

## Life Science

**Major :**

- (1) Total credits:
  - Multiple majors: a minimum of 45 credits
  - Single major: a minimum of 62 credits
  - Teacher training program: a minimum of 65 credits
- (2) Required courses: BIO2121, 2122, 2131, 2132, 3123, 3124 (14 cr.)
- (3) Multiple majors need at least 31 credits, single majors need at least 48 credits, and students in the teacher-training program need at least 51 credits (which can include EDUS981 982 983) from major courses in the Life Science Department (but cannot include BIO1101, 1102, 1105, 1106, 2130) in addition to the above requirements.
- (4) Major prerequisites:  
 In order to declare Life Science as their major, students must take a minimum of 16 credits from the following major prerequisites (Note: These courses cannot be included as major credits.):

BIO1101, 1102, 1105, 1106 8 cr.

Select one from: 8 cr.

<PHY1001, 1002, 1101, 1102>

<CHM1001, 1002, 1051, 1052>

Total: 16 cr.

### Course Completion Roadmap

Acad. Year	1st Semester	2nd Semester
1	COR 1007 <span style="float: right;">1</span>	COR1001 <span style="float: right;">3</span>
	COR 1009 <span style="float: right;">3</span>	COR1003 <span style="float: right;">3</span>
	Select 1 from ETS2001~2004 <span style="float: right;">3</span>	STS2006 <span style="float: right;">3</span>
	STS2005 <span style="float: right;">3</span>	BIO1102 <span style="float: right;">3</span>
	BIO1101 <span style="float: right;">3</span>	BIO1106 <span style="float: right;">1</span>
	BIO1105 <span style="float: right;">1</span>	Select 1 from
	Select 1 from	- A: PHY 1002 and 1102 <span style="float: right;">4</span>
	- A: PHY1001 and 1101 <span style="float: right;">4</span>	- B: CHM 1002 and 1052
- B: CHM1001 and 1051 <span style="float: right;">4</span>	Others <span style="float: right;">2</span>	
Others <span style="float: right;">1</span>		
<u>19</u>	<u>19</u>	
2	Select 1 from HFS2001~2003 <span style="float: right;">3</span>	Select 1 from CHS2001~2004, <span style="float: right;">3</span>
	Select 1 from SHS2001~2007 <span style="float: right;">3</span>	2006
	BIO2121 <span style="float: right;">3</span>	BIO2122 <span style="float: right;">2</span>
	BIO2131 <span style="float: right;">2</span>	BIO2132 <span style="float: right;">3</span>
	Others <span style="float: right;">8</span>	Others <span style="float: right;">11</span>
	<u>19</u>	<u>19</u>
3	BIO3123 <span style="float: right;">2</span>	BIO3124 <span style="float: right;">2</span>
	Others <span style="float: right;">17</span>	Others <span style="float: right;">17</span>
	<u>19</u>	<u>19</u>
4	Others <span style="float: right;">19</span>	Others <span style="float: right;">19</span>
	<u>19</u>	<u>19</u>

## Undergraduate Curriculum

**BIO1101 General Biology I** 3 cr.

(lect.: 3hr)

Fundamental facts, principles, concepts, and questions on structure, function, heredity, evolution, and ecology of organisms.

**BIO1102 General Biology II** 3 cr.

(lect.: 3hr)

A continuation of BIO1101.

**BIO1105 General Biology Laboratory I** 1 cr.

(lab.: 3hr)

Learn the contents of BIO1101 through experiments.

**BIO1106 General Biology Laboratory II** 1 cr.

(lab.: 3hr)

Learn the contents of BIO1102 through experiments.

**BIO2121 Modern Biology Laboratory I** 2 cr.

(lab.: 4hr)

This course is intended to introduce widely used experimental procedures in biochemistry, including preparation of buffers, protein purification and characterization, enzyme assays and kinetics, and antibody production and manipulation. In addition, students learn how to apply these techniques to the study of life science.

**BIO2122 Modern Biology Laboratory II** 2 cr.

(lab.: 4hr)

This is a 2-credit course designed to give students both the theory and application of recombinant DNA technology through hands-on exercises. The specific techniques to be covered in this course include the preparation of plasmid DNA, specific cleavage of DNA with restriction endonucleases, gel electrophoresis, DNA cloning, DNA sequencing, and bioinformatic analysis.

