracts of land, research on advancing engineering technology, social systems, and economic systems becomes necessary. Agricultural science is thus an integrated science linking a wide range of academic disciplines, from life sciences to biological resource science, environmental science, engineering, economics, and social sciences.

Climate change including global warming is clearly visible on a global scale with abnormal weather more frequent in recent years, causing greater risk to human life and assets. Severity of the climate change impacts on primary industry dependent on the natural environment is expected to increase in the future. The world population is predicted to be 1.5 times larger than now, exceeding 10 billion by the end of this century. In this scenario, securing a stable supply of safe food and environmental preservation are two greatest challenges faced by humankind. Thus the role to be played by agricultural science in developing technological and social solutions for dealing with these challenges becomes increasingly important. Agricultural science is expected to elucidate various biological processes and bring benefits to human society in the future.

In April 2015, The University of Tokyo began comprehensive reforms of undergraduate education based on three

pillars of 1) internationalization aimed at improving study abroad prospects and diversifying academic opportunities, 2) substantiation aimed at promoting proactive learning and securing qualitative and quantitative study improvements, and 3) sophistication aimed at specialized education facilitating innovation and high-level liberal arts education over four years. Along with changes to the educational system, including introduction of recommendation-based entrance examinations and the shift to a four-quarter academic year, we are also making changes to our educational content, such as improving the first-year curriculum. The Graduate School of Agricultural and Life Sciences provides new students with opportunities for hands-on learning through a network connecting classrooms and field sites such as forests, rice paddies, fields, and pastures managed by affiliated facilities. The Faculty of Agriculture structures courses and specialized programs so that students learn agricultural science systematically step-by-step, with the goal of developing a solid foundation as well as broadening their perspectives in the chosen specialization.

In our educational reforms, we are working towards creating in-depth understanding in specialized areas as well as enriching our multidisciplinary educational program that facilitates engagement with diverse disciplinary fields that make up agricultural science. One such program is the AGRI-COCOON project (the Agricultural Research Incubator Community for Cooperative Network of Public, Administrative, Business, and Academic Sectors), which conducts field-based, solutions-driven educational programs for undergraduate and graduate students. This is done in cooperation with private companies, public agencies, and NPOs on specific issues such as food safety, biomass utilization, and the effects of radiation on agriculture. The Graduate School cultivates a high degree of specialization incorporating leading-edge research conducted in the Graduate School of Agricultural and Life Sciences. In addition, it provides opportunities to learn advanced research methods relating to issues of interest to agricultural science, including the agricultural bioinformatics educational program to utilize genomes and other bioinformatics in agricultural research.

The faculty members of the Graduate School of Agricultural and Life Sciences are making concerted efforts to develop agricultural science as an integrated discipline as well as nurture outstanding professionals in the field. We intend to publicize our research activities through public seminars organized by the Faculty of Agriculture and research conferences on the effects of radiation on agricultural, marine, and other products.

On behalf of the faculty, I extend my appreciation for your understanding and support to the educational and research activities of the Graduate School of Agricultural and Life Sciences.

Chronology

- 1874 The Agricultural Training School established.
- 1877 The Agricultural Training School renamed as Agricultural School.
- 1878 University Farm established.
- 1880 Veterinary Hospital established.
- 1882 The Agricultural School renamed as The Komaba School of Agriculture.
- 1886 The Tokyo School of Agriculture and Forestry established.
- 1890 The Tokyo School of Agriculture and Forestry became The College of Agriculture of The Imperial University consisting of three Departments: Agriculture, Forestry, and Veterinary Science.
- 1893 Department of Agricultural Chemistry added.
- 1894 The University of Tokyo Chiba Forest opened.
- 1897 The College of Agriculture of The Imperial University renamed as The College of Agriculture of The Tokyo Imperial University.
- 1909 Botanical Research Nursery established.
- 1910 Department of Fisheries established in The College of Agriculture.
- 1919 The College of Agriculture renamed as The Faculty of Agriculture of The Imperial University of Tokyo.
- 1925 Department of Agricultural Economics and Agricultural Civil Engineering added.
- 1935 Faculty moved from Komaba-cho, Meguro-ku, to its present location at 1-chome, Yayoi, Bunkyo-ku, Tokyo.
- 1936 Fisheries Research Station established.
- 1946 Part of Department of Agriculture merged with Department of Veterinary Science to form Department of Zootechnics.
- 1947 The Faculty of Agriculture of The Imperial University of Tokyo renamed as The Faculty of Agriculture of The University of Tokyo.
- 1948 Department of Agricultural Civil Engineering renamed Department of Agricultural Engineering.
- 1949 Animal Resource Science Center established.
- 1950 Department of Veterinary Science became independent from Department of Zootechnics. Experimental Station for Landscape Plants established.
- 1955 Radioisotope (RI) Center established.
- 1956 Department of Forest Products became independent from Department of Forestry.
- 1957 Biotron facility setup.
- 1964 Department of Agriculture renamed Department of Agrobiolgy. Department of Veterinary Science and Zootechnics reunited to form Department of Veterinary Medicine and Animal Sciences.
- 1965 Agricultural Library established. Research Facility for Radiation Breeding opened.
- 1984 Biotechnology Research Facilities established.
- 1987 Course in Biotechnology introduced.
- 1988 Department of Veterinary Medical Science reorganized.
- 1991 Course in Animal Resource Sciences introduced.
- 1993 Biotechnology Research Center established.
- 1993 Special Doctoral Course in Agricultural Development introduced.
- 1994 Graduate School of Agriculture renamed as Graduate School of Agricultural and Life Sciences.
- 1995 Asian Natural Environmental Science Center established.
- 1997 Department of Global Agricultural Sciences established.

- 1998 Endowed Chair in Food-induced Bio-Signaling (Meiji Milk Products Co.) established (1998–2008).
- 2000 The 125th founding anniversary celebrated. Construction of Yayoi Auditorium completed. Department of Ecosystem Studies established.
- 2001 Agricultural Library renamed as University Library for Agricultural and Life Sciences.
- 2002 Ebara-Donated Research Unit on Biomass Refinery established.
- 2003 ILSI JAPAN-Endowed Chair of Functional Food Science and Nutrigenomics established (2003–2013).
Office for International Cooperation and Exchange (OICE) established.
- 2004 All National Universities, including The University of Tokyo, transformed into National University Corporations.
Koishikawa Arboretum opened (former Botanical Research Nursery).
Agricultural Bioinformatics Research Unit established.
- 2005 AGRI-COCOON (Agricultural Research Incubator Community for Cooperative Network of Public, Administrative, Business, and Academic Sectors) established.
- 2006 Endowed Chair in Clinical Plant Science (Ikeda Scientific Co.) established (2006–2011).
Technology Advancement Center and Research Center for Food Safety established.
- 2007 Veterinary Hospital renamed as Veterinary Medical Center.
Endowed Chair in Governance-oriented Civil Engineering for Sustainable National Land Management (Maeda Co. and Kumagai Gumi Co.) established (2007–2009).
Endowed Chair in Taste Science (Nissin Food Products Co.) established (2007–2017).
Special Doctoral Course in Agricultural Development renamed as Special Course for Advancement of Agricultural and Life Sciences.
- 2008 Ninomiya branch of University Farm closed down. Construction of Yayoi Auditorium Annex completed.
- 2009 University Library for Agricultural Life Sciences reopened after renovation.
- 2010 Institute for Sustainable Agro-ecosystem Services established.
Construction of Food Science Building completed. International Program in Agricultural Development Studies (IPADS) introduced.
- 2011 Ecohydrology Research Institute and Forest Therapy Research Institute established.
Experimental Station for Landscape Plants closed down.
Endowed Chair in Microbial Metabolic Potential (Institute for Fermentation, Osaka [IFO]) established.
The University of Tokyo Forests Executive Office and Education and Research Center established.
The University of Tokyo Tanashi Forest opened.
- 2013 Technical Staff Division established.
- 2015 Endowed Chair in Food and Physiological Models (FORDAYS Co.) established (2015–2020).
Special Course for Advancement of Agricultural and Life Sciences renamed as Special Course for Sustainable Agriculture



The mark on the back cover is the motif design of the “Nou-Seimon”. This gate, “Nou-Seimon”, was originally built in 1937 for the Faculty of Agriculture to commemorate its transfer in 1935 from the University’s Komaba Campus to the site of the former First High School. The present gate was reconstructed with Hinoki cypress in 2003.

Number of Personnel in Various Categories

Number of Personnel in Various Categories

Dean	1	Lecturers (full-time)	13	Professors	90	Administrative Personnel	85
Vice Dean	4	Assistant Professors	82	Associate Professors	86	Technical Staff	91

Faculty Staff

(As of April 1, 2015)

	Professor	Associate Professor	Lecturer	Assistant Professor	Administrative Personnel	Technical Staff	Total
Graduate School (Faculty)	84	79	8	66	63		300
Institute for Sustainable Agro-ecosystem Services	2	2		4	4	13	25
University Forests	3	4	5	11	13	56	92
Animal Resource Science Center					2	8	10
Veterinary Medical Center	1				2		3
Fisheries Laboratory		1		1	1	3	6
Technology Advancement Center						11	11
Total	90	86	13	82	85	91	447

Center Staff

(As of April 1, 2015)

	Professor	Associate Professor	Lecturer	Assistant Professor	Total
Biotechnology Research Center	3	3		4	10
Asian Natural Environmental Science Center	4	4		1	9
Total	7	7		5	19

Required Units and Years for Degree

(As of April 1, 2015)

	Units	Years
Bachelor Degree	154 or 160*	4
Bachelor Degree of Veterinary Medical Sciences	228.5 or 234.5*	6
Master's Degree	30	2
Doctoral Degree	20	3
Doctoral Degree of Veterinary Medical Sciences	32	4

*Depends on the course of the Junior Division students are admitted.

Enrollment of Students

Undergraduates (International students in parentheses)

(As of May 1, 2015)

	3 rd Year	4 th Year	5 th Year	6 th Year	Research Students	Total
Applied Life Sciences	137 (0)	155 (1)			4 (0)	296 (1)
Environmental Resource Sciences	114 (2)	120 (0)			1 (1)	235 (3)
Veterinary Medical Sciences	29 (1)	31 (0)	31 (0)	34 (0)	0 (0)	125 (1)
Total	280 (3)	306 (1)	31 (0)	34 (0)	5 (1)	656 (5)

Graduates (International students in parentheses)

(As of May 1, 2015)

	Master's Program	Doctoral Program	Research Students	Total
Agricultural and Environmental Biology	67 (1)	25 (13)	2 (1)	94 (15)
Applied Biological Chemistry	120 (7)	50 (18)	2 (2)	172 (27)
Biotechnology	81 (6)	58 (19)	7 (7)	146 (32)
Forest Science	33 (5)	29 (13)	3 (1)	65 (19)
Aquatic Bioscience	63 (8)	54 (15)	1 (1)	118 (24)
Agricultural and Resource Economics	17 (1)	15 (6)	1 (0)	33 (7)
Biological and Environmental Engineering	22 (4)	18 (6)	0 (0)	40 (10)
Biomaterial Sciences	45 (5)	33 (3)	0 (0)	78 (8)
Global Agricultural Sciences	78 (20)	47 (17)	9 (5)	134 (42)
Ecosystem Studies	34 (1)	14 (3)	0 (0)	48 (4)
Animal Resource Sciences	35 (2)	20 (4)	1 (0)	56 (6)
Veterinary Medical Sciences		57 (10)	4 (3)	61 (13)
Total	595 (60)	420 (127)	30 (20)	1045 (207)

Enrollment of International Students

(As of May 1, 2015)

		FY 2011			FY 2012			FY 2013			FY 2014			FY 2015		
		26 countries			28 countries			25 countries			25 countries			27 countries		
Country/region		National funds	Personal funds	Total												
Asia	Pakistan	1		1	1		1		1	1		1	1		1	1
	India				1		1	2	1	3	2	1	3	3	2	5
	Nepal	2	1	3	2	1	3	2		2	2		2	2	1	3
	Bangladesh	4	2	6	4	1	5	4	1	5	2	2	4	1	2	3
	Sri Lanka	2		2	3		3	5	2	7	5	4	9	4	5	9
	Myanmar	5		5	5		5	3		3	2	1	3	1	2	3
	Thailand	12	10	22	9	11	20	9	9	18	4	4	8	7	2	9
	Malaysia	2		2	3	1	4	3	2	5	4	4	8	4	3	7
	Indonesia	6	5	11	6	7	13	6	5	11	4	6	10	4	3	7
	Philippines	3	2	5	2	3	5	4	4	8	5	4	9	7	3	10
	South Korea	12	29	41	8	23	31	7	16	23	4	15	19	3	11	14
	Mongolia	2		2	3		3	1	1	2	1	1	2	1	1	2
	Vietnam	6	3	9	3	3	6	3	5	8	2	5	7	3	6	9
	China	30	73	103	26	79	105	23	78	101	19	77	96	15	77	92
	Laos				1		1	1		1	1		1			
Cambodia		1	1													
Taiwan		23	23		19	19		19	19		14	14		16	16	
	Subtotal	87	149	236	77	148	225	73	144	217	57	139	196	55	135	190
Middle East	Iran		1	1		1	1									
	Lebanon	1		1	1		1									
	Afghanistan											1	1		1	1
		Subtotal	1	1	2	1	1	2				1	1		1	1
Africa	Tunisia	1		1												
	Ethiopia	1		1	1		1									
	Zimbabwe				1		1	1		1	1		1	2		2
	Madagascar										1		1	1		1
	Botswana												1	1		1
	Egypt												1	1		1
		Subtotal	2		2	2		2	1		1	2		2	5	
Oceania	Australia		1	1		1	1								1	1
		Subtotal	1	1		1	1								1	1
North America	USA							1	1			1	1			
		Subtotal						1	1			1	1			
Central/South America	Brazil	3		3	1		1	1		1						
	Argentina	1		1	1		1									
	Bolivia							1	1							
	Peru					1	1	1	1							
	Ecuador	1		1	1		1	1		1		1	1		1	1
	Columbia										1	1	2	1	1	2
		Subtotal	5		5	3	1	4	3	1	4	2	1	3	2	1
Europe	Denmark		1	1		1	1		1	1						
	Germany	1		1	1		1	2		2	2		2	1		1
	Spain							1		1	1		1	1		1
	Portugal	1		1	1		1								1	1
	Bulgaria										1		1	1		1
		Subtotal	2	1	3	2	1	3	3	1	4	4		4	3	1
	TOTAL	97	152	249	85	152	237	80	147	227	65	142	207	65	139	204

Undergraduate Courses

Courses	Major
Applied Life Sciences	Biological Chemistry and Biotechnology
	Applied Biology
	Forest Life Science
	Aquatic Life Science
	Animal Life Sciences
	Biobased Materials Chemistry
Environmental Resource Sciences	Landscape Ecology and Planning
	Forest Environmental and Resource Science
	Wood Science and Timber Engineering
	Biological and Environmental Engineering
	Agricultural and Resource Economics
	Field Science
	International Sustainable Agriculture Development
Veterinary Medical Sciences	Veterinary Medical Sciences

For 3rd and 4th year (3rd–6th year in case of Veterinary Medical Sciences) undergraduate courses.

