Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Biological Sciences	BIO2001	Cell Biology	Undergraduate (low graders)	Theory	3	6	3	Major	As a lecture/discussion course, this course will study the structure/function relationship of the cell. The lecture will focus on the structure/function relationship of the cell organelles, cellular genetics, and cellular differentiation. In addition, the regulation of these cellular functions will be discussed.
Biological Sciences	BIO2002	Biochemistry	Undergraduate (low graders)	Theory	3	6	3	Major	This course is directed to introduce the basic principles of life and various kinds of chemical reactions to students. The nature and function of biomolecules (protein, carbohydrate, lipid, nucleic acid) are covered. Basics of metabolism and its integrity will be discussed. The primary object of this course is to let students understand the basic mechanism of biochemical reactions.
Biological Sciences	BIO2004	Plant Taxonomy	Undergraduate (low graders)	Theory	3	6	3	Major	Principles and methods of classification, description, identification and nomenclature of the wild plants. Modern taxonomic systems of vascular plants Mechanisms of speciation and evolution. Identification of major taxa of vascular plants as well as some noteworthy families and species. Bases and methods to research the vascular systematics.
Biological Sciences	BIO2005	Cell Biology Laboratory	Undergraduate (low graders)	Experiment	2	4	4	Major	Cellular structure and function relationship will be studied by basic experiments. The main focus will be on the experimental approach of the concepts studied in the biology class.

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Biological Sciences	BIO2006	Experimental Biochemistry	Undergraduate (low graders)	Experiment	2	4	4	Major	This course is designed to offer training of various techniques for separation, analysis and characterization of all major classes of biologically important compounds and to confirm biochemical concepts through observation and experiment.
Biological Sciences	BIO2010	Molecular Biology	Undergraduate (low graders)	Theory	3	6	3	Major	This course emphasizes basic molecular processes and genetic phenomena in both prokaryotic and eukaryotic cells. It includes nucleic acid bio-chemistry, structure and function of macromolecules such as DNA, RNA and proteins, interactions between the macromolecules, recombinant DNA technology, DNA replication mechanism, organization of genome, transcription, translation and regulation of gene expression.
Biological Sciences	BIO2011	Genetics Laboratory	Undergraduate (low graders)	Experiment	2	4	4	Major	The lab is designed to experience various genetic phenomena. The experiments include mutation, DNA isolation and manipulation, DNA amplification, Western blotting using mammalian cells, Saccharomyces cerevisiae, Escherichia coli.
Biological Sciences	BIO2012	Biophysics	Undergraduate (low graders)	Theory	3	6	3	Major	The objective of biophysics is to understand biological phenomenon based on physical chemical and mathematical concepts and laws. Physical property and structure of biomolecule, thermodynamics, kinetics and applications to biological systems will be covered in this lecture.

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Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Biological Sciences	BIO2013	Disease Biology and Biochemistry	Undergraduate (low graders)	Theory	3	6	3	Major	The Disease Biology and Biochemistry aims to present the basic principles of disease process in a form readily accessible to students trying to assimilate large volumes of information from a variety of sources. Sections of this lecture cover major areas of biomedical science including epidemiology, immunology, infection, disorders of the blood. Genetic diseases, oncology and mental health. The lecture fuses the biology (physiological and biochemical) processes underlying the diseases manifestations. Feature of Diseases Biology is integration of basic science and biomedical science
Biological Sciences	BIO2014	Individual Studies in Biological Science1	Undergraduate (low graders)	Independent Research	1	2	0	Major	This course is designed to offer a student individual studies in biological science during the 2nd~3rd years. Students are expected to carry out research on the selected theme under the guidance of the professor in the specific area of interest and to submit research reports. This is followed by BIO3050 (Individual Studies in Biological Science 2) to provide pre-research activities which will lead to the research for undergraduate thesis required for completing a B. S. degree program in Biological Science.
Biological Sciences	BIO3001	Genetics and Genomics	Undergraduate (high graders)	Theory	3	6	3	Major	This class teaches endless human challenge to reveal the mystery of genetic material which is the essence of all the living organisms and the methodology and knowledge of genetics starting from Mendel to the modern molecular genetics during last 130 years. The class includes topics as follows; Mendelian genetics and cell division, gene expression and regulation, DNA replication and amplification, in vivo DNA recombination and gene manipulation, mutation and DNA repair, genetic regulation of cancer development, control of cell cycle,, current progress on genomics genetic engineering and the future.
Biological Sciences	BIO3002	Animal Physiology	Undergraduate (high graders)	Theory	3	6	3	Major	Animal physiology can be defined as the study of the function of animals and their constituent parts. The ultimate goal of this subject is to understand, in physical and chemical terms, the mechanisms that operate in living organisms at all levels, ranging from the subcellular to the integrated whole animal.