**BIO2130 Basic Biochemistry** 3 cr.

(lect.: 3hr)

This course provides a survey of biochemistry in an easily understandable form for students who are not majoring in a life science. The basic properties of cells and their components, macromolecules, is discussed.

**BIO2131 Biochemistry I** 3 cr.

(lect.: 3hr)

A study of the biochemical characteristics of macromolecules such as carbohydrates, lipids, proteins, and nucleic acid, as well as their monomers, with an emphasis on hydrogen ion concentrations and dissociation constants in biochemical reactions, as well as active transport and enzyme action with kinetics.

**BIO2132 Biochemistry II** 3 cr.

(lect.: 3hr)

A survey of bioenergetics, metabolic control of catabolism and anabolism, regulatory mechanism of intracellular energy flow, and ATP generation.

**BIO2141 Cell Biology** 3 cr.

(lect.: 3hr)

This course examines the fine structure and chemical composition of cells, cellular metabolism and macromolecules that transduce biological information, cell division, and cellular and molecular bases of heredity and aging.

**BIO2151 Molecular Biology** 3 cr.

(lect.: 3hr)

A study of the structure, biosynthesis, and metabolism of molecules involved in heredity, their replication, transcription, translation, and expression, as well as activity regulation, mutation, and manipulation of nucleic acids.

**BIO2311 Human Biology** 3 cr.

(lect.: 3hr)

The aim of this course is to understand the human being as a biological model. This course will examine the functional structure and physiology of the human body and explore human health, diseases,

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reproduction, and interaction with the environment.

### **BIO2350 Host Microbe Interaction 3 cr.**

(lect.: 3hr)

As microbe and host live together for a long time and co-exist or cause disease, they have useful or harmful impact on each other. This course looks at this interaction. In this course, students learn concretely the roles of intestinal bacteria, mechanism to induce microbial disease, mechanism to respond to infection of various hosts, mechanism of microbes' immune evasion, immune deficiency and antibiotics.

### **BIO2511 Industrial Microbiology 3 cr.**

(lect.: 3hr)

This course helps students understand the nature of industrial microbes and its application areas. In addition, in this course, students will learn the nature and importance of microbes such as bacteria, fungi, and yeast and learn industrial process, microbial enzyme related to products, bio fuel, food and alcoholic fermentation, ecology-related biodegradation and control.

### **BIO2522 Plant Biology 3 cr.**

(lect.: 3hr)

This course has a goal of learning latest scientific knowledge along with overall introduction of plant biology. It covers the nature of plant basic system, plant structure, cell study, molecular biology and the application of plant biology.

### **BIO2601 Introduction to Gene Cloning 3 cr.**

(lect.: 3hr)

In this course, students can learn the latest method related to gene cloning. Students will learn theoretically the theoretic contents such as bacteria cultivation theory, conversion of formation, agarose gel electrophoresis, plasmid DNA, genomic DNA, RNA refinement principle, cutting and analyzing nucleic acid quantitative DNA restriction

enzyme, Southern hybridization, library production, polymerase chain reaction (PCR), computer based DNA sequencing and its related basic contents and data acquisition through the Internet. In addition, this course makes students study basic contents of various latest biomics areas including DNA cloning vector, restriction enzymes, modifying enzymes, polymerases, reagents used in other molecular biology study, next generation sequencing or microarray.

### **BIO2701 Environmental Science 3 cr.**

(lect.: 3hr)

This basic course focuses on the fundamental concepts of ecology, which will help students understand the 'SUSTAINABILITY' of the natural ecosystems and recognize the impacts of human activities on our environments. Through scientific and systematic thinking of the current crisis of the Earth, students would acquire the abilities to associate and communicate with other fields studying the Earth and Human.

### **BIO3123 Modern Biology 2 cr. Laboratory III**

(lab.: 4hr)

Students will learn genetic principles, animal development, and basic mechanisms in cell differentiation through this lab. The lab will also provide several experiments in animal and plant physiology such as concepts of water potential, photosynthesis, plant hormones, and animal cell membrane potential.

### **BIO3124 Modern Biology 2 cr. Laboratory IV**

(lab.: 4hr)

The first part of this course aims to understand electrophysiological properties of neurons. In the second part, microbial genetics and mutant screening using transposon will be covered. In the third part, virus replication, diagnosis of viral disease, and separation will be taught.