Graduate Courses

Departments	Courses	Departments	Courses
Agricultural and Environmental Biology	Bioresource Development	Biomaterial Sciences	Structural Biomaterials Science
	Applied Agrobiology		Material and Housing Sciences
	Basic Agrobiology		Biomass Chemistry
	Asian Biological Resources		Sustainable Materials Design
	Field Production Science		Global Animal Production Sciences
	Associated Courses		Global Plant Production Sciences
Applied Biological Chemistry	Biofunctional Chemistry	Global Agricultural Sciences	Global Biological and Environmental Sciences
	Agricultural Chemistry		International Development and Agro-Environmental Sciences
	Food Science		Biological Conservation
	Associated Courses		Ecosystem Management
Biotechnology	Biomolecular Research	Ecosystem Studies	Bioresources Management
	Biofunctional Research		Bioresources and Eco-Environmental Studies
	Molecular and Cellular Biosciences		Bio-regulatory Systems
	Biotechnology Research	Animal Resource Sciences	Functional Bioscience
	Associated Courses		Bio-animal Science
Forest Science	Forest Life and Environmental Science	Veterinary Medical Sciences	Basic Veterinary Medicine
	Forest Resources and Environmental Science		Clinical Veterinary Medicine
	Asian Environmental Science		Bio-animal Science
	Forest Ecosystem Science and Management		Food Safety and Science
Aquatic Bioscience	Aquatic Molecular Biology and Biotechnology		Experimental Medicine
	Aquatic Production and Environmental Science		
	Aquatic Life Science		
	Applied Marine Biology		
	Marine Bioscience		
	Coastal Marine Environment Assessment		
Agricultural and Resource Economics	Agricultural Structure and Farm Business Management		
	Development Policies and Economics		
	Rural Development Finance		
	Pan-Asia		
	Sustainable Agro-ecosystem Economics		
Biological and Environmental Engineering	Rural Environment Engineering		
	Biological Systems Engineering		
	Biological and Environmental Information Engineering		
	Radio Environmental Technology		
	Ecological Safety Studies		



1. Study trip FY 2014: Odawara Castle, Kanagawa Prefecture
 2. Yayoi International Day FY 2014
 3. Study trip FY 2014: Tomioka Silk Mill, Gunma Prefecture

Overseas Research Visits by Faculty Members

Overseas trips by faculty of the Graduate School of Agricultural and Life Sciences for the purpose of research exchanges spans numerous countries and diverse locations. Travel expenses are borne by the Ministry of Education, Culture, Sports, Science and Technology and other government-related institutions 21.5%, Grants-in-Aid for Scientific Research 38.9%, other funds from Japan 33.3%, foreign governments and research institutes 4.7%, and personal research funds 1.6% of the faculty.

Number of overseas research visits by faculty members (by how expenses are borne)

Classification	FY 2012	FY 2013	FY 2014
1. Ministry of Education, Culture, Sports, Science and Technology project		3	4
2. Grants-in-Aid for Scientific Research <KAKENHI>	156	207	167
3. Overseas assignment from other government body			
(1) Japan Society for the Promotion of Science	21	13	11
(2) Japan International Cooperation Agency	7	7	8
(3) Other	57	67	69
4. Other funds from Japan	126	114	143
5. Foreign government, research institute, or similar	27	74	20
6. Personal funds	17	7	7
Total	411	492	429

Number of overseas research visits by faculty members (by region)

Region	FY 2012	FY 2013	FY 2014
North America	70	80	74
Central/South America	6	25	24
Europe	104	117	65
Africa	16	8	10
Middle East	1	14	9
China	30	47	44
South Korea	37	41	27
Other countries-regions of Asia	137	150	178
Oceania	10	10	15
Total	411	492	446

Hosting International Researchers

The Graduate School of Agricultural and Life Sciences actively conducts academic exchanges with overseas researchers, including hosting of foreign researchers, with 177 researchers received by the Department in FY 2014. Researchers from Asia account for nearly 70% of all exchanges. The Graduate School receives researchers from around the world based on agreements with departments. Many others from overseas also visit the Graduate School for purposes such as observational tours.

Number of foreign researchers and other persons received (by how expenses are borne)

Classification	FY 2012	FY 2013	FY 2014
1. Ministry of Education, Culture, Sports, Science and Technology project	0	2	5
2. Grants-in-Aid for Scientific Research <KAKENHI>	17	37	44
3. Overseas government body			
(1) Japan Society for the Promotion of Science	47	27	27
(2) Japan International Cooperation Agency (foreign contract researcher, etc.)	0	0	0
(3) Other	1	12	18
4. Other funds from Japan	99	27	27
5. Foreign government, research institute, or similar	9	0	29
6. Personal funds	31	37	48
Total	204	142	198

Number of foreign researchers and other persons received (by region)

Region	FY 2012	FY 2013	FY 2014
North America	25	13	26
Central/South America	0	1	2
Europe	16	9	36
Middle East	1	6	3
China	60	28	42
South Korea	19	21	15
Other countries-regions of Asia	74	55	66
Oceania	6	3	4
Africa	3	6	4
Total	204	142	198

International Academic Exchange Agreements

(As of May 1, 2015)

Countries and Regions	Universities/Institutes	Started on
Bangladesh	University of Chittagong	Aug. 7, 2010
Cambodia	Cambodian Agricultural Research and Development Institute	Jul. 6, 2009
China	Beijing Forestry University	Feb. 25, 1984
	Northeast Forestry University	Dec. 23, 1996
	China Agricultural University	Sep. 17, 1997
	Nanjing Forestry University	Mar. 9, 2002
	Institute of Soil Science, Chinese Academy of Sciences	Jan. 5, 2007
	Nanjing Agricultural University	Mar. 21, 2007
	Sichuan Agricultural University	Mar. 29, 2007
	Tianjin Agricultural University	Aug. 9, 2010
	Northeast Agricultural University	Aug. 25, 2010
	Nankai University*	Dec. 6, 2010
	Southwest University	Jan. 8, 2014
	College of Resources and Environment, University of Chinese Academy of Sciences	May. 30, 2014
	School of Geographical Science, Northeast Normal University	May. 31, 2015
India	Tamil Nadu Agricultural University	May. 27, 2013
Indonesia	Bogor Agricultural University	Oct. 21, 1988
	Gadjah Mada University*	Nov. 22, 2010
	Padjadjaran University*	Mar. 4, 2002
	Mulawarman University	Jan. 27, 2006
	Lampung University (Faculty of Agriculture)	Apr. 16, 2014
Malaysia	Sabah University of Malaysia (School of International Tropical Forestry)	Oct. 18, 2012
Mongolia	Mongolian State University of Agriculture	Oct. 13, 2003
Laos	National University of Laos, Planning and International Cooperation Office	Jul. 21, 2015
South Korea	Seoul National University (College of Agriculture and Life Sciences)	Sep. 9, 2006
	Pukyong National University (College of Fisheries Sciences)	Jan. 24, 2007
	Pukyong National University (College of Environmental and Marine Science and Technology)	Jan. 24, 2007
	Kangwon National University (College of Forest & Environmental Sciences)	Jan. 31, 2013
	Konkuk University (College of Veterinary Medicine)	Apr. 28, 2015
Sri Lanka	University of Ruhuna	Jun. 7, 2011

Countries and Regions	Universities/Institutes	Started on
Taiwan	National Taiwan Ocean University	Apr. 27, 2006
	National Chung Hsing University (College of Veterinary Medicine)	Mar. 26, 2008
	Taipei Medical University (College of Public Health and Nutrition)	Jan. 28, 2013
Thailand	Kasetsart University (Faculty of Veterinary Medicine, Faculty of Agriculture and Faculty of Forestry)	Jun. 8, 1998
	Khon Kaen University (Faculty of Agriculture)	Feb. 3, 2009
	Agricultural Research Development Agency	Jul. 12, 2011
Vietnam	Hanoi University of Agriculture	Dec. 25, 1995
	Can Tho University	Jul. 19, 2010
Argentina	National University of La Plata	Dec. 6, 1990
Colombia	International Center for Tropical Agriculture (CIAT)	Feb. 19, 2010
New Zealand	Massey University	Feb. 8, 2006
Finland	Aalto University	Aug. 18, 2010
France	AgroParisTech	Jan. 30, 1996
	IBEB, French Alternative Energies and Atomic Energy Commission	Sep. 7, 2010
	Life Sciences Division, French Alternative Energies and Atomic Energy Commission	Dec. 16, 2014
Germany	Karlsruhe Institute of Technology	Dec. 25, 2010
Poland	University of Agriculture in Krakow	Dec. 5, 2012
	University of Warmia and Mazury in Olsztyn	July. 2, 2013
Sweden	Swedish University of Agricultural Sciences	Aug. 23, 2004
	KTH Royal Institute of Technology*	Nov. 30, 2010
UK	The University of Edinburgh (The Royal (Dick) School of Veterinary Studies)	Mar. 9, 2009
Turkey	Ege University (Faculty of Medicine)	Jul. 24, 2014

*University-wide Agreement

Departments

Department of Agricultural and Environmental Biology

The Department of Agricultural and Environmental Biology deals with field crops, vegetables, fruit trees, flowers, insects, silkworm, and plant pathogenic microorganisms, and has made numerous contributions to the sciences related to plant production and environmental conservation. The Department studies issues to create comfortable human environments in the closed ecosystem of the Earth, such as 1) higher crop productivity and quality, and genetic crop improvements, 2) control of plant diseases and insect damage, 3) development of sustainable production systems, 4) development of analytical methods to handle the increasing complexity and volume of biological information, and 5) development of technologies to improve the environment by utilizing plants and insects.

▶ <http://www.ab.a.u-tokyo.ac.jp/aeb/index-e.html>

Bioresource Development

- ▶ Plant Breeding and Genetics
Genetic and molecular studies on the regulatory mechanisms of important crop traits
- ▶ Insect Genetics and Bioscience
Genetics, genomics, developmental biology, virology, and molecular pathology of the silkworm and insects

Applied Agrobiology

- ▶ Crop Science
Carbon and nitrogen metabolism in relation to yield performance of various crop species
Mechanisms of environmental stress tolerance in crop plants
- ▶ Horticultural Science
Physiological and genetic studies on improving the quality of horticultural products

- ▶ Applied Entomology
Physiological, ecological, and genetic studies on reproduction, dormancy, and speciation in insects

Basic Agrobiology

- ▶ Plant Ecology and Morphology
Ecological and morphogenetic basis for improving productivity and sustainability of plant production systems
- ▶ Plant Pathology
Molecular and biological studies to understand the pathogenicity mechanisms of plant pathogens and host plant resistance
- ▶ Plant Molecular Genetics
Structure, function, and evolution of genomes in higher plants
- ▶ Biometrics and Statistical Genetics
Biometric studies on DNA polymorphism, inheritance of quantitative traits, population genetic structure, and plant morphology



Experimental materials include crops, insects, microorganisms, and organelles



Molecular biology experiment room



Department greenhouses

Nippon Gene and Vegetalia-Endowed Chair

- ▶ Clinical Plant Science
Development of technologies to diagnose and control plant diseases toward establishment of a plant clinic network

Asian Biological Resources*¹

- ▶ RNA Virology and Resistance Mechanisms
Replication, transmission, and pathogenesis of RNA viruses and resistance mechanisms
- ▶ Environmental Stress Tolerance Mechanisms
Tolerance mechanisms of plants to environmental stresses and development of stress-tolerant plants

- ▶ Regional Resource Reassessment
Sustainable land use and agricultural production under fragile regional conditions

Field Production Science*²

- ▶ Advanced Environmental and Plant Sciences*
Studies on sustainable crop production systems achieving high productivity and quality with low environmental impact

*1 Cooperative course. The laboratories and their staff belong to the Asian Natural Environmental Science Center.

*2 Cooperative course. The laboratory and its staff belong to the Institute for Sustainable Agro-ecosystem Services.

Department of Applied Biological Chemistry

The Department of Applied Biological Chemistry carries out studies and education across a wide range of research fields related to biological chemistry. In addition to the basic research methodology of biological chemistry, which consists of biochemistry, organic chemistry, and cellular biochemistry, the Department is actively introducing new research methodologies and techniques such as genetic engineering, protein engineering, and cellular engineering. By applying these research methodologies and techniques to plant and animal research fields related to food production, the cellular functions of food-producing organisms, and food immunology, the Department seeks to discover new bioactive compounds and mechanisms supporting the environmental coexistence of human beings and living organisms, with the ultimate aims of advancing biological chemistry research methodology and the enhanced coexistence of human beings and all living things. The Department's efforts are part of a world network that is developing techniques in bioproduction and biological chemistry.

▶ <http://www.xyz.a.u-tokyo.ac.jp/english/xyz/>

Biofunctional Chemistry

- ▶ Plant Molecular Physiology
Molecular and cellular biology of plant response and tolerance to environmental stresses
- ▶ Biological Function and Developmental Chemistry
Molecular cell biology, neurology of taste signaling, and biochemistry of food proteins

Agricultural Chemistry

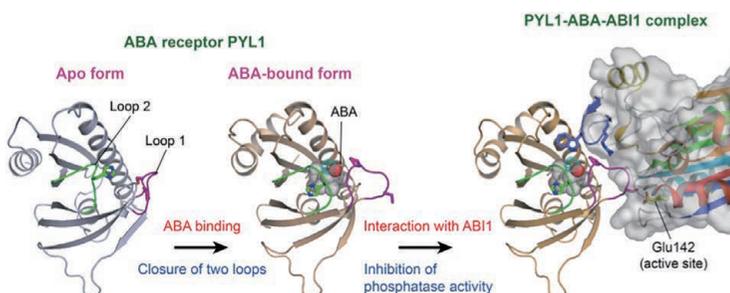
- ▶ Plant Nutrition and Fertilizer
Plant nutrient transport, metabolism, responses to nutritional conditions, and nutrient stress-tolerance
- ▶ Biological Chemistry
Chemistry, molecular biology, and neuroscience of chemosensory signals and receptors in mammals, insects, plants, and microorganisms
- ▶ Organic Chemistry
Organic synthesis of bioactive natural products and

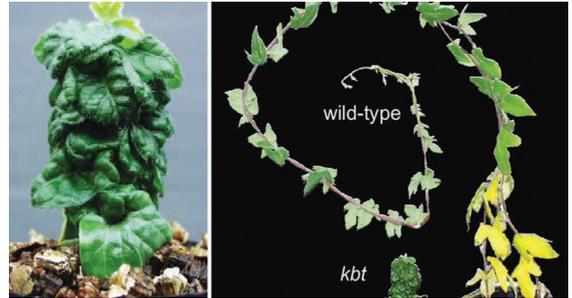
their derivatives to elucidate bioactive functions and their practical application

Development of new reactions realizing efficient synthesis of optically active substances

- ▶ Bioorganic Chemistry
Chemistry, biochemistry, and molecular biology of bioactive compounds such as invertebrate peptide hormones, microbial secondary metabolites, and compounds regulating biomineralization
- ▶ Soil Science
Soil microbiology for sustainable agriculture and environmental conservation
- ▶ Chemical Biology
Chemistry, physiology, and molecular biology for plant growth regulation
- ▶ Food Science
Nutritional Biochemistry
Nutrient regulation of gene expression
Differentiation of mammalian cells

A structural view of the positive regulatory mechanism of abscisic acid (ABA) signaling. ABA receptor PYL1 interacts with type 2C protein phosphatase ABI1 using two loops closed by ABA binding. In the resulting (PYL1-ABA-ABI1) complex, loop 1 of PYL1 seals the active site of ABI1 to inhibit its phosphatase activity, which confers tolerance to environmental stresses such as drought and high salinity in plants.