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Biological Sciences	BIO3003	Biostatistics	Undergraduate (high graders)	Theory	3	6	3	Major	Various statistical parameters dealt in biology. Methods to design the biological experiments efficiently, to analyze the data, to find the logical significance of the result, and to understand the statistical treatments of other scholars.
Biological Sciences	BIO3004	Microbiology	Undergraduate (high graders)	Theory	3	6	3	Major	Through microorganisms, the basic principles that govern the mystery of life as well as their practical applications toward human welfare will be taught. This introductory microbiology course will cover both the basic and applied aspects of microbiology. It will includes various subjects of microbiology such as structure and function of microbial cells, methodologies used in microbiology, growth and control of microorganisms, microbial biotechnology, industrial micro-biology, medical microbiology, microbial ecology, and microbial classifications .Concurrent registration with Microbiology Laboratory course is strongly recommended.
Biological Sciences	BIO3005	Ecology	Undergraduate (high graders)	Theory	3	6	3	Major	Introductions to the relationships of organisms and environment on the perspectives of energy cycle, nutrient cycle, changes and equilibrium of individuals within populations, interrelationships between populations, kinds and dynamics of communities as well as the problems involved between human beings and their environment.
Biological Sciences	BIO3009	Immunology and Human Defense	Undergraduate (high graders)	Theory	3	6	3	Major	This course is designed to offer students a firm understanding on the fundamental principles governing immune function as a body’s natural defense mechanism. Starting from the molecules, cells, and organs comprising the immune system, the students will learn the overall process of immune cell development, expression and regulation of immunity. A special emphasis is made to enhance the understanding on the interaction between the innate and adaptive immune function and the evolution of the human immune system against diseases future prospects of life science in relation to other discipline.

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Biological Sciences	BIO3010	Virology	Undergraduate (high graders)	Theory	3	6	3	Major	The class provides - basic concepts in modern virology which has contributed to a rapid advance in molecular biology and life science. . In this class, students will learn and understand each virus in the aspect of molecular biology, immunology and viral pathology. Particularly, the class covers viral diseases, such as AIDS, influenza, cancers, hepatitis in view of molecular pathogenic mechanism, disease progression, and the efforts for drug development. In addition various strategies to develop antiviral agents and role of viruses as a tool of biotechnology will be discussed.
Biological Sciences	BIO3013	Microbial Genetics and Physiology	Undergraduate (high graders)	Theory	3	6	3	Major	This course consists of two major parts; bacterial genetics and physiology. Bacterial genetics includes transformation, transduction, conjugation, plasmids, transposable elements, bacteriophages, mutant isolation, strain construction, bacterial gene expression and genetic engineering. Bacterial physiology covers physiological implications of nutrition, transport, catabolic metabolism, fermentation, energy generation, biosynthesis, effects of environmental factors on microbes, and molecular microbial physiology. Prior registration of Micro biology course is recommended.
Biological Sciences	BIO3014	Animal Development	Undergraduate (high graders)	Theory	3	6	3	Major	Animal development is the study (descriptive or experimental)of changes in the form or shape of animal during their embryonic phase. The ultimate goal of this subject is to understand the mechanisms of early embryonic development, gene control, cell differentiation and morphogenesis.
Biological Sciences	BIO3015	Human Reproduction	Undergraduate (high graders)	Theory	3	6	3	Major	As a lecture discussion, this course focuses on the human reproduction, especially the reproductive physiology of male and female and pregnancy. In addition, subjects on reproductive health, such as contraception and the prevention of venereal disease will be lectured.