### **BIO3161 Genetics 3 cr.**

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(lect.: 3hr)

A study of continuity and variation in multiplication of organisms, mutation and selection as a mechanism for biological change, principles of genetics, structure and function of the hereditary, molecular basis for mutation, and basic concept of genomics.

### **BIO3212 Principles of Biotechnology 3 cr.**

(lect.: 3hr)

This course provides an overview of the biotechnology and its applications. Briefly, this course will cover an extensive range of topics, including concept of biotechnology, understanding of core biological sciences, overview of various applications (Microbial, Plant, Animal, DNA, Bioremediation, Aquatic, and Medical), and other disciplines in biotechnology; ethics, regulations, intellectual property, and business.

### **BIO3311 Developmental Biology 3 cr.**

(lect.: 3hr)

General aspects of gametogenesis, early developmental processes, origin and differentiation of tissues, and organogenesis will be covered. The fundamental mechanisms of development will be studied in relation to cell and tissue interactions, endogenous and exogenous factors, and modulation of gene expression. The mechanisms of pattern formation will be considered at the cellular and molecular levels, and the mechanisms of teratogenicity, oncogenicity, and regeneration will also be discussed in conjunction with pattern formation.

### **BIO3511 Plant Physiology 3 cr.**

(lect.: 3hr)

A survey of functions of higher plants, mechanisms and general principles concerned with water relations, mineral nutrition, photosynthesis, transport, metabolism, growth, differentiation, responses to environment, and plant biotechnology.

### **BIO3711 Microbiology 3 cr.**

(lect.: 3hr)

A study of the properties of microorganisms, including their composition, metabolism, and structural organization, as well as seeing them as systems for the study of cellular growth and its physiological basis. Also includes variation, heredity, and the organization of the genetic system in bacteria and other microbes.

### **BIO3712 Microbial physiology 3 cr.**

(lect.: 3hr)

This advanced course focuses on the physiological diversity of microorganisms (Bacteria, Archaea and eukaryotic microbes) that have survived, adapted and evolved in extremely diverse ecosystems. Students learn the concept of 'PHYSIOME' via studying both universal and specific features of microbial responses to and interactions with their environments.

### **BIO4100 Life-science Internship 3 cr.**

(Full time for 4 weeks or more during summer or winter breaks)

This course helps students apply the academic knowledge and experience learned in school to the industrial setting in real biotech-related companies.

### **BIO4152 Advanced Molecular Biology 3 cr.**

(lect.: 3hr)

Covers the major areas of advanced molecular biology including chemical properties of nucleic acid and related molecules that are involved in gene expression and epigenetics. This course also provides recent molecular biology techniques.

### **BIO4203 Patents and Technology 1 cr.**

#### **Transfer of Bio-science**

(lect.: 1hr)

This course covers the process required to make useful research result of bio-science intellectual property rights(IPR) and related contents. To do so, this course helps students the

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importance of IPR, process to create the rights and the contents of technology transfer through the cases in the present system. (The courses of Physics Patents and Technology Transfer(PHY4023) and Patents and Technology Transfer(CHM4203) cannot be overlapped in taking)

### **BIO4231 Biophysics** 3 cr. (lect.: 3hr)

This course is the study of living systems from the perspective of physics. It covers three areas: molecular structures, biophysical techniques, and biological mechanisms. Our aim is to provide students with the ability to apply physics in understanding the workings of organ systems as well as the structure and dynamics of cells and biomolecules.

### **BIO4251 Statistics in Biology** 3 cr. (lect.: 3hr)

A survey of the principles and methods of design as well as an analysis and interpretation of biological sampling and experiments.

### **BIO4252 Cancer Biology** 3 cr. (lect.: 3hr)

This course covers the overall contents related to cancer biology. This course helps students learn related oncogenes, tumor suppressor genes, cancer stem cells, tumor micro-environment, chemotherapy and drug resistance to understand the cause and mechanism of the genetical change that normal cells are converted to cancer cells.

### **BIO4321 Animal Physiology** 3 cr. (lect.: 3hr)

Principles of cellular and system physiology, including membranes and transport, excitation, signal conduction, and transduction. Movement architecture, animal excretion, respiration, circulation, and neural and hormonal control are also explored.