Morphology of the kobito (*kbt*) mutant of morning glory
 The *kbt* mutant has a defect in the biosynthesis of brassinosteroids, a class of plant hormones, and shows conspicuous dwarf phenotype, demonstrating the importance of this hormone function. (left) Two-month old *kbt*. (right) Seven-week-old *kbt* and wild-type plants.

- ▶ Food Chemistry
 Chemical, biochemical, and molecular biological studies on intestinal function-modulating food substances
- ▶ Food Biochemistry
 Molecular and cellular biological studies on lifestyle-related diseases
 Search for food factors that prevent lifestyle-related diseases
- ▶ Analytical Chemistry
 Bioinorganic chemistry of biological and environmental systems
 Structural Biology and Food Biotechnology
 Biotechnology, structural biology, and physicochemistry of proteins, enzymes, and foods

ILSI Japan Endowed Chair

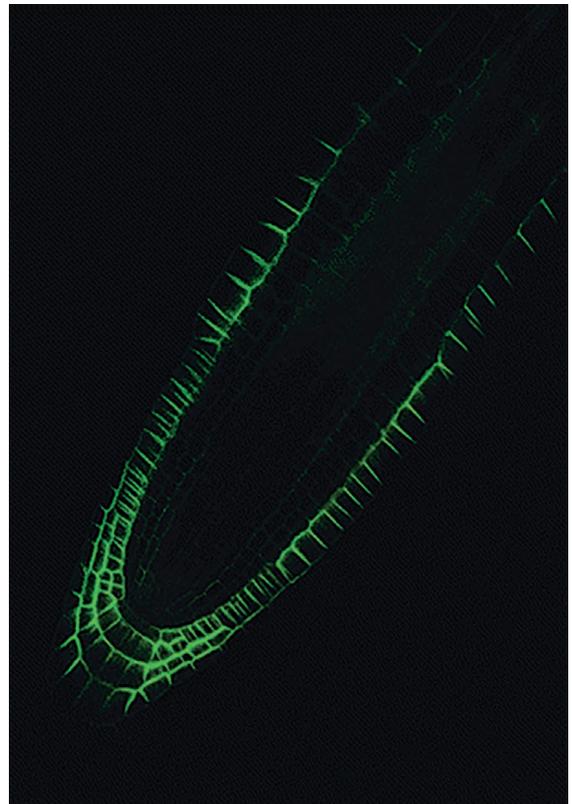
- ▶ Functional Food Science and Nutrigenomics
 Functional genomics to investigate food-induced physiological responses

Nissin Food Products Endowed Chair

- ▶ Taste Science
 Investigation of the molecular logic of sensory events for application in food quality design

Nestlé Endowed Chair

- ▶ Food for Life
 Molecular nutrition and functional genomics to improve quality of life



A confocal microscope image of *Arabidopsis* root expressing GFP-tagged BOR1 borate transporter carrying mutation at Lys-590 (K590A). The mutant BOR1-GFP localizes in the plasma membrane and shows inward (stele-facing) polarity similar to the wild type, although high boron-induced endocytic degradation of BOR1 is completely blocked by this mutation.

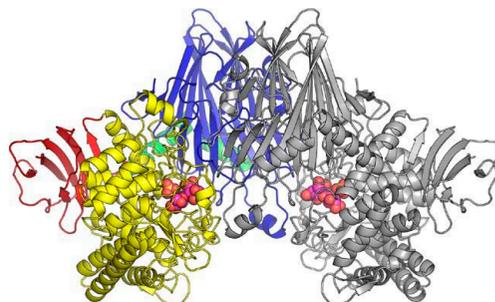
Department of Biotechnology

The Department of Biotechnology maintains high educational and research standards across wide-ranging areas of biotechnology. Employing DNA technology, protein engineering, and cell/tissue culturing techniques in combination with recent advances in biomolecular structure determination, genomic information, and bioinformatics, the Department elucidates the basic mechanisms of a variety of biological functions. Furthermore, the Department is applying these findings to contribute to the prosperity and well-being of human beings.

▶ <http://www.bt.a.u-tokyo.ac.jp/english/introduction/>

Biomolecular Research

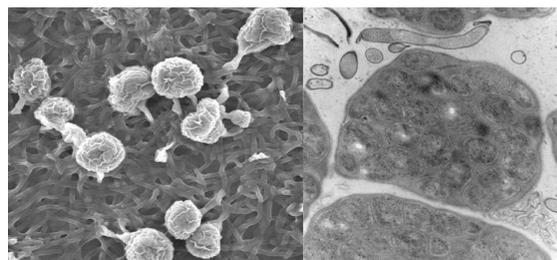
- ▶ Molecular and Cellular Breeding
Analysis and improvement of beneficial genes in microorganisms
- ▶ Bioinformation Engineering
Computational biology, computational chemistry, and bioinformatics
- ▶ Molecular Biotechnology
Structure, function, and localization of biological molecules



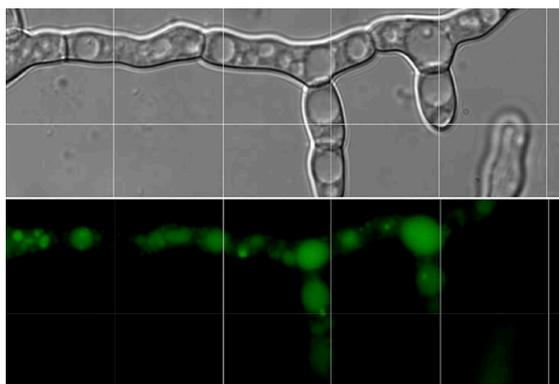
Crystal structure of cellobionic acid phosphorylase, which plays a key role in biofuel production

Biofunctional Research

- ▶ Fermentation and Microbiology
Genetic and protein engineering, bioactive substances
- ▶ Applied Microbiology
Application of diverse microbiological metabolisms
- ▶ Enzymology
Structure–function relationship of enzymes and proteins
- ▶ Microbiology
Protein secretion in bacteria and fungi, and neural network information
- ▶ Cellular Genetics
Regulation of macromolecular biosynthesis in microorganisms



Scanning and transmission electron microscopic images of actinomycete *Actinoplanes missouriensis* sporangia



Microscopic images of vacuoles in *Aspergillus oryzae*, the “Japanese National Microorganism,” visualized by differential interference contrast and green fluorescence protein

Cooperative Course

- ▶ Environmental Biochemistry *1
- ▶ Cell Biotechnology *1
- ▶ Plant Functional Biotechnology *1
- ▶ Microbial Metabolomics (Endowed course)*1
- ▶ Microbial Metabolic Potential (Endowed course)
- ▶ Membrane proteins *2
- ▶ Genome Structure and Function*2

*1 The laboratory and its staff belong to the Biotechnology Research Center.

*2 The laboratory and its staff belong to the Institute of Molecular and Cellular Biosciences.

Department of Forest Science

Our comfortable life is dependent on advanced science and technology and creates large environmental load. Environmental problems on a global scale, such as extreme weather and extinction of species, have become apparent. Degradation of the environment is a serious problem for human beings. Forests are the biggest terrestrial ecosystems on earth, accounting for about 80% of plant production. They play a major role in hydrological and carbon cycles on a global scale and help conserve the global environment. Extensive human activity leading to deforestation and forest degradation is a cause of deterioration of the global environment. Moreover, forests bring various benefits such as wood resources, pure water, and a comfortable environment, and the use of forests is indispensable to our life. Forest science is a discipline that helps us to sustainably enjoy the benefits of forests by harmonizing forest ecosystems with human activities.

▶ <http://www.fr.a.u-tokyo.ac.jp/english.html>

Forest Life and Environmental Science

- ▶ Forest Botany
 - Ecology and physiology of trees
 - Symbiology and pathology in forests
- ▶ Forest Zoology
 - Ecological studies of animals in forest ecosystems
 - Studies on management of animal populations in forests
- ▶ Silviculture
 - Biology for forestation
 - Physiology and ecology of forest trees
 - Pedology and edaphology in forests

Forest Resources

and Environmental Science

- ▶ Forest Management
 - Research on integrated management and utilization of forest areas
 - Research on forest inventory and monitoring techniques using remotely sensed data
- ▶ Forest Policy
 - Studies on policies to manage and utilize forests
 - Social scientific studies on relationship between human beings and forests



Practical student exercise in a mountain village

- ▶ Forest Utilization
 - Planning and design of forest-road networks
 - Forestry mechanization and operational efficiency
- ▶ Forest Hydrology and Erosion Control Engineering
 - Hydrological research on the relationship between forests and the environment
 - Soil conservation, landslide and mud flow, and disaster-prevention science
- ▶ Forest Landscape Planning and Design
 - Planning methods for conservation and creation of living environments
 - Planning, design, and management of forest landscape



An 80-m-tall canopy crane with a 75-m-long rotating jib in a tropical rainforest, Sarawak, Malaysia

***Asian Environmental Science* *1**

- ▶ Regional Resources Planning
 - Evaluation of regional resources for nature conservation planning
 - Methodological studies on sustainable tourism
- ▶ Tree Physiology and Tropical Silviculture
 - Tolerance mechanism of trees to environmental stress
 - Development of reforestation methods for deteriorated lands in the Asian tropics
- ▶ Forest Molecular Ecology
 - Population genetics and reproduction ecology of forest tree species
 - Ecology and physiology of ectomycorrhizal fungi



Collecting botanical specimens in a practical course

***Forest Ecosystem Science and Management* *2**

- ▶ Forest Ecosystem
 - Conservation of biodiversity and ecosystem functioning
 - Forest pest and wildlife management
- ▶ Forest Functional Biology
 - Utilization of biological functions and metabolites of woody plants
 - Responses of woody plants against biotic and abiotic stress
- ▶ Forest and Human Society Relationships
 - Monitoring and management of forest information
- ▶ Forest and Water Resources Management
 - Long-term monitoring of hydrological cycle with forest restoration
 - Sustainable management of forest resources and ecosystem services

*1 Cooperative course. The laboratories and their staff belong to the Asian Natural Environmental Science Center.

*2 Cooperative course. The laboratories and their staff belong to the University of Tokyo Forests.

Department of Aquatic Bioscience

The Department of Aquatic Bioscience has the following major aims: 1) find ways to preserve aquatic ecosystems given the global scale of environmental havoc wreaked by humankind, 2) develop self-sustaining fisheries, and 3) investigate ways to contribute to human well-being including food production using knowledge and expertise from other research fields such as biotechnology. The Department's laboratories, including the Fisheries Laboratory on Lake Hamanako and those in the Atmosphere and Ocean Research Institute, are tackling these problems and have achieved many encouraging results. However, the ocean, which has spawned and nurtured life since the Earth's formation, is vast and as yet only partially understood. There is a real need to once again observe biological phenomena in the ocean from a fresh viewpoint and with an open mind.

▶ <http://www.a.u-tokyo.ac.jp/english/departments/D-AB.html>



School of sardines

Aquatic Molecular Biology and Biotechnology

- ▶ Aquatic Molecular Biology and Biotechnology
 - Development and function of aquatic animal muscles
 - Molecular response to environmental stress
 - Protein engineering

Aquatic Production and Environmental Science

- ▶ Fisheries Biology
 - Management of coastal fish stocks and ecosystems
 - Ecology and life-history studies of fish
 - Fish Disease Research
 - Pathology of infectious diseases of fish and shellfish
 - Biology and ecology of pathogens
 - Host defense mechanisms
- ▶ Aquatic Biology and Environmental Science
 - Ecology of marine organisms and related environmental changes

Aquatic Life Science

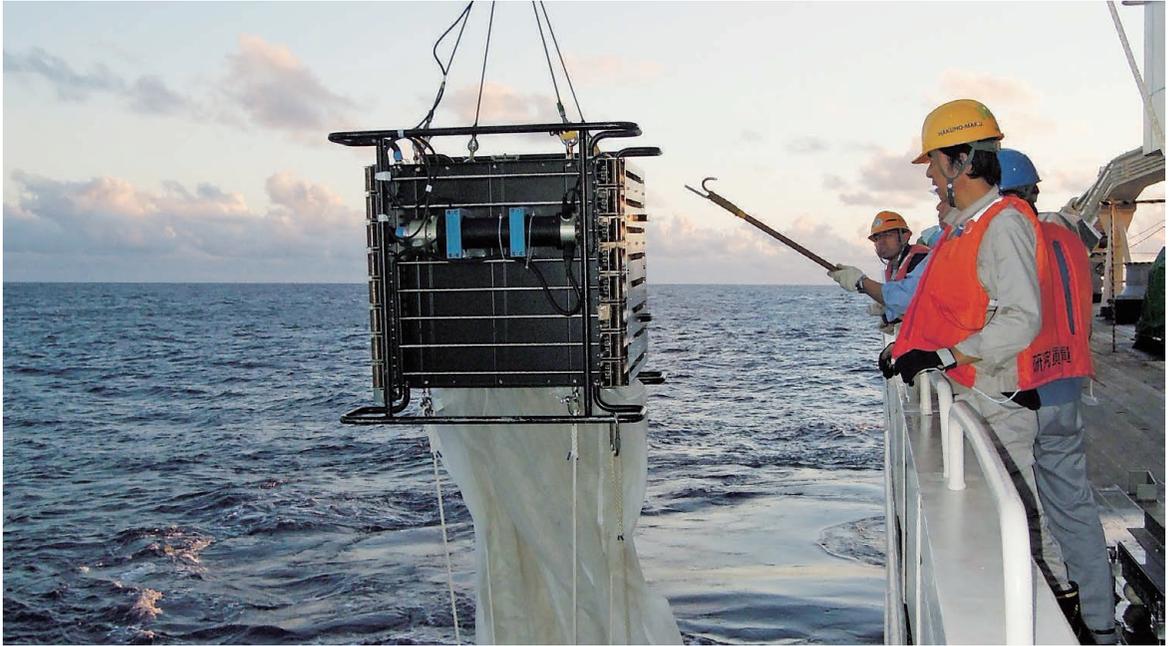
- ▶ Aquatic Animal Physiology
 - Mechanisms of reproduction and environmental adaptation in aquatic animals
- ▶ Aquatic Natural Products Chemistry
 - Search for biologically active substances from marine invertebrates
 - Characterization of biosynthetic pathways of natural aquatic products
- ▶ Marine Biochemistry
 - Functional diversity of metabolic pathways in aquatic organisms