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Biological Sciences	BIO3016	Brain Science	Undergraduate (high graders)	Theory	3	6	3	Major	Neurological behavior will be explained by physical-chemical methods. Upon these understandings, animal behavior and cognizance governed by nerve cells will be discussed at the molecular level.
Biological Sciences	BIO3017	Tumor Biology	Undergraduate (high graders)	Theory	3	6	3	Major	Tumor is considered as a micro-evolutionary process of cells in the multicellular organism. Based on such notion, this class is designed to offer in depth analysis and discussion on the mechanism of tumorigenesis, emerging concepts and connections, and progression to cancer. A special emphasis is made on the role of cell growth promoting factors, aberrant regulation of gene expression, intracellular signal transduction, and mechanism of tumor cell metastasis. In addition, modern approaches for prevention and diagnosis of cancer as well as new advances in anti-cancer therapy will be discussed.
Biological Sciences	BIO3018	Infection Response Biology	Undergraduate (high graders)	Theory	3	6	3	Major	Living organisms recognize infection and environmental changes through a series of cell-cell interactions and/or signaling. They keep their integrity by responding to the each condition appropriately through sophisticate signal transduction pathways. This class covers entire signaling and responsive pathways from the early stage of receptor-mediated recognition of infection and/or environmental changes to the intracellular gene expression and regulation, ultimate adaptation of cells or each organism to a new environment.
Biological Sciences	BIO3019	Biomolecular Structure and Function	Undergraduate (high graders)	Theory	3	6	3	Major	This class studies biological processes from structural perspectives and includes the following topics. First, the structural characteristics of various biological molecules such as protein and nucleic acids and the structure-function relationships of these molecules. Second, various biochemical and biophysical methods to study structures of biological molecules. Third, molecular interactions between biological molecules and their physiological meanings. Fourth, protein engineering and design. Fifth, computer modeling of biological molecules. Last, biological application of structural biology.

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Biological Sciences	BIO3020	Evolution	Undergraduate (high graders)	Theory	3	6	3	Major	The origin of life has attracted the most people's interest during the human history. This class discusses various hypotheses on the origin of life suggested by ancient Greek philosophers, the Darwinism and Neo-Darwinism, and molecular evolution which has brought the evolution to one of the major fields in life science. In addition, the class includes the following topics; evolution and creation-ism, prebiotic evolution of biological molecules, evolution of cell, evidences of evolution, selectionism and neutral theory, evolution of human being, the future of evolution and extraterrestrial life, biotechnology of in vitro evolution.
Biological Sciences	BIO3026	Senior Thesis	Undergraduate (high graders)	Independent Research	1	2	0	Major	In this course, senior students survey new concepts and methods in advanced biological fields through in-depth review and discussions on selected topics from the recent literature. Alternatively, students many learn key biological methods and scientific approach applied to modern biology by conducting experimental research under the supervision of a faculty member. This work will result in the writing of a thesis to be evaluated by committee members.
Biological Sciences	BIO3027	Animal Physiology Laboratory	Undergraduate (high graders)	Experiment	2	4	4	Major	The animal physiology laboratory aim to acquaint the student with animal physiology problems and with the more important methods of animal physiology research.
Biological Sciences	BIO3029	Microbiology Laboratory	Undergraduate (high graders)	Experiment	2	4	4	Major	Basic methodologies used in general microbiology will be taught. It will include methods of culturing and handling of microorganisms, observing microorganisms and their structures, enzyme assay of microbial enzymes, enumeration of microorganisms, microbial growth, culturing bacteriophages, microbial genetics, medical, and food microbiology. Concurrent registration with Microbiology course is strongly recommended.

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Biological Sciences	BIO3030	Ecology Laboratory	Undergraduate (high graders)	Experiment	2	4	4	Major	This course offers practice in a broad range of experimental ecological methodology with relation to major concepts in ecology, such as distribution and abundance of organisms, population dynamics and community structure. The course is consisted of two field trips:2-3 days for intertidal habitats in Namhae Island and one day trip to tidal mudflat on the west coast.
Biological Sciences	BIO3031	Immunology Laboratory	Undergraduate (high graders)	Experiment	2	4	4	Major	This laboratory course is designed to observe in vivo and in vitro immune responses and to introduce methods for basic immunological analysis through following experiments; Isolation of immune cells and tissues, antibody production and purification, qualitative and quantitative analysis of antigens and antibodies, measurement of cytokine effects on immune cells, and immune cross-reactivity analysis between species.
Biological Sciences	BIO3032	Virology Laboratory	Undergraduate (high graders)	Experiment	2	4	4	Major	This class covers basic technologies for virus research, through a series of experiments with poliovirus vaccine vector. Students are encouraged to generate recombinant polioviruses expressing foreign viral gene, which will be used to evaluate the immunogenicity in vaccinated mice against the foreign virus. Through the experiments students will learn the basic technologies required for the research of animal virus, such as animal cell culture, generation of recombinant virus, one-step growth curve, plaque assay, analysis of antiserum after vaccination, titration of neutralizing antibody, neutralizing inhibition assay, etc.
Biological Sciences	BIO3037	Genetic Engineering	Undergraduate (high graders)	Theory	3	6	3	Major	This course will emphasize the basic concepts and principles of genetic engineering ranging from recombinant DNA technology to new aspects of modern bio-engineering such as RNA interference. Through this course, students will understand how basic principles in life sciences are applied to molecular therapeutics of several diseases as well as modern biotechnology.