### **BIO4331 Neurobiology** 3 cr.

(lect.: 3hr)

Neuroscience is composed of many different areas of studies, but this course will provide the foundation for the study of molecular and cellular neurobiology. This course will proceed from the basic properties of nervous system; such as structure, electrical and chemical communications, synaptic plasticity, and general neuroanatomy of the brain. From the basic properties, this course also covers other selective areas; such as 1) General neuronal process (neuronal circuits and neuronal regeneration), 2) Specific nervous system (eye and visual processing and wiring), 3) Complex and composite system (association cortex and memory).

### **BIO4351 Immunology** 3 cr. (lect.: 3hr)

This course deals with basic concepts in immunology, components of the immune system, organization of the immune system, and its relevance to health and diseases. The course will cover innate and adaptive immune systems, although the main focus will be on the adaptive immune system. The purpose of this course is to understand how the immune system works as a whole by studying its individual components, and then theorize where current immunology will be directed to improve human health.

### **BIO4441 Molecular Cell Biology** 3 cr. (lect.: 3hr)

A study of the major areas of molecular and cellular biology including signal transduction, cell cycle control, programmed cell death, stem cell research, animal models for human diseases, and cancer biology. Includes lectures and exams, and involves presentations and discussions of relevant literature, with a focus on major concepts and recent advances in experimental molecular cell biology.

### **BIO4521 Plant Developmental Biology** 3 cr.

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(lect.: 3hr)

This course is a mid-advanced level plant developmental biology. The course is designed to provide the students with the basic and current knowledge of plant development at molecular and cellular levels. Plant development is different from animal development in that it takes place continuously even after embryogenesis. To understand this, we will study various aspects of plant development with many case studies.

### **BIO4721 Virology** 3 cr. (lect.: 3hr)

This course focuses on the structure, morphology, classification, genome replication, and regulation of gene expression of viruses. Immune responses and pathogenesis induced by viral infection, acute and chronic infections, viral carcinogenesis, diagnosis, emerging infectious disease, mechanism and development of vaccines, and antiviral chemotherapy are discussed.

### **BIO4911 Progresses on Life Science** 3 cr. (lect.: 3hr)

This course introduces the major articles presented recently among the themes attracting the attention in bio-science. Students will be asked to improve skills for slide preparation and presentation, and discussion.

### **BIO4921 Special Research** 3 cr. (experiment: 6hr)

Required course for senior students. Independent study and research under the supervision of a professor in the last semester. (This course cannot be taken at the same time in the same semester as micro study(BIO4931))

### **BIO4931 Applied Bio-Technology Experiment** 3 cr. (experiment: 6hr)

This course covers necessary experimental technology including gene recombination, gene expression, cell culturing, technology to separate fungal

phytase for the students who are focusing on the employment to industry or the process to become professional research among the students in the graduation grades of 7th to 8th semester and students can learn through the experiment. The result of the research needs to be submitted, presented with slides and its excellence will be evaluated. (This course cannot be taken at the same time in the same semester as micro study(BIO4921))

### **BIOG001 Introduction to Biotechnology Commercialization : Capstone Design** 3 cr. (Lecture 2 hours & design 1 hour)

Through this course, students will learn, analyze and apply various disciplines related to biotech industry. This course helps students learn the strategy needed for planning academic-industry cooperation and for the startup of biotech business. This course is designed for the students with sufficient knowledge to evaluate the current trends and technologies in the biotech fields. The course will be taught with the experts on the fields of the followings; R & D of Biotech, Market Analysis, IP and Patents, Regulations, Business Model, Financing, and Entrepreneurship.

### **BIOG241 Structural Biology** 3 cr. (lect.: 3hr)

This course covers the structure and dynamics of proteins, relating them to protein function and the possibilities of protein design. The course also looks at the methods used in research and current questions in drug design.

### **EDUS981 Education Theory on Science Course** 3 cr.

(lect.: 3hr)

This course takes a look at various theories and views for the goal, contents, method and evaluation of chemistry course and analyzes concretely the bio-science course in the middle and high schools.

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**EDUS982 Logics and Essay on Science Course 3 cr.**

(lect.: 3hr)

This course helps students improve the thoughts and the ability to teach essay with the contents and principles of bio-science or science based on the overall understanding of the structure and nature of bio-science course.

**EDUS983 Study and Teaching Method of Science Course Textbook 3 cr.**

(lect.: 3hr)

This course helps students improve the thoughts and the ability to teach essay with the contents and principles of bio-science or science based on the overall understanding of the structure and nature of bio-science course.