Applied Marine Biology*1

- ▶ Applied Marine Biology
 - Molecular genetics, immunology, and comparative genomics
 - Structure and function of coastal ecosystems



Kuruma prawn



Plankton sampling

Asian Natural Environmental Science Center^{*2}

- ▶ Coastal Marine Environment Assessment
Taxonomy, phylogeny, and distribution of harmful marine microalgae

Marine Bioscience^{*3}

- ▶ Marine Planktology
Phylogeny, life history, and production ecology of plankton and micronekton
The marine food web and interactions between shallow and deep-sea ecosystems
- ▶ Marine Microbiology
Ecology, phylogeny, and physiology of marine bacteria
Bacterial contribution to microbial loop and material cycles
- ▶ Fish Population Dynamics
Assessment of exploited fish stocks, establishment of practical fishery management systems, and conservation of marine organisms

- ▶ Biology of Fisheries Resources
Ecology and physiology of living marine resources and underlying mechanisms of their reproductive fluctuations
- ▶ Fisheries Environmental Oceanography
Studies on coastal and open ocean environments for living resources and related physical oceanography
- ▶ Behavior, Ecology and Observation Systems
Physio-ecological mechanisms, development of behavior, and evolutionary aspects of fish migration
Ecology and development of measuring systems for remote sensing and GIS, sampling gear and methods, and seagrass and seaweed ecology
- ▶ International Coastal Research Center
Basic marine sciences including marine ecology, marine pollution, marine biology, physiology, taxonomy, and physical oceanography

^{*1} Cooperative course. The laboratory and its staff belong to the Fisheries Laboratory.

^{*2} Cooperative course. The laboratory and its staff belong to the Asian Natural Environmental Science Center.

^{*3} Cooperative course. The laboratory and its staff belong to the Atmosphere and Ocean Research Institute

Department of Agricultural and Resource Economics

How can we meet the global need for foodstuffs and agricultural materials under the growing constraints of natural resources and the environment as well as imperfect food distribution, such as coexistence of hunger and satiation? This challenging issue should be addressed in consideration of fundamental socio-economic elements, e.g., unsustainable development and resource depletion, enlargement of poverty and social inequality, and economic and institutional conflicts among developed and developing countries.

Our department embodies the following two key principles of graduate education and academic research for the new age of agricultural and resource economics.

(1) Global perspective: Our research concerns have become broader and more internationalized beyond traditional agricultural economics to include intergenerational resource conservation, multifunctionality of agriculture, the global food system, harmonization of international trade systems, and rural development and communities, while encompassing new disciplines of other applied economics such as development economics, environmental economics, and institutional economics.

(2) Local perspective: We pay attention to the reality of rural communities and individuals. Our fieldwork approach, through which we have accumulated academic knowledge and established research networks, is one effective method to achieve our aim of comparing Japanese and overseas agricultural economies.

We continue to offer intensive seminars and classes for graduate students, which deepen their professional insight and enhance their communication abilities. In addition, we intend to strengthen intellectual collaboration with other natural science disciplines. One of the keys to solving the aforementioned complex problems is technological progress owing to developments in bioscience and information technology. As a department of Graduate School of Agricultural and Life Sciences, we have an excellent opportunity and favorable position from which to engage in academic dialogue and scientific discussion for the future.

▶ <http://www.a.u-tokyo.ac.jp/english/departments/D-ARE.html>



The food supply is the basis of our lives. (Photo: wikipedia)



Economic theories and field researches are essential in our department



We seek consistency between efficient agricultural production and favorable rural environments

Agricultural Structure and Farm Business Management

- ▶ Farm Business Management and Rural Development
 - Management and analysis of farm business
 - Management for regional and environmental resources
- ▶ Agricultural Structure and Policy
 - Comparative studies on agricultural structure
 - Agricultural policy
- ▶ Agricultural History
 - Comparative studies on agricultural development
 - History of agricultural sciences

Development Policies and Economics

- ▶ Agricultural and Development Economics
 - Political economy of agriculture
 - Development economics
 - Agricultural trade
- ▶ Food and Resource Economics
 - Food system economics
 - Resource and environmental economics

Rural Development Finance

- ▶ Rural Development Finance
 - Risk and agriculture
 - Agricultural productivity and technology adoption
 - Agricultural market development
 - Rural organization

Pan-Asia*

- ▶ Economic Development in Asia
 - Economic development in Asia
 - Social and cultural changes in Asia

* Cooperative course. The laboratory and its staff belong to the Institute for Advanced Studies on Asia.

Department of Biological and Environmental Engineering

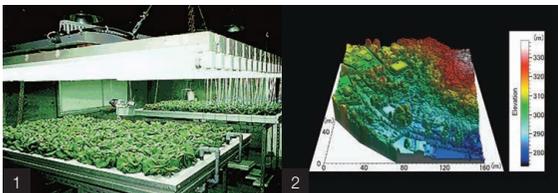
The Department of Biological and Environmental Engineering (BEE) deals with the creation and preparation of favorable environments in rural areas and production control of living things. Technologies in this field are essential for appropriate management of natural and biological resources sustaining human beings on the Earth. The Department consists of the six branches of Rural Environmental Engineering (REE), Biological Systems Engineering (BSE), Biological and Environmental Information Engineering (BEIE), Ecological Safety Studies (ESS), Sustainable Agro-ecosystem Engineering (SAE), and Radio Environmental Technology (RET). REE seeks advances in modern technologies associated with the engineering of land foundations, water resources, soil conditions, plants, and air resources. It aims to encourage efficient food production and to conserve the Earth's environment, especially in rural areas, by harmonizing production with natural ecological systems. BSE aims to develop advanced techniques and research in bioengineering, biological process control, controlled environment plant production, biosensing and robotics, bioenergy production, and post-harvest technology by making greater use of biological functions. BEIE applies the latest information technology to contribute to the harmonious coexistence of living organisms and the environment as well as optimized food production. It also encompasses the effects of changes in the conditions of both the geosphere and food materials. ESS is an associated branch of the Department of BEE in the National Institute for Agro-Environmental Sciences (NIAES), which is located in the science hub of Tsukuba City. NIAES is the leading institute on environmental sciences in agriculture. ESS conducts interdisciplinary studies on atmosphere and soil environments, the material cycle in agro-ecosystems, and ecological statistics as the basis for such studies. SAE cooperative course is in the Institute for Sustainable Agro-ecosystem Services (ISAS) at the Nishitokyo Campus. SAE conducts research on sustainable and effective use of ecosystem services. RET cooperative course is in the Radioisotope (RI) Center. RET conducts research on agricultural rehabilitation in areas polluted by radioactive materials.

► <http://www.a.u-tokyo.ac.jp/english/departments/D-BEE.html>

Rural Environmental Engineering

- Land Environmental Engineering
 - Nitrogen circulation in watershed areas with agricultural activity
 - Monitoring and analysis of flood mitigation function of paddy fields and upland fields
 - Water and material circulation in the soil-plant-atmosphere continuum
 - Soil conservation in arid regions through control of salt accumulation
- Water Environment Engineering
 - Development and application of hydraulic and hydrological

- models for large-scale irrigation systems to improve water management
- Quantitative valuation and demand-oriented provision of irrigation service
- Control of greenhouse gas emissions from paddy fields through on-farm water management
- Survey and analysis of water resources and environmental problems in Asian monsoon regions
- Soil Physics and Soil Hydrology
 - Unsaturated water and solute transport in soils
 - Migration and remediation of metals in soils
 - Carbon dynamics in soil and transport phenomena
 - Climate change and soil physical conditions
 - Erosion and conservation of low-pH soils
 - Colloid and fine-bubble-facilitated transport of chemicals in soils



1. Lettuce production under artificial lighting
2. 3D image of forest measured by helicopter-borne scanning LiDAR

Biological Systems Engineering

- Bioenvironmental Engineering
 - Analyses of plant responses to light, gas, and water environments
 - Control and analysis of plant environments in greenhouses and plant factories

Development of advanced plant production technologies and experimental devices for plant-response research
Advanced technology utilization for plant production and plant-response research
Ecophysiology and biotechnology in advanced greenhouse horticulture

- ▶ Biological and Mechanical Engineering
High-speed autonomous vehicles for forage production
Three-dimensional measurement in identification of plants
Vehicle control using omnidirectional machine vision
Energy production from marine biomass through hybrid treatment
System analysis of bioenergy production and utilization
- ▶ Bioprocess Engineering
Storage of foods and agricultural products by application of both gas-hydrate formation and freezing
Non-destructive and real-time monitoring for food safety and quality
Evaluation of the dynamic properties of micro-/nano-bubble water for application in biosystems
Prediction of dynamic change in agricultural product quality
Studies on accumulation of functional compounds in fruits and vegetables during storage

Biological and Environmental Information Engineering

- ▶ Biological and Environmental Information Engineering
Remote sensing of biosphere functioning
Analysis and modeling of ecosystems
Analysis of impacts of global environmental changes on ecosystems
Image instrumentation for biomonitoring
Information engineering for biological and environmental systems

Ecological Safety Studies

- ▶ Ecological Safety Studies
Detailed mechanisms of trace-gas dynamic exchange
Environmental biophysics
Microbial interaction in soil ecosystems
Behavior of carbon and phosphorous in soils and ecosystems
Biodiversity and material flow in Japanese ecosystems
Theoretical and empirical study of methods for phylogenetic estimation from DNA and amino-acid sequence data
Geometric morphometrics of biological shapes and statistical analysis of shape variation

Cooperative Courses

- ▶ Sustainable Agro-ecosystem Engineering
Development of a fully controlled crop production system based on energy-efficient technologies
Physiological and genetic evaluation of climate change effects on horticultural crop production
Development of safe and comfortable farm work systems
Survey of agricultural technology history (management of agricultural museum)
Optimization of pre- and post-harvest food chain technologies, and QOL improvements for seniors through fusion of medicine, agriculture, and food
- ▶ Radio Environmental Technology
Analysis of agricultural rehabilitation in areas polluted by radioactive materials
Movement explication of radioactive materials in plants and soil
Heterogeneity of radiocesium and stable cesium within the same field
Monitoring inspection for radiocesium in agricultural, livestock, forest, and fishery products in Fukushima Prefecture

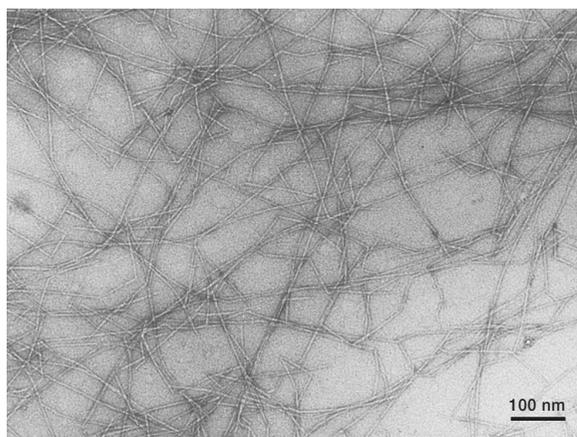


Tone Oozeki barrage for irrigation and municipal water supply

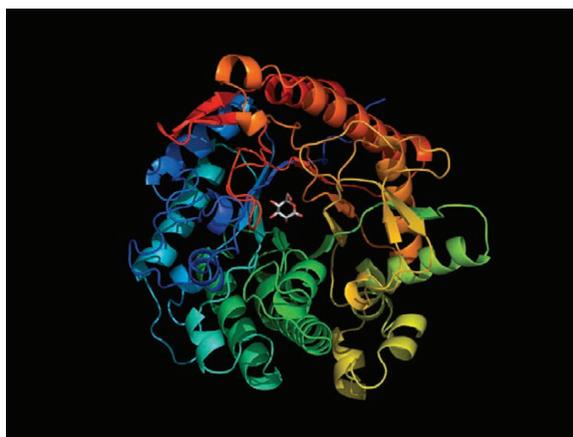
Department of Biomaterial Sciences

We consume various kinds of raw materials to better our quality of life. As many of these materials are currently produced from fossil resources, the environmental impact of their excessive consumption is cause for concern. Development and introduction of biomaterials more in harmony with the environment is therefore desirable to facilitate replacement of fossil resources. Wood, the most important biomaterial, is both renewable and clean. Promoting its beneficial utilization will help to preserve the environment and is essential for the continued existence of human beings far into the future. To constructively promote biomaterial utilization, we must strive for efficient and complete wood usage and the application of knowledge and research methods based on material sciences to biomaterials other than wood. The Department is advancing science and technology toward this goal.