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Biological Sciences	BIO3038	Molecular and Cellular Glycobiology	Undergraduate (high graders)	Theory	3	6	3	Major	Since protein-glycan interaction seems to play a role in many of the cases, it is essential to elucidate the mechanism. The significance of glycobiology is mainly derived from the findings that cell surface glycans are critically involved in cell adhesion and, thus, cell-cell interaction. The lecture aims to review current knowledge of the roles of carbohydrates in cell adhesion and modulation of protein function, the histological background that led to recent discoveries, and the prospects in this field. The lecture also encompasses the pathological consequences in humans of defects in glycoprotein glycosylation, study of which has shed light on the roles of
Biological Sciences	BIO3042	Molecular and Cellular Glycobiology Experiment	Undergraduate (high graders)	Experiment	2	4	4	Major	Background: Change of the cell surface glycosylation is one of the most important modifications that occur in cellular transformation such as development, differentiation, growth, aging, immune system and oncogenesis. Experiments: The experimental lecture aims to analyze the glycan structures such as glycoprotein and glycolipids localized in cell surfaces and tissues. Since the current knowledge of the roles of carbohydrates in cell adhesion and modulation of protein function, the histological analysis of tissue glycans and in vitro cellular localization of glycans are needed with respect to functional glycomics and
Biological Sciences	BIO3044	Plant Physiology	Undergraduate (high graders)	Theory	3	6	3	Major	This lecture covers diverse physiological phenomena of plants such as photosynthesis, stress physiology, plant development or nutrient movements. For most part, basic biochemical and molecular biological principle will be adopted to understand these processes. The level of this course will be adequate for the students who finished the "general biology" course.
Biological Sciences	BIO3045	Neurogenetics	Undergraduate (high graders)	Theory	3	6	3	Major	In this course, we will discuss where animal behaviors come from and how they controlled by genes. By generating and studying mutant animals that exhibit abnormal behavior, mistakes in neural wiring, or anomalies in the structure or function of neurons, neuro-geneticists can track down the genes responsible for these phenotypes, thereby understanding the function of the genes in producing a normal brain and its associated behaviors. This relationship between the genetic mechanisms in the brain and behavior will be discussed.

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Biological Sciences	BIO3048	Translational Biology	Undergraduate (high graders)	Theory	3	6	3	Major	Translational biology will cover basic knowledge on therapeutic agents and therapeutics against human diseases. This lecture will deal various therapeutic agents against diverse human diseases and principles involved in the development of many bio-therapeutic agents including therapeutic proteins, therapeutic cells, and other bio-therapeutics. We will also study about mechanism of action of bio-therapeutics and current issues on the development of bio-therapeutic agents.
Biological Sciences	BIO3050	Individual Studies in Biological Science2	Undergraduate (high graders)	Independent Research	1	2	0	Major	This course is designed to provide a student individual studies in biological science during the 3rd~4th years. Students who have completed BIO2014 (Individual Studies in Biological Science 1) are eligible. Students carry out research on the selected theme under the guidance of the professor in the specific area of interest and to submit research reports. This is to offer pre-research activities which will lead to the research for undergraduate thesis required for completing a B. S. degree program in Biological Science.
Biological Sciences	BIO3051	Laboratory of Plant Taxonomy	Undergraduate (high graders)	Experiment	2	4	4	Major	The aim of the class entitled “Laboratory of Plant Taxonomy” is to learn and practice conceptions and their applications in various topics in plant taxonomy (or systematics). In addition, this laboratory course is designed to help students to explore new frontiers and emerging fields in plant taxonomy. Several topics that will be covered in depth throughout this class include identification of major flowering plant families and determination of their phylogenetic relationships, principles and methods of phylogenetic systematics, principles and applications of molecular systematics, and application of phylogenomic data in plant systematics.
Biological Sciences	BIO3053	Molecular and Environmental Biology	Undergraduate (high graders)	Theory	3	6	3	Major	With development of integrated multidisciplinary research area, undergraduate students in biological science learn general molecular biology. In this class, students learn how environmental biology can be integrated with molecular biology based on gene structure and expression in response to environmental pollutants in the levels of organisms to molecular response.

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Biological Sciences	BIO4001	Molecular Cell Biology	Graduate (Bachelor/Master)	Theory	3	6	3	Major	The main focus of this course is to understand the structure/function relationship of the cell at the molecular level. In the first part of the course we will discuss the structure and the function of the cell organelles; later, we will examine how these organelles are inter-related to perform the cellular function as a whole.
Biological Sciences	BIO4003	Advanced Genetics	Graduate (Bachelor/Master)	Theory	3	6	3	Major	In this course, more updated and in-depth stories of the contents that were studied in undergraduate genetics are discussed. The included subjects are the principle of Mendelian genetics and its exceptions. molecular mechanism of Mendelian genetics, gene expression and regulation, replication, recombination, linkage, translation, mutation and genetic diseases.
Biological Sciences	BIO4011	Advanced Animal Physiology	Graduate (Bachelor/Master)	Theory	3	6	3	Major	This course deals with the details in the function of animals and their constituent parts by understanding the mechanisms that operate in the living organisms at all levels, ranging from the subcellular to the integrated whole animal.
Biological Sciences	BIO4012	Advanced Animal Development	Graduate (Bachelor/Master)	Theory	3	6	3	Major	This lecture addresses the descriptive or experimental aspects of changes in the form or shape of animal during their embryonic phase. The main goal of this subject is to understand the mechanisms of early embryonic gene control, cell differentiation and morphogenesis

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Biological Sciences	BIO4021	Neurobiology	Graduate (Bachelor/Master)	Theory	3	6	3	Major	Physical properties and biochemical activities of a neuron will be lectured. In addition to the sensory and motor functions of the neuron, the integrative function of the neuron will be discussed.
Biological Sciences	BIO4024	Advanced Ecology	Graduate (Bachelor/Master)	Theory	3	6	3	Major	Details in ecological concepts are reviewed from its history to future direction on top of the general overview covered by the undergraduate ecology course. Particular emphases on ecological theory will include competition, predation, mutualism. Species coexistence on the evolutionary process is evaluated by understanding resource partitions and life history strategies of organisms. Community dynamics and regulation are explained in the light of equilibrium and non-equilibrium theories.
Biological Sciences	BIO4027	Bioscience Field Training and Job Practice I	Graduate (Bachelor/Master)	Internship	1	2	0	Major	This class provides filed training and job practice in the Research Institute and/or bio-industry for 2 weeks per semester during the summer or winter vacation. Students, who want to have a Field experience in the Research institute or Industry, are strongly encouraged to take this course. This course will give you a chance to improve and expand your basic knowledge and fundamental technologies obtained in the university.
Biological Sciences	BIO4028	Bioscience Field Training and Job Practice II	Graduate (Bachelor/Master)	Internship	2	4	0	Major	This class provides filed training and job practice in the Research Institute and/or bio-industry for 4 weeks per semester during the summer or winter vacation. Students,who want to have a Field experience in the Research institute or Industry, are strongly encouraged to take this course. This course will give you a chance to improve and expand your basic knowledge and fundamental technologies obtained in the university.

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Biological Sciences	BIO4029	Bioscience Field Training and Job Practice III	Graduate (Bachelor/Master)	Internship	3	6	0	Major	This class provides filed training and job practice in the Research Institute and/or bio-industry for 6 weeks per semester during the summer or winter vacation. Students,who want to have a Field experience in the Research institute or Industry, are strongly encouraged to take this course. This course will give you a chance to improve and expand your basic knowledge and fundamental technologies obtained in the university.
Biological Sciences	BIO4030	Bioscience Field Training and Job Practice IV	Graduate (Bachelor/Master)	Internship	4	8	0	Major	This class provides filed training and job practice in the Research Institute and/or bio-industry for 8 weeks per semester during the summer or winter vacation. Students,who want to have a Field experience in the Research institute or Industry, are strongly encouraged to take this course. This course will give you a chance to improve and expand your basic knowledge and fundamental technologies obtained in the university.
Biological Sciences	BIO4032	Microbial physiology	Graduate (Bachelor/Master)	Theory	3	6	3	Major	Graduate-level topics covering major principles and current research topics in microbial physiology
Biological Sciences	BIO4033	Microbial Genetics	Graduate (Bachelor/Master)	Theory	3	6	3	Major	Graduate-level course covering major principles and current research topics in microbial genetics