▶ <http://www.fp.a.u-tokyo.ac.jp/graduate/english/>



Cellulose nanofibers prepared by TEMPO-mediated oxidation



Three-dimensional structure of beta-glucosidase

Structural Biomaterials Science

- ▶ Structural Biomaterials Science
 - Ultra-structure and physicochemical properties of cellulose and chitin
 - Correlation between structure and biogenetic mechanisms of polysaccharides
 - Development of nanomaterials from polysaccharides

Material and Housing Sciences

- ▶ Wood Physics
 - Physical and mechanical properties of structural biomaterials
 - Properties of wood for musical instruments
 - Timber drying and wood-water relationships
 - Evaluation of wooden dwelling environments for human comfort
 - Analysis of strength decreases in wood from biodegra-

ation

Properties of wood for exterior uses

- ▶ Wood-based Materials and Timber Engineering
 - Development of new wood-based materials and processing
 - Development of high-strength wooden joints for heavy timber construction
 - Evaluation of structural performance of timber construction
 - Environmental impact of wooden housing and recycling of wood resources
- ▶ Cellulose, Pulp, and Paper Science
 - Preparation of new bio-based nanomaterials from cellulose and chitin through environmentally friendly processes including TEMPO-mediated oxidation
 - Efficient surface modification of TEMPO-oxidized cellulose nanofibrils for application in high-tech fields
 - Self-assembly behavior of bio-nanofibers and their structural characterization in nanocomposite materials



Uroko Dome for the May Festival using a new construction system with wood-based materials

Biomass Chemistry

- ▶ Forest Chemistry
 - Total genome and transcriptome analysis of wood decay fungi
 - Functional and structural analysis of enzymes related to biomass conversion
 - Biotechnology for production of fuel and chemical feedstock from cellulosic biomass
 - Biochemical and genetic analysis of plant cell-wall components and secondary metabolites
- ▶ Wood Chemistry
 - Chemical structure, reactivity, and function of plant cell-wall components
 - Pollution-free pulping, bleaching, and biorefinery technology
 - Biomass utilization by chemical modification of lignin and carbohydrates
- ▶ Science of Polymeric Materials
 - Chemical and microbial syntheses of new bio-based

polymers

- Development of biodegradable polymeric materials
- Structure and properties of fibers, films, and nanocomposites
- Improvement of adhesives and adhesive performance

Asian Natural

Environmental Science Center*

- ▶ Sustainable Material Design
 - Design of high-performance wood-based materials and timber engineering
 - Wood biomass flow and life cycle analysis of wood biomass products
 - Influence of habitat environment on tree growth and material quality

*Cooperative course. The laboratories and their staff belong to Asian Natural Environmental Science Center.

Department of Global Agricultural Sciences

The Department of Global Agricultural Sciences (GAS) is committed to serving the global society with education and research on sustainable ecosystem services such as foods, fibers, and other bioresources. GAS programs are issue-oriented rather than technology-oriented and are based on a strong combination of expertise across disciplinary and national boundaries. The associated programs offered by professors from institutions outside the university give further breadth to GAS education and research.

Students are advised to join overseas training courses organized by GAS in collaboration with universities and institutes in the country. Students in the Master's program are also encouraged to minor in another department to strengthen their expertise in the pertinent discipline. Students will thus become well prepared to navigate the globalizing and ever-changing world.

Global Animal Production Sciences

- ▶ Global Fishery Science
 - Biological studies for sustainable fisheries and aquaculture
 - Economics and social aspects of community-based fisheries
 - Consumer markets, value chains, and international trade in fishery products
- ▶ Global Animal Resource Science
 - The study of human–animal relations
 - Virus-based recombinant vaccines for animal diseases
 - Molecular pathology of malaria and leishmaniasis
 - Host immunity to protozoan parasites
 - Development of edible vaccines and other mucosal vaccines

Global Plant Production Sciences

- ▶ Plant Science for Sustainable Agriculture
 - Impact of atmospheric changes on agriculture and ecosystems
 - Adaptation of agriculture to changes in climate
 - Root-system development of cereal plants
 - Soil conservation in cereal fields



Field survey observing land conversion from crop field to fruit orchard in Java, Indonesia



Rice plants grown in a free-air ozone exposure facility (FACE) in eastern China. Surface ozone concentration is rising sharply, which could cause significant crop losses across Asia in the near future

- ▶ Global Plant Material Science
 - Techniques for utilization of unused biologically active plant resources
 - Functions of plant components in ecosystems
 - Development of techniques for material performance evaluations of lesser-utilized biomass resources
 - Development of techniques for effective utilization of biomass resources as wood-based building materials and components

Global Biological and Environmental Sciences

- ▶ Global Forest Environmental Studies
 - Policy options for collaborative forest governance based on field realities and CPR management theory

International comparative analysis on participatory forest-management policy

Forest monitoring using satellite remote sensing

Development of forest environment assessment methods by remote sensing and GIS

► Plant Biotechnology

Cellular and molecular analysis of iron-acquisition mechanism in plants

Studies on transporters in plants

Analysis of stress response and molecular genetic breeding of stress-tolerant plants

Genetic improvement of plants for production of valuable chemical substances

► International Agricultural Development Studies

Water and nitrogen use efficiency for tropical rice cultivation in South America

Modeling studies for optimizing growing conditions of upland NERICA in Africa

Genetic studies on the use of organic nitrogen in rice for higher nitrogen use efficiency

Development of decision support system for optimum fertilization of winter wheat in Japan

Adoption studies on the cultivation of medicinal plants for poverty alleviation in tribal areas of West India

International Development and Agro-Environmental Sciences

► International Environmental Economics

Effects of global warming on world agriculture and forestry

System modeling to interpret global food supply and demand

Economic development and environmental problems in developing countries

Historical studies on global climate change, agriculture, and population growth

► International Agro-Informatics

Development of biodiesel fuel (BDF) production

Monitoring system for agricultural and soil information using IT technology

Engineering developments in soil and water conservation

Optimized project scheme and evaluation methods in international development and cooperation

Optimal distribution model for fresh produce in rural Java, Indonesia

Beneficial technology for agricultural and socio-economic development

Conservation and rehabilitation of land and soil in tropical and arid conditions



Local children collecting fish from a fixed net installed in shallow water, Thailand

Department of Ecosystem Studies

The Department of Ecosystem Studies aims to develop sustainable global management schemes that value ecosystem mechanisms and allow human society and nature to exist in harmony. An important feature of the Department is a focus on fieldwork, which is conducted in different ecosystems from forests to coastal environments. Based on an understanding of the mechanisms and existing problems of focal ecosystems, the Department aims to both integrate agricultural and life-science-related academic achievements and develop related principles and techniques while educating skilled professionals. The Department has two main divisions, Biological Conservation and Ecosystem Management, and the two associated divisions of Bioresources Management and Bioresources and Eco-Environmental Studies. The Bioresources Management associated division cooperates with the former two divisions in research and education and is composed of six facilities within the Graduate School of Agricultural and Life Sciences.

▶ <http://www.es.a.u-tokyo.ac.jp/english/>

Biological Conservation

- ▶ Biodiversity Science
 - Studies on various aspects of biological diversity, from both pure and applied views
 - 1) Mechanisms maintaining biodiversity
 - 2) Conservation and management of biodiversity
- ▶ Conservation Ecology
 - Studies for the conservation and restoration of natural environments
 - Studies on molecular mechanisms of phytoremediation
 - Studies on genetic engineering of crops to enhance environmental stress tolerance

Ecosystem Management

- ▶ Landscape Ecology and Planning
 - Landscape ecological studies on global and regional environments, monitoring of natural environmental changes caused by human impact, and ecological land evaluation and its application in landscape and environmental planning
- ▶ Forest Ecosystem Studies
 - Genetic and ecological studies for the conservation of forests and surrounding ecosystems
 - Planning sustainable use of forest resources
 - Analysis and conservation of tree diversity, forest species interactions, population dynamics of animals and plants,



Satoyama, a traditional rural landscape of Japan



Participatory monitoring project for invasive bumblebee in Hokkaido



Sika deer in a forest on the Boso peninsula

- and endangered species conservation
- ▶ Aquatic Conservation
 - Effects of environmental changes in coastal habitats on fishes and invertebrates
 - Assessing restored and natural intertidal flats in a damaged embayed system
 - Production mechanisms in coastal ecosystems based on stable isotope analyses
 - Life cycles of coastal fishes and invertebrates
 - Development of strategies for coastal ecosystem conservation

Bioresources Management

- ▶ Agricultural Field Ecology
- ▶ Ecological Environmental Studies
- ▶ Aquatic Bioscience

The University of Tokyo Forests

- ▶ Forest Ecosystem
- ▶ Forest Functional Biology
- ▶ Forest and Human Society Relationship
- ▶ Forest and Water Resources Management

Bioresources and Eco-Environmental Studies

- ▶ Bioresources and Eco-Environmental Studies
- ▶ Rural Landscape Ecology

Department of Animal Resource Sciences

The primary aim of research and education at the Department of Animal Resource Sciences is to maximize the utility of various functions of animals, mainly mammals, by revealing mechanisms underlying diverse and complex life phenomena. To this end, the Department is working to elucidate life phenomena from a variety of perspectives, ranging from molecular biology to ethology. It also aims to improve the productive capability of animals and seeks effective ways to preserve valuable genetic resources by applying state-of-the-art biotechnologies that enable elicitation of the potentiality of animals and animal cells. At the same time, the Department has always placed high priority on fostering the potential of its students. Graduates from the Department occupy important positions not only in the field of animal resource sciences but also other fields including medical and pharmacological sciences.

▶ http://www.ar.a.u-tokyo.ac.jp/pages/English/E_top.html

Bio-regulatory Systems

▶ Molecular Immunology

Studies on molecular mechanisms of immunity against protozoan infection

Development of diagnostic, therapeutic, and prophylactic technologies for protozoan diseases

Epidemiological studies on visceral leishmaniasis in the Old World

▶ Applied Genetics

Reverse-genetic analyses of mechanisms in mammali-

an oocyte growth, oocyte maturation, fertilization, and early embryo development

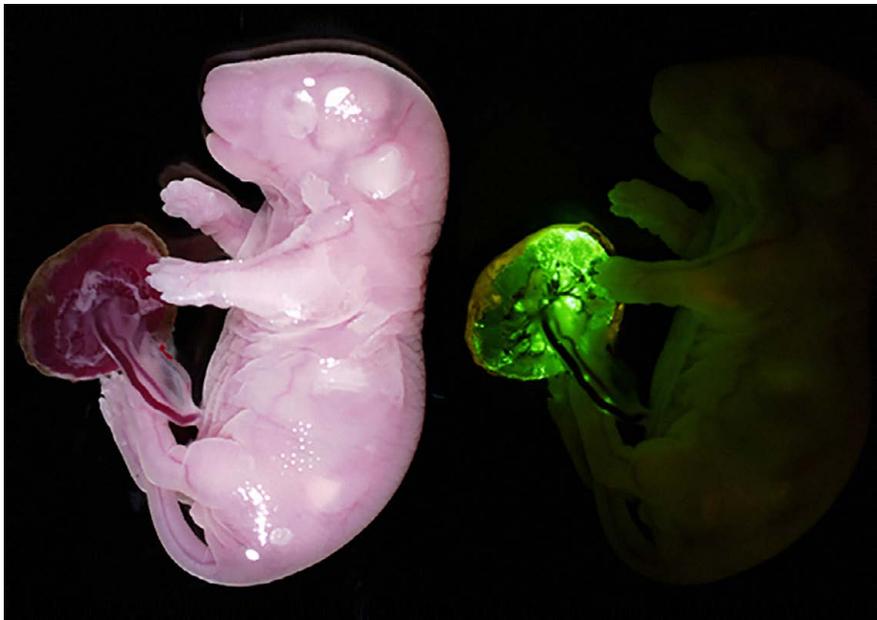
Molecular mechanisms of bi-directional communication between oocytes and surrounding somatic granulosa cells

Studies on animal remodeling by developmental biotechnology using artificial chromatin-targeting enzymes

▶ Cell Regulation

Signal transduction in cell proliferation, differentiation, and carcinogenesis

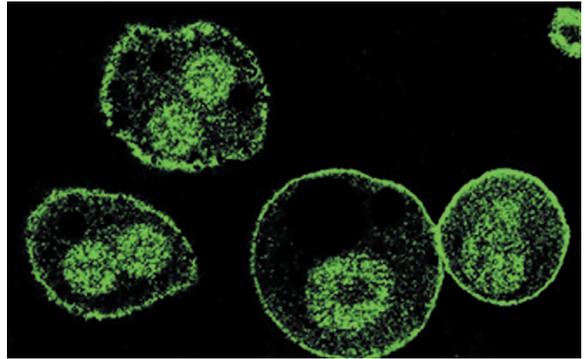
Molecular mechanisms in regulation of hormone action



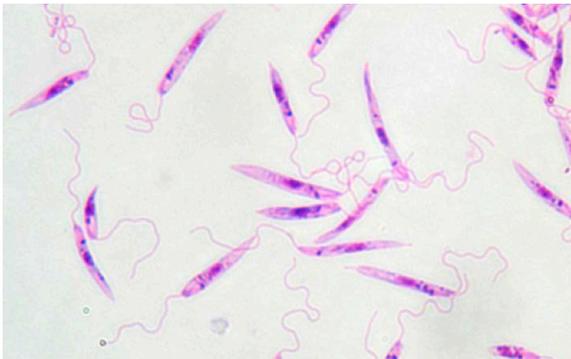
Chimeric mouse placenta produced by injection of GFP-positive TS cells



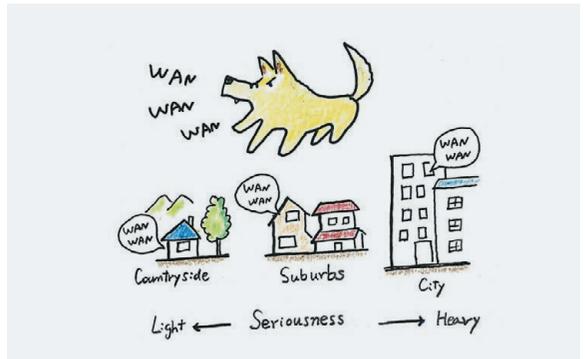
DNA microinjection into mouse zygote



Insulin-dependent activation of Akt associated with plasma membrane



Promastigotes of Leishmania parasites (Giemsa stain)



Clinical research on problem behaviors of companion animals

Functional Bioscience

- ▶ Cellular Biochemistry
 - Studies on molecular mechanisms underlying growth and differentiation of trophoblast lineage
 - Elucidation of the role of genomic DNA methylation in epigenetic control of cellular differentiation and mammalian development
 - Investigation of molecular mechanisms for the maintenance of totipotency and pluripotency
 - Epigenetic risk assessment of hyperglycemia
- ▶ Veterinary Ethology
 - Chemical communication via pheromones in mammalian species
 - Nature-vs-nurture questions in personality formation
 - Clinical studies in veterinary behavioral medicine
- ▶ Animal Radiology
 - Studies on the pathophysiological effects of low-dose radiation
 - Studies on lipid signaling in inflammation (tumor, allergy, and tissue regeneration)

Cooperative course

- ▶ Animal Life Science and Biotechnology*¹
 - Safety and risk assessment of feeds and animal-derived foods
 - Studies on the nutritional effects of amino acids in farm animals
 - Studies on reproductive function in farm animals
 - Studies on compost using ultra-high-temperature aerobic fermentation
- ▶ Applied Microbiology of Animal Products*²
 - Studies on the health-promoting effects of lactic acid bacteria and their fermentation products using various evaluation systems in vitro and in vivo

*¹ The laboratory and its staff belong to the Animal Resource Science Center.