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Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Biological Sciences	BIO4034	Glycomics	Graduate (Bachelor/Master)	Theory	3	6	3	Major	Change of the cell surface glycosylation is one of the most important modifications that occur in cellular transformation such as development, differentiation, growth, aging, immune system and oncogenesis. Membrane domain is a transient supra-molecular organization assembled by specific glycoconjugates and sphingolipids. Although domain formation is promoted by purely physical interactions between components, synthesis and distribution of these components are under strict genetic control. Both glycoproteins and glycolipids carbohydrate moieties are affected by cellular transformation, leading to the appearance of
Biological Sciences	BIO4035	Molecular Glycobiology	Graduate (Bachelor/Master)	Theory	3	6	3	Major	Molecular Glycobiology will be focused on cellular and molecular mechanism(s) of cellular interaction phenomenon in eukaryotic cells and organs. Glyco-chains are biological chain-structures composed of monosaccharides, like galactose and glucose. Structural diversity of glyco-chains contributes to the efficiency of signal deciphering and transmission. Supra-biomolecular system composed of several membrane molecules through non-covalent bonding is recently recognized to play important roles for the signaling, and glyco-chains are involved in this supra-biomolecular system. Glyco-chain functions are supported by
Biological Sciences	BIO5001	Advanced Molecular Biology	Graduate (Master/PhD)	Theory	3	6	3	Major	Molecular biology is a major research tool to explain the biological phenomena. This class introduces various biological processes that are newly understood using molecular biological approaches. The topics s includes new findings on structure and modifications of DNA, replication, mechanism and applications of mutation, molecular regulation of gene expression, DNA recombination, protein synthesis.
Biological Sciences	BIO5003	Advanced Virology	Graduate (Master/PhD)	Theory	3	6	3	Major	Centering around the current viral diseases, Principles of virology with emphasis on fundamental physical-chemical properties, schemes of classification, genetics and mode of replication. action will be covered in the class.

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Biological Sciences	BIO5025	Plant Phylogenetics	Graduate (Master/PhD)	Theory	3	6	3	Major	The course aims an understanding of the characteristics and evolutionary trends of vascular plant taza above the order level and their phylogenetic relationships. The major characters contributing to the phylogenetic inference are reviewed on the viewpoint of theoretical bases and applications of the characters.
Biological Sciences	BIO5029	Plant Molecular Biology	Graduate (Master/PhD)	Theory	3	6	3	Major	This course is designed to teach general aspects of molecular biology in plant system. The contents include mechanisms underlying transcription/translation and expression/control of plant genes and comparing these phenomena to those occurring in animal and microobialsystems. This course is aimed at allowing students to familiarize them with the molecular events that operate during flowering and photosynthesis, the typical physiological functions in plants.
Biological Sciences	BIO5032	Marine Ecology	Graduate (Master/PhD)	Theory	3	6	3	Major	Biological dynamics of individuals, population and community in marine ecosystem will be evaluated by understanding direct and indirect interactions in marine food webs and abiotic factors that exert substantial influences on habitats of subtidal, intertidal and open ocean.
Biological Sciences	BIO5042	Community Ecology	Graduate (Master/PhD)	Theory	3	6	3	Major	This course deals with the theoretical background for how the community is organized and changed. Biotic and abiotic factors affecting population dynamics are reviewed with various habit at types. General succession models are mentioned in depth.