*² The laboratory and its staff belong to the NARO Institute of Livestock and Grassland Science (National Agriculture and Food Research Organization).

Department of Veterinary Medical Sciences

Veterinary medicine encompasses a broad area of the life sciences, not only animal medicine but also the biology of mammals and higher vertebrates. In the Department of Veterinary Medical Sciences, highly advanced research is being carried out at the molecular, cellular, and in vivo levels in order to fully understand the vital processes of normal and diseased animals. Veterinary medicine encompasses two aspects of science: basic science to understand the mechanisms underlying biological phenomena, and applied science to satisfy social demands for the maintenance and improvement of human well-being and the productivity of domestic animals. The department collaborates with the Veterinary Medical Center located on the Yayoi campus. The Center is equipped with the latest advanced medical instruments and plays an important role as an advanced veterinary hospital in the area.

▶ <http://www.vm.a.u-tokyo.ac.jp/eng/>



Joint orientation meeting at the Animal Resource Science Center

Basic Veterinary Medicine

▶ Theriogenology

Neuroendocrine mechanisms regulating ovulation and follicular development in female mammals

Pathophysiological mechanisms mediating suppressed gonadal activities under malnutrition

Remodeling of mechanisms associated with pregnancy establishment

Changes in placental structures through mammalian evolution

Development of systems effective in improving reproductive efficiency

▶ Veterinary Anatomy

Molecular and cellular analyses of mammalian gonadogenesis, testiculogenesis, and spermatogenesis

Roles of SOX (Sry-related HMG box) genes in mammalian embryogenesis and organogenesis

▶ Veterinary Physiology

Regulation of reproductive function by the neuroendo-

crine-immune system

Molecular mechanisms underlying sexual differentiation in the brain

Neuroendocrine control of body growth and metabolism

Regulatory mechanisms involved in growth and regeneration of skeletal muscle

▶ Veterinary Pharmacology

Signal transduction in cells and its modification by drugs

Pharmacological effects of bioactive natural products

▶ Veterinary Microbiology

Studies on the mechanisms of persistent infection and reactivation of animal viruses and protozoa

Development of recombinant vaccines for animals

▶ Veterinary Public Health

Control of zoonotic bacterial and viral pathogens in humans, livestock, and foods

Ecology and role of bacteria harboring in the intestines of humans and animals

▶ Cellular Biochemistry*1

Studies on molecular mechanisms underlying growth and differentiation of trophoblast lineage

Elucidation of the role of genomic DNA methylation in the epigenetic control of cellular differentiation and mammalian development

Investigation of molecular mechanisms for the maintenance of totipotency and pluripotency

Epigenetic risk assessment of hyperglycemia

► **Veterinary Ethology***¹

Chemical communication via pheromones in mammalian species

Nature-or-nurture questions for personality formation

Clinical studies in veterinary behavioral medicine

► **Molecular Immunology***¹

Immunopathological understanding of the host–parasite relationship in protozoan diseases

Development of drugs, vaccines, and diagnostics for parasitic diseases

Ecology and biology of sandflies as the vector of Leishmania

► **Applied Genetics***¹

Reverse-genetic analyses of mechanisms in mammalian oocyte growth, oocyte maturation, fertilization, and early embryo development

Molecular mechanisms of bidirectional communication between oocytes and surrounding somatic granulosa cells

Studies on animal remodeling by developmental biotechnology using artificial chromatin-targeting enzymes

► **Animal Radiology***¹

Studies on the pathophysiological effects of low-dose radiation

Studies on lipid signaling in inflammation (tumors, allergies, and tissue regeneration)



Staff describes the disease history of an elephant farm in Thailand to students in a practical collaboration with Kasetsart University

Clinical Veterinary Medicine

► **Veterinary Pathophysiology and Animal Health**

Study on stress responses of animals from a preventive medicine perspective

Pathophysiology of circulation, respiration, and autonomic nervous system

► **Veterinary Pathology**

Comparative neuropathology

Comparative oncology

Experimental and toxicologic pathology

► **Veterinary Internal Medicine**

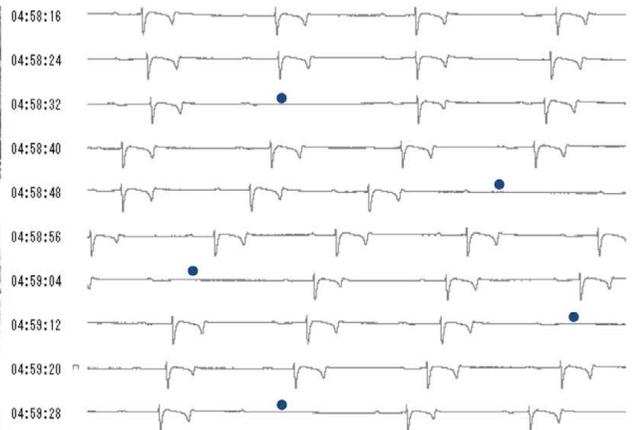
Molecular diagnostics of lymphoid and hematopoietic malignancies

Pathogenesis of inflammatory gastrointestinal (GI) and liver diseases

Clinical application of acute phase proteins (APPs)

► **Veterinary Surgery**

Biological and translational research on tumors in small animals



A horse (Winerscircle; left) at the stock farm of the Animal Resource Science Center, and his Holter electrocardiography recording in the early morning (blue dot, atrio-ventricular block; right)

Regenerative therapy in veterinary medicine
Anesthetic, analgesic, and perioperative management in small animals

- ▶ Biomedical Science
Studies on infectious viral diseases in experimental animals
Establishment and analysis of animal models of disease
- ▶ Veterinary Clinical Pathobiology
Diagnosis and pathophysiology of central nervous system disorders
Diagnostic and therapeutic studies on diabetes
Molecular basis of genetic disorders
- ▶ Infection Control and Disease Prevention
Studies on pathogenesis of slow infections including viral cancers
Studies on pathogen detection methods
Studies on vaccines for controlling infectious diseases
- ▶ Veterinary Emergency Medicine
Regeneration of bone tissue using artificial bone implants
Development of new treatments for osteoporosis
Biological effects of trehalose
- ▶ Global Animal Resource Science*²
Veterinary epidemiology, import risk assessment of animals and animal products, and food-safety risk assessment
Vaccinology including the mucosal delivery system, edible vaccines, immunogen formulation, and host immunity

Bio-Animal Science

- ▶ Animal Life Science and Biotechnology*³
Safety and risk assessment of animal-derived foods including evaluation of radioactive contamination of livestock and livestock products due to the Fukushima Daiichi nuclear power plant accident
Studies on regulation of microbial infection by sterilization of compost using ultra-high-temperature aerobic bacterial fermentation
Studies on the physiological characteristics of ovaries including research on molecular mechanisms of oocyte selection in mammalian ovaries
Studies on the nutritional effects of amino acids on infantile growth in farm animals
- ▶ Food and Physiological Models (Donated Fund Laboratory)
Molecular mechanisms of learning and memory
Elucidation of Insulin/IGF signal transduction
Establishment of animal models for food and feed additives



Surgery in progress at the Veterinary Medical Center

Food Safety and Science*⁴

- ▶ Laboratory of Food-borne Pathogenic Microbiology
Genome-wide screening for the virulence markers of *Streptococcus suis*
Surveillance of virulent *Streptococcus suis* strains among healthy pigs and retail pork meat in Japan
Functional analysis of genetic regions associated with fimbriation in *Streptococcus suis*
Studies on the virulence mechanisms of *Streptococcus gallolyticus* of avian origin
Development of a rapid detection system for bacterial pathogens associated with food poisoning

Experimental Medicine*⁵

- ▶ Laboratory Animal Research Center
Analysis of pathogenicity and species specificity of RNA viruses
Analysis of mechanisms of RNA-virus persistent infection
Development of novel treatments for emerging lethal virus infections
Development of new recombinant vaccines
Development of recombinant viruses as oncolytic virotherapy agents

*1 Cooperative course. The laboratory and its staff belong to the Department of Animal Resource Sciences.

*2 Cooperative course. The laboratory and its staff belong to the Department of Global Agricultural Sciences.

*3 Cooperative course. The laboratory and its staff belong to the Animal Resource Science Center.

*4 Cooperative course. The laboratory and its staff belong to the Research Center for Food Safety.

*5 Cooperative course. The laboratory and its staff belong to the Institute of Medical Science.

**Inter-departmental Research and
Education Program (IREP)**

Agricultural Bioinformatics Research Unit



Scene during a lecture at the Unit

The Agricultural Bioinformatics Research Unit was established in 2004 with support from MEXT (Ministry of Education, Culture, Sports, Science and Technology) to conduct education and research on bioinformatics for graduate students who are studying agricultural and life sciences. The Unit's educational program includes lectures, practical education, and seminars in advanced topics of bioinformatics and their agricultural applications. It also supports the research of master's and doctoral students and presents practical education linked directly to each research topic. The Unit aims to become a base of cooperation for experimental and computational studies as well as industry–university cooperation. The Agricultural Bioinformatics Research Unit was renewed in 2009 in order to enhance our activities by building upon past experience and to promote university–industry cooperation and international cooperation. So far (2004–2014 academic years), a total of 1237 students have completed the lectures and a total of 173 students have completed this program.

Educational Program

► Fundamentals

- Introduction to Biological Sequence Analysis
- Introduction to Genome Informatics
- Introduction to Biostatistics
- Introduction to Structural Bioinformatics

► Methodology

- Knowledge Information Processing
- Sequence Statistics and Mathematical Biology
- Molecular Modeling and Simulation
- Omics Analysis
- Functional Genomics
- Introduction to Systems Biology

► Advanced Topics

- Special Lectures on Agricultural Bioinformatics I (Next-Generation Sequencing Informatics)
- Special Lectures on Agricultural Bioinformatics II
- Special Lectures on Agricultural Bioinformatics III
- Special Lectures on Agricultural Bioinformatics IV
- Research Exercises on Agricultural Bioinformatics



Certification graduation ceremony

Graduate students can obtain credits by attending these lectures and practical education toward professional certification. Besides these lectures and practices, several seminars and workshops are held every year.

AGRI-COCOON

AGRI-COCOON (AGricultural Research Incubator COMMunity for COoperative Network of Public, Administrative, Business, and Academic Sectors) is a research and educational community established in 2005 at the Graduate School of Agricultural and Life Sciences, the University of Tokyo. The principal mission of AGRI-COCOON is to develop and implement multidisciplinary programs for graduate students. The programs are designed to enable graduate students to conduct original, highly creative, and self-directed research projects by enhancing their skills in:

- ▶ Information collection
- ▶ Problem assessment
- ▶ Academic communication
- ▶ Knowledge building
- ▶ Knowledge integration

AGRI-COCOON also contributes to the further advancement and enrichment of the Graduate School through collaborative interactions among academia, business, government, and private institutions. Graduate students of all majors and departments are welcome at AGRI-COCOON's unique multidisciplinary workshops and seminars, with some academic courses open to undergraduate students since 2011.

By building agro-science knowledge and developing a new agricultural research and education protocol, AGRI-COCOON aims to systemize mutual understanding and communications among academia, industry, government, and private individuals and organizations related to agricultural sciences. Throughout the academic year, AGRI-COCOON hosts many international symposiums and seminars that are open to all students and the general public.



Academic Curriculum

- ▶ Food Safety Seminar Series I (for graduate students)
- ▶ Advanced Studies of Food Safety (for undergraduate students)
 - Multidisciplinary lectures on food safety with leading topics in economics, veterinary science, and chemistry
- ▶ Food Safety Seminar Series II (for graduate students)
- ▶ Seminar on Food Safety System (for undergraduate students)
 - Discussions with guest lecturers, one-day study trips to factories, testing centers, and/or research institutes
- ▶ Food Safety Seminar Series III
 - Internship programs on food safety policy at government organizations
- ▶ Seminar for Global Agriculture and Culture
 - Intensive lectures on natural and socioeconomic environments in developing countries
- ▶ Practices in Global Agriculture and Culture
 - Practical training at Japanese farming sites and field trips to developing countries
- ▶ Topics in Biomass Utilization Research I/II
 - Periodic seminars by UT Faculty members with guest lecturers on leading topics in biomass utilization, and fieldwork at biomass utilization sites in Japan
- ▶ Biomass Utilization Research Seminar I/II
 - Intensive practical training and fieldwork on biomass utilization
- ▶ Biodiversity and Agriculture
 - Discussions and fieldwork on biodiversity of agricultural sites with local citizens, organizations, and researchers



Practices in Global Agriculture and Culture: field trip to Lampung, Indonesia

- ▶ Training in Nature-Restoration Operational Monitoring
Monitoring research of nature-restoration project sites in Japan
- ▶ Agro-Informatics Seminar
Seminars and symposiums on agro-informatics
- ▶ Influence of Radioactive Substances in Agriculture (for graduate students)
Influence of Radioactive Substances in Agriculture and the Environment (for undergraduate students)
Multidisciplinary lectures on the problems of radioactive substances attributable to the nuclear accident in Fukushima
- ▶ Influence of Radioactive Substances in Forest Ecosystems (for graduate students)
Practical training to monitor and analyze radioactive substances in forest ecosystems



Food Science Seminar: field training at an independent research institute

Affiliated Institutions

Institute for Sustainable Agro-ecosystem Services



The Institute for Sustainable Agro-ecosystem Services (ISAS) was founded on April 1, 2010, by integrating the University's Field Production Science Center (University Farm) and the Experimental Station for Landscape Plants. The Institute is also affiliated with the University of Tokyo Tanashi Forest for education and research in forest sciences.

With the integration of these research facilities, the Institute aims to conduct research for sustainable provision of foods, forest products, and other ecosystem services. Our scope also entails robustness and resilience of ecosystem services against natural disasters and human perturbations. The research toward these goals is done by three groups: the Information and Social Science Group, the Agricultural and Forest Ecology Group, and the Agricultural Biology and Biogeochemistry Group. The members of the research groups have diverse academic backgrounds but work together across disciplines toward common aims. They also collaborate with scientists outside ISAS, especially those at the Graduate School of Agricultural and Life Sciences, the University of Tokyo, to utilize their expertise to achieve the research aims.

The ISAS campus is located in Nishitokyo City and has a total area of 31 ha covering upland fields, rice paddies, forests, greenhouses, and other research and education facilities. For more details, you may visit our website (<http://www.isas.a.utokyo.ac.jp/index-e.html>) or even better, visit our campus personally!



Learning the operation of agricultural machinery in a field class for undergraduate students

The University of Tokyo Forests

The University of Tokyo Forests (UTF) was established for research and educational purposes in the field of forestry and forest science. The UTF has seven branches in a wide variety of vegetation localities. The total forest area is approximately 32,300 ha.

- ▶ **Executive Office (EO):** The Executive Office located on the Yayoi campus was established to coordinate the various activities of the seven branch forests and the Education and Research Center. The role of the office is to coordinate educational, research, public, personnel, financial, and international affairs as well as to promote cooperation between the branches and other organizations.
- ▶ **The University of Tokyo Chiba Forest (UTCBF):** The University of Tokyo Chiba Forest was established in the southern corner of the Boso Peninsula in 1894 as the first university forest in Japan. The forest has an area of 2,226 ha and is located in the warm-temperate forest zone. The area is covered with various types of trees, which include *Cryptomeria*, *Chamaecyparis*, *Abies*, *Tsuga*, and broad-leaved evergreen trees.
- ▶ **The University of Tokyo Hokkaido Forest (UTHF):** The University of Tokyo Hokkaido Forest, which has an area of 22,716 ha and is located in central Hokkaido, is dominated by boreal coniferous trees mixed with broad-leaved deciduous trees.
- ▶ **The University of Tokyo Chichibu Forest (UTCF):** The University of Tokyo Chichibu Forest has an area of 5,812 ha and is located in Chichibu-Tama-Kai National Park. It is in the cool-temperate zone with mountainous terrain. The vast majority of the UTCF (>85% of the total area) is covered with natural forest. The major tree species are *Abies firma*, *Tsuga sieboldii*, *Fagus japonica*, and *Fagus crenata*. Of the 26 *Acer* species in Japan, 19 are found in the UTCF.



1. Hands-on learning program for undergraduates to make chocolate using cacao plants grown in the green house (photo by Arboricultural Research Institute)
2. Maintenance of Moso bamboo plantation site where mass flowering mechanism has been researched (photo by the University of Tokyo Chiba Forest)



Social experiment of Iyashinomori Research Project: a public auction of firewood (photo by Fuji Iyashinomori Woodland Study Center)

- ▶ **The University of Tokyo Tanashi Forest (UTTF):** The University of Tokyo Tanashi Forest is the nearest university forest to the University of Tokyo campus and is approximately 9 ha in area.
- ▶ **Ecohydrology Research Institute (ERI):** Ecohydrology is an interdisciplinary field studying the interactions between forest and water, and their ecosystem services. The ERI manages the Akazu Research Forest (ARF, 745 ha), the Inuyama Research Forest (IRF, 442 ha), and the Ananomiya Experimental Forest (AEF, 77 ha) for various field researches and educations.
- ▶ **Fuji Iyashinomori Woodland Study Center (FIWSC):** Fuji Iyashinomori Woodland Study Center 38 ha in area and located on the eastern slope of Mt. Fuji. The area lies between the cool-temperate and sub-frigid forest zones.
- ▶ **Arboriculture Research Institute (ARI):** The Arboriculture Research Institute is 247 ha in area and located at the southern tip of the Izu Peninsula. It is a typical warm-temperate forest covered with evergreen tree species. We have conducted field adaptation tests over several decades to select locally adaptable *Eucalyptus* species. Further screening of candidate species is planned to identify better species in terms of tree growth.
- ▶ **Education and Research Center (ERC):** The Education and Research Center is located on the Yayoi campus of the Graduate School of Agricultural and Life Sciences, the University of Tokyo. Students who belong to the UTF study and conduct research at ERC.

Animal Resource Science Center

The Animal Resource Science Center, which was established in 1949 as a livestock farm for undergraduate and graduate student instruction, is located in Kasama, Ibaraki Prefecture, 90 km north of the main campus. One professor, one assistant professor, eight technical assistants including a veterinarian and staff with doctoral and master's degrees, two management staff members, and two part-time assistants support teaching and research for veterinary medicine, animal life sciences, and animal biotechnology. Some graduate students, who belong to the research unit of animal resource sciences, investigate front-line topics in veterinary, animal and agricultural sciences.

The Center provides education in the form of many practical trainings and seminars for undergraduate and graduate students. In addition, many practical seminars on animal life sciences are offered for students at preschools, elementary schools, and junior high schools, and for the general public. The Center also serves as a social educational center for assessing animal food safety.

There are more than 40 pigs and 10 horses at the Center including Criollo horses, a gift from La Plata University, Ar-

gentina, which are employed in animal therapy. Around 30 dairy cattle and 100 native Japanese Shiba goats bred at the Center are used as experimental animals for studies on ruminants' physiological processes. These farm animals are also supplied to many research institutes as experimental animals for veterinary medicine, animal resource sciences, agricultural sciences and medical fields.

Recent research areas of the Center are as follows: 1) evaluation of radioactive contamination of livestock and livestock products due to the Fukushima Daiichi nuclear power plant accident and developmental research for animal husbandry reconstruction; 2) researches on fundamental physiology of mammalian embryos and reproductive organs to improve pregnancy rate in farm animals; 3) studies on the nutritional effects of amino acids on prevention of mastitis in dairy cattle, and on infantile growth and gastric ulcers in farm animals; 4) neuroendocrine control of the reproductive function in pigs and identification of primer pheromones in ruminants; 5) studies on ultra-high-temperature (more than 110°C) fermentation for sterilizing disposal of livestock excretion using aerobic bacterial flora.



Practical exercises for animal resource science



Assessing radioactive contamination of livestock (piglets) and livestock products (cow's milk) due to the Fukushima Daiichi nuclear power plant accident

Veterinary Medical Center

The Veterinary Medical Center (VMC; formerly the Veterinary Hospital) was established in 1880 and engages in education and research on clinical veterinary medicine. VMC is a 4-story, 3,000-m² building and is equipped with advanced diagnostic imaging systems, such as those for color Doppler ultrasonography, endoscopy/arthroscopy, computed tomography (CT), and magnetic resonance imaging (MRI). Approximately 12,000 animal patients are referred to VMC every year to receive advanced and high-level clinical services.

VMC plays an important role in educating undergraduate students. They receive practical clinical education via the academic staff of VMC as well as bedside education through clinical rotations. In addition, graduate students carry out researches at the clinical laboratories they belong to, utilizing information on diseases specialized to their fields. Current research projects at VMC include neoplastic diseases, various immune-mediated diseases, neurological diseases, hereditary diseases, anesthesia/analgesia, and orthopedic diseases. Recently, collaborative researches with medical schools/medical hospitals, companies, and/or other institutions have been conducted, which may lead to novel techniques and drugs useful for both human and veterinary medicine. These translational researches should be one of the important roles of VMC.

Furthermore, VMC accepts 10 to 15 newly licensed veterinarians for clinical training every year. They work as residents/hospital staff in the clinical services of VMC to obtain advanced knowledge and techniques in small animal practices.

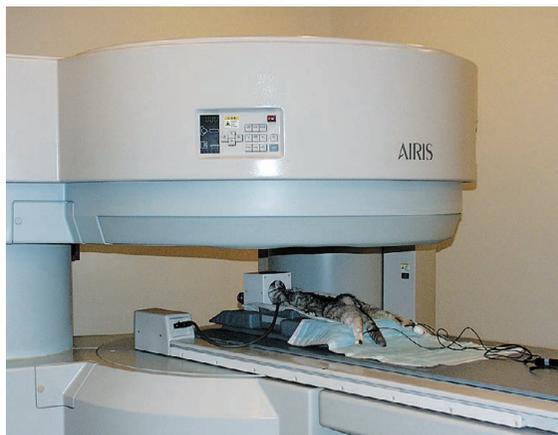
These activities of VMC are designed to satisfy the social demands for maintenance and improvement of human welfare and fulfill requirements for education and research in veterinary medicine.



Students and residents observing a surgery



The Veterinary Medical Center building



MRI is used mainly for diagnosis of neurological diseases

Fisheries Laboratory

(Aquatic Bioscience Research Center)

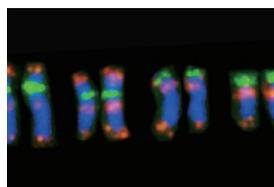


Fieldwork in Lake Hamana on the Seriola

The Laboratory is well situated for research and education regarding the genetics, physiology, development, and ecology of marine organisms. The facility can supply seawater as well as fresh water to more than 100 tanks and ponds of various sizes, ranging from 1 to 100 m³. Moreover, state-of-the-art instruments for use in genomics, genetics, imaging, cell biology, and biochemistry enable researchers to study marine organisms at the molecular level. Currently, as part of our main research focus, we are investigating the genetic basis of phenotypic evolution of aquatic animals in order to help make fisheries and aquaculture sustainable. In the past few years, we have been making a strong effort to understand the genetic and immunological aspects of the fugu or pufferfish, the genome of which was the second vertebrate genome to be sequenced. The Fisheries Laboratory accepts both undergraduate and postgraduate students, including those from overseas.



Practical training for undergraduate students



Fugu chromosomes



Fugu embryos

Radioisotope Center

The Radioisotope (RI) Center in the Graduate School of Agricultural and Life Sciences was established in 2004. The use of isotope tracers in agricultural study started as early as the 1950s, mainly in the fields of plant nutrition and fisheries. With recent and rapid developments in genetic engineering, most isotope experiments are now focused on labeling of DNA or RNA. Besides genetic engineering, isotope labeling of chemicals or cells are also performed. Since there are many advantages to using radioisotopes for researches, the laboratories using isotopes are widespread among almost all of the departments in the Graduate School. About 300 people register to use isotopes each year and most of them are graduate students, senior researchers, and academic staff.

The Center houses an administrative office. Following strict regulations in Japan, the administrative office provides a radiation safety program for each user, and everyone using an isotope must be registered. All users are required to attend two kinds of lectures, which are provided by the University of Tokyo and the Graduate School of Agricultural and Life Sciences. Health checks and radiation exposure monitoring are also performed for each user. Every user must have an ID to enter the facility, and administrative records are kept. There are two members of the academic staff at the Center who, through their research and training, can advise researchers on how to use radioisotopes and provide new information about the application of radiation and radioisotopes.



Radioactivity measuring room



Experimental room

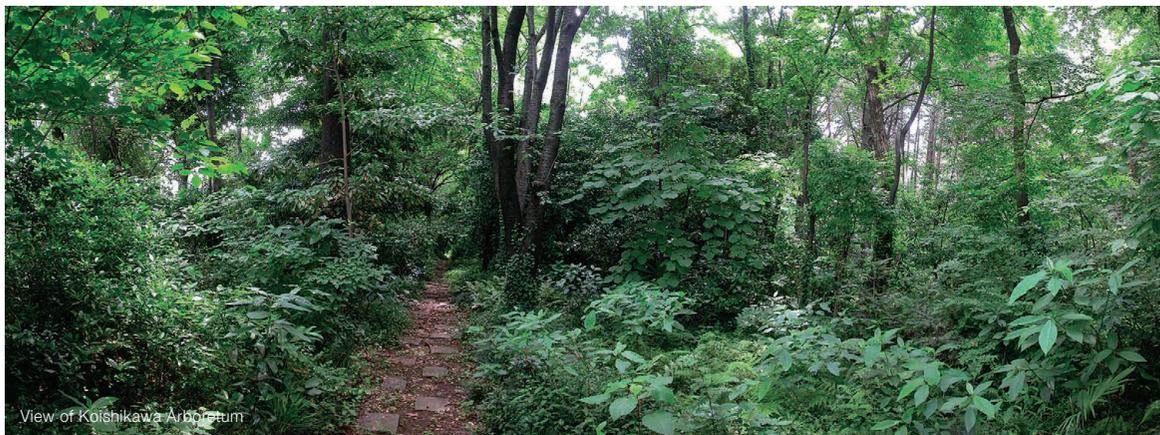


Radioactivity inspection room



Entrance to the Radioisotope Center

Technology Advancement Center



View of Koishikawa Arboretum

Main facilities

► Biotron

As environmental conditions in agricultural field experiments are frequently affected by natural climate conditions, the accuracy and reproducibility of experimental data are occasionally limited. Such problems can be resolved to a certain extent by the use of the Biotron facility, where environmental conditions are kept constant and controlled year-round and different conditions can be set at the same time for comparative experiments. Laboratory animals, insects, and aquatic organisms as well as plants can be bred in our Biotron. The conditions of each room of the Biotron facility are as follows:

- Bldg. No. 6
- Chamber (for insects) 20-35°C
- Rooms G1-G4 (natural light) 20-30°C
- M (machine room)
- Bldg. No. 7 (A) rooftop
- Room G1 (natural light) D30-N25°C
- G2 (natural light) 20°C (constant)
- G3 (natural light) D25-N20°C
- M1 (machine room)
- M2 (for managing)
- Bldg. No. 7 (B) rooftop
- Rooms G1-G3 (natural light) 20-35°C
- M1 (machine room)
- M2 (for managing)
- Life Sciences Research Bldg.
- Rooms G1-G3 (natural light) 20-35°C



Panoramic view of the Biotron



Phytotron

► Koishikawa Arboretum

Koishikawa Arboretum occupies about 0.6 ha of the northwest part of the Koishikawa Botanical Gardens, which belongs to the Graduate School of Science, the University of Tokyo. As an experimental nursery, since 1909 the Arboretum has provided plant materials for research on physiology, pathology, genetics, and breeding of plants.

A rhizotron constructed in 2003 has provided valuable facilities for researchers and students studying symbiotic relationships between trees and fungi.

Research Center for Food Safety

The Research Center for Food Safety was established in November 2006 to meet the expectations and need for the development of food safety science and technology. The Center aims to conduct comprehensive research on food safety and dissemination of scientific information through close collaboration with national and international organizations.

The Center is devoted not only to research activities but also to providing scientific information to the public and government and private sectors. The Center also aims to develop leaders with high levels of knowledge and skills by training students, researchers, and government officials from Asian and other countries.

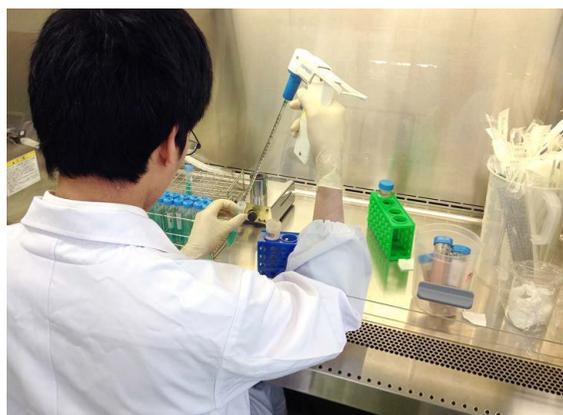
The Center is composed of four divisions, with representative research activities as follows:

▶ Division of Radiological Sciences

- Analysis of radioactive substances in foods
- Biological effects of radioactivity, including on the genome and epigenome

▶ Division of Risk Assessment Science

- Risk assessment and control of bacterial pathogens in foods
- Prevention of health problems caused by food contaminants
- Pathological, toxicological, and pathophysiological studies of the mechanisms of health problems caused by food contaminants
- Development of experimental animals and cellular systems useful for risk assessment of food contaminants and animal-derived pathogens
- Development of analytical methods for food contaminants



Microbiological examination at the Laboratory of Food-borne Pathogenic Microbiology



Experiments using cultured cells at the Laboratory of Immune Regulation



Analytical experiments at the Laboratory of Food Functionality Science

▶ Division of Risk Control Science

- Control of intestinal immune response and food allergies
- Maintenance and improvement of healthy livestock to provide food safety

- Development of functional foods and low-risk foods

▶ Division of Information Science and Economics

- Policy decisions and economics relating to food safety
- Risk perception and risk communication relating to food safety
- Training and education of researchers, administrators, and other professionals in the field of food safety

These research activities of the Center are expected to promote the development of innovative science and technology for the advancement of food safety and contribute to fostering experts capable of dealing with food safety issues based on the most current knowledge in these fields.

University Library for Agricultural and Life Sciences

The Faculty has its own library, which was established in 1965 with donations from alumni and the aid of the Rockefeller Foundation. Former libraries of the various departments were then consolidated into one library. The Library contains 420,000 volumes of books and periodicals dealing with agricultural and other natural sciences. Currently, the Library subscribes to about 2,500 titles of periodicals.

In 1977, the Library was designated by the Ministry of Education, Science and Culture (currently the Ministry of Education, Culture, Sports, Science and Technology) as the central library for foreign agricultural periodicals and functions as such by collecting foreign periodicals that are difficult to find in Japan and providing services to affiliates of other institutions.

In July 2009, the main building was reopened after seismic retrofitting.



Main building



Reference Corner (1st floor)



Browsing Corner (2nd floor)



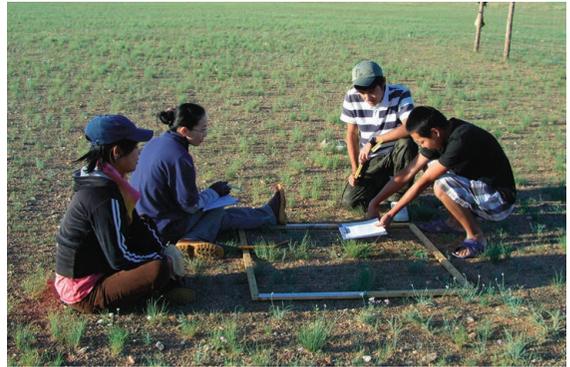
PC Room (3rd floor)

Overseas Research Unit

Center for Biodiversity and Ecosystem Restoration in Mongolia

In response to threats posed by declining biodiversity from climate change and desertification, the Center for Biodiversity and Ecosystem Restoration in Mongolia was established at the Mongolian University of Life Sciences (formerly Mongolian State University of Agriculture) in 2003 as part of the Biodiversity and Ecosystem Restoration Research Project, a 21st Century COE Program headed by Professor Izumi Washitani of the Graduate School of Agricultural and Life Sciences, the University of Tokyo. This collaborative research continued even after the five-year program finished, and it was handed over to the Asian Conservation Ecology as Basis of Symbiotic Society, a Global COE Program, in 2008.

Mongolia has a harsh continental climate with high annual and diurnal temperature fluctuations and low levels of intermittent rainfall, which makes the ecosystem in the region very sensitive to climate change and anthropogenic disturbances. Moreover, political transition at the beginning of the 1990s in Mongolia, followed by livestock privatization and declines in infrastructure, caused a rapid increase in the concentration of livestock, which has resulted in land degradation. The missions of the Center are to understand such vulnerable arid ecosystems



Mongolian and Japanese students conducting joint field work in semi-desert grassland

in relation to human activities, to effectively conserve grassland ecosystems, and to provide appropriate pasture management strategies to sustain ecosystem functions for future generations by taking the initiative in international and interdisciplinary research through exchanges of researchers, lecturers, and students, collaborative research, and holding lectures and symposiums.



Local professors, researchers, and staff at the Center

Related Research Centers

Biotechnology Research Center

The Biotechnology Research Center is a University-wide center and plays a leading role in educational and research activities in biotechnology. Mission of the Biotechnology Research Center is to solve the problems associated with food shortage, environmental pollution, natural resource depletion, and human health, by utilizing plant and microbial biotechnology. All staff in the Center also participate in educational courses for graduate students in the Department of Biotechnology, Graduate School of Agricultural and Life Sciences. In addition, the Center supports researchers in other departments of the University by providing advice and facilities. The Center was established as the Biotechnology Research Facilities in the Faculty of Agriculture, the University of Tokyo, in 1984. After several times re-organization, the Center has currently three core research divisions, Environmental Biochemistry, Cell Biology, and Plant Functional Biotechnology, two endowed research units supported by private companies, and three outside collaborative units.

<Core Divisions>

■ Laboratory of Environmental Biochemistry

The main focus of the research activities in this laboratory are as follows:

- 1) Analysis of novel metabolic capacities of bacteria for xenobiotics and their application to archive effective bioremediation of environmental pollution(Fig.1).
- 2) The elucidation of signal transduction pathways leading to activation of disease resistance in rice and their application in the development of agrochemicals conferring plant disease-resistance and rice cultivars resistant to pathogens.

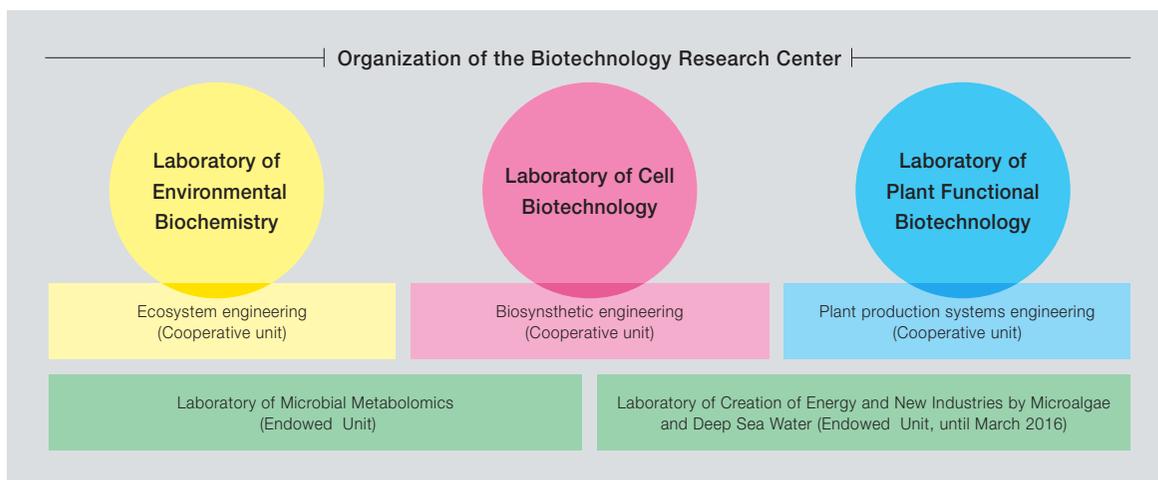
■ Laboratory of Cell Biotechnology

The goal of the research in this laboratory is to understand the mechanistic principles and evolution underlying the biosyn-

thesis of amino acids and biologically active natural products such as terpenes, polyketides, peptides, and their hybrids. The laboratory uses a variety of techniques to solve these problems including molecular biology, spectroscopy, enzymology, directed evolution, synthetic biology, and X-ray crystallography(Fig.2).

■ Laboratory of Plant Functional Biotechnology

This laboratory is studying molecular mechanisms underlying regulation of gene expression associated with nutrient assimilation pathways and signal transduction of nutrient signals in plants. Plant transcription factors are a focus of particular interest(Fig.3). This laboratory is also studying plant interaction with symbiotic microorganisms and the effects of rhizospheric microorganisms on plant growth.



<Endowed Research Units>

■ Laboratory of Microbial Metabolomics

This laboratory focuses on protein acylation in bacteria and investigates its biological functions and applications for metabolic regulation with proteomic, molecular biological, and structural biological approaches.

■ Laboratory of Creation of Energy and New Industries by Microalgae and Deep Sea Water

(until March 2016)

This laboratory promotes the practical study of how to best use microalgae as marine photosynthetic organisms for the benefit of humans. Surprisingly, microalgae perform almost the same amount of photosynthetic production as land plants. The Laboratory is planning to associate these microalgae with deep-sea water, considered an untapped resource, for two uses. The first is as an instant fossil fuel, and the second is as feed for next-generation aquaculture.

<Collaborative Units>

■ Laboratory of Microbial Ecology

It is well known that the behaviors of microorganisms are quite different under laboratory conditions. This Laboratory focuses on the elucidation of microbial behavior and functions in the natural environment, especially under oligotrophic and biofilm conditions.

■ Laboratory of Synthetic Biology

This laboratory aims to develop technologies for cloning biosynthetic gene clusters of bioactive natural products and for efficient production of them in genetically engineered microorganisms. Such technologies will enable the stable supply of bioactive compounds that could become leads in the development of new drugs.

■ Laboratory of Plant production systems engineering

The purpose of this research group is to elucidate mechanisms controlling plant productivity and development of innovative technology to improve plant productivity. This research group is currently engaged in investigation of the phytohormone network and the plant immunity system.

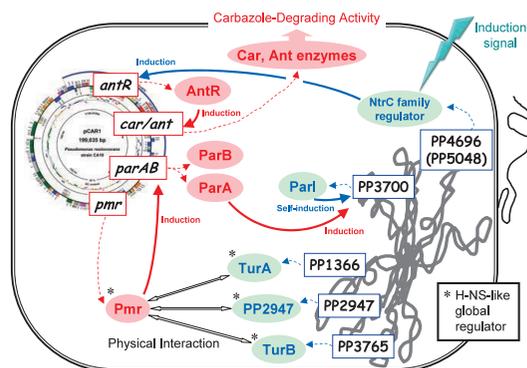


Fig.1 Interaction between the IncP-7 carbazole-degradative plasmid, pCAR1, and the *P. putida* KT2440 chromosome detected by transcriptome and biochemical analyses. Such interactions are indispensable for the effective expression of plasmid function in host bacterial cells and are key determinants of host phenotype and fate under environmental conditions.

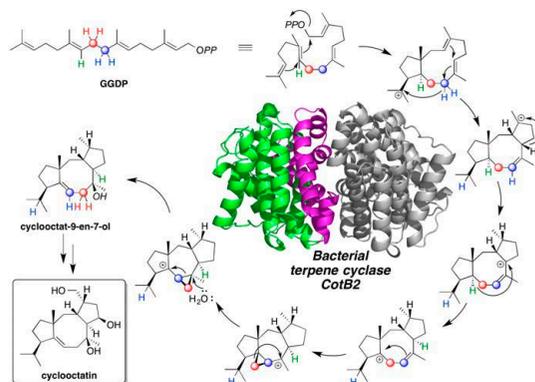


Fig.2 Reaction mechanism for the formation of cyclooctat-9-en-7-ol from GGDP catalyzed by terpene cyclase CotB2

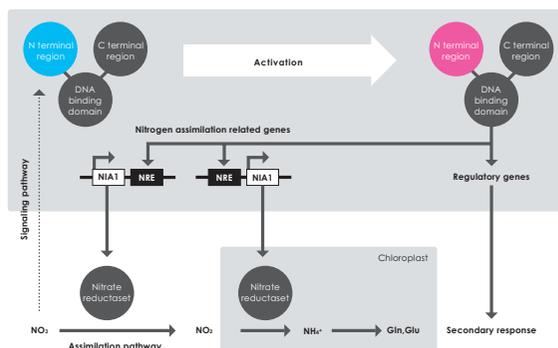


Fig.3 A model for the molecular mechanism underlying nitrate response in plants. Nitrate activates a transcription factor post-translationally, and the activated factor promotes the expression of nitrogen assimilation-related genes.

Asian Natural Environmental Science Center

To achieve environmentally sustainable biological production, we must create a methodology for reasonable, feasible land-use and for the efficient utilization of bioresources, and develop low-input technology for biological production. For this purpose, a new academic discipline combining basic science and applied technology and the active implementation of international joint research are needed.

The mission of the Asian Natural Environmental Science Center (ANESC) is to establish a foundation for sustainable biological production through integrated understanding of the continuum from forest to cropland and coastal ecosystems, relating each ecosystem to its specific local environment and community with a focus on the Asian region where environmental problems are prominent due to the high utilization of bioresources. ANESC promotes both advanced laboratory work and fieldwork in cooperation with researchers and research institutes throughout Asia to conduct basic interdisciplinary research with the goal of establishing new methods in field science and as a focal point for bioresource and environmental sciences in Asia.

ANESC comprises two divisions: Bioenvironmental Assessment and Biological Resources Development, staffed by tenured faculty; and Resources and Environmental Management, staffed by adjunct faculty from international research institutes. As cooperative members of the Graduate School of Agricultural and Life Sciences, the professors and associate professors of ANESC's tenured faculty supervise research by postgraduate students and researchers affiliated with the graduate school.

ANESC aims not only to be a research center for Asian bioresources and the environment at the University of Tokyo,



Planting trial for environmental reforestation in acid sulfate soils in Thailand

but also to be a focal point for research activities aimed at tackling serious local problems and harmonizing the utilization of biological resources and environmental conservation in collaboration with local researchers. Thirty-one research institutes located in Asian and other countries are involved in international joint research activities.

To execute the mission of ANESC, staff promote the following four research programs in cooperation with researchers from other Asian countries: 1) environmental rehabilitation, aiming at the development of methods for restoring ecosystem function and increasing biological productivity applicable for the rehabilitation of degraded lands by utilizing stress-tolerant plants and symbiotic microorganisms, 2) solutions for global environmental problems, aiming at the development of basic technologies for sustainable land use and bioresource utilization as effective measures to mitigate climate change risks and conserve biodiversity, 3) regional resource utilization, aiming at the development of effective systems of regional resource utilization suitable and applicable in terms of socioeconomic and natural environments for sustainable development of local communities, and 4) genetic resource development, aiming at the exploration of useful genetic resources and the development of effective utilization methods for them to achieve sustainable biological production providing superior efficacy in terms of environmental restoration and conservation.



1. Transplanting of traditional and improved rice varieties for a participatory experiment in Cambodia
2. Alkaline soil area in northeast China, where desertification is in progress

www.a.u-tokyo.ac.jp/english/

The University of Tokyo
Graduate School of Agricultural and Life Sciences / Faculty of Agriculture

Yayoi, Bunkyo-ku., Tokyo 113-8657
Phone: +81-3-5841-5485
E-mail: ryugaku@ofc.a.u-tokyo.ac.jp