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Biological Sciences	BIO5050	Biology Signal Transduction	Graduate (Master/PhD)	Theory	3	6	3	Major	This course is designed to offer the most advanced yet most fundamental knowledge of the information processing in the multi-cellular organisms. The students will learn in detail on the subject of cell-cell communication, the mechanism of transmembrane as well as intracellular signal transduction leading to distinct cellular responses involving specific gene expression. A special emphasis will be made regarding how extracellular signals diverge into many signaling pathways, amplify, and then are controlled by feed-back mechanisms, to be ultimately integrated as a specific information.
Biological Sciences	BIO5067	Methodology in Environmental Monitoring	Graduate (Master/PhD)	Theory	3	6	3	Major	This course is to understand the application of various biomonitoring techniques used in detecting environmental changes and habitat degradation in ecosystems. Also the course deals in detail with BACI, remote sensing and GIS and the various uses of bio indicator species.
Biological Sciences	BIO5074	Proteomics	Graduate (Master/PhD)	Theory	3	6	3	Major	The set of proteins coded by a genome is called proteome. Proteomics can be defined as the qualitative and quantitative comparison of proteomes under different conditions to further unravel biological processes. This class is designed to review an expression proteomics and cell-map proteomics based on structure and functional relationship of proteins.
Biological Sciences	BIO5081	Special Topics in cellular Immunology	Graduate (Master/PhD)	Theory	3	6	3	Major	This course is designed to improve understanding on the mechanism of immune responses by examining interactions between cells and molecules of the immune system involved in the regulation of immune function as a natural defense system of higher organisms. Special emphasis is placed on the cellular and molecular interactions during the development and activation process for the acquisition and expression of immune function, focusing on the cytokine network which governs the immune homeostasis and regulation, through the in-depth review and presentation of the up to date research articles in the field and active

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Biological Sciences	BIO5085	Protein Biochemistry	Graduate (Master/PhD)	Theory	3	6	3	Major	Proteins are polymers composed of hundreds or even thousands of amino acids linked in series by peptide bonds. This class mainly will focus on the following subjects. 1. Protein basic theories, primary structure and biological functions 2. Secondary, Tertiary, and Quaternary structure 3. Basic Proteomics
Biological Sciences	BIO5086	Glycomics	Graduate (Master/PhD)	Theory	3	6	3	Major	This research aims at the elucidation of molecular mechanisms responsible for glyco-chain expression involved in the supra-bio-molecular system, and contributes to the establishing of integrative glycobiology and glycomics. (1) Expression analysis of glyco-chain related genes using DNA and Proteomic microarray. (2) Studies on the molecules controlling the expression of sialic acid species
Biological Sciences	BIO5088	Glyco signaling	Graduate (Master/PhD)	Theory	3	6	3	Major	Glycoproteins, sphingolipids and glycolipids are a family of bio membrane components in supra-biomolecular system. Supra-biomolecular system is considered to play important roles for signal transduction. This complex suggests that the targeting of lipids is highly regulated and that cells require complex supramolecular organization within membranes. In particular, glycoproteins, sphingolipid/cholesterol supramolecular domains have been recently revealed to play an important role in membrane biogenesis as well as signal transduction. This lecture focuses on enzymes involved in the glycoproteins, sphingolipid and glycolipid
Biological Sciences	BIO5089	Viral pathology	Graduate (Master/PhD)	Theory	3	6	3	Major	Viruses not only infect humans, but plants and other animals as well. They can wreck havoc on a population, in spite of their simple biological structure. But even though they are simple organisms from a biochemical and genetic standpoint, their power to cause harm is not due solely to their biological structure. It is also due to the biology of the life which can sometimes assist, and sometimes thwart, a viral invasion. This course emphasizes the details of how the immune system responds to a viral invasion. Graduate students of biological science can no doubt take advantage of this course to their graduate studies.

Course Description

Department/Major	Code	Course Title	Target Attendee	Course Type	Credit	Self-study Hour(s)	Contact Hour(s) Require	Requirement Type	Description
Biological Sciences	BIO5090	Viral oncology	Graduate (Master/PhD)	Theory	3	6	3	Major	Scientists have long been aware of the association between cancer and viruses, through the study with Epstein-Barr virus (EBV) human papilloma virus (HPV), hepatitis virus, adenovirus, HTLV, Kaposi's Sarcoma Virus (KSV), etc. This class covers the detail mechanism how viruses do their work by infiltrating cell pathways and how they provide a unique window into the cellular reprogramming that puts the cancer process in motion.
Biological Sciences	BIO5092	Stress Immunology	Graduate (Master/PhD)	Theory	3	6	3	Major	This course is designed to provide integrative approach for the analysis of mechanism of stress response in the living system evoked by diverse stressors of internal/genetic and external/environmental origin, by focusing on the super-regulatory system of the immune network. In particular, the role of oxidative stress on the chronic inflammation leading to the immune dysfunction and the mechanism of resilience is discussed
Biological Sciences	BIO5093	Expressional control of plant genes	Graduate (Master/PhD)	Theory	3	6	3	Major	This lecture concentrates on the updates in the area of plant genomics and expressional control of plant genes. The major lecture subjects include posttranscriptional gene silencing and functional genomics.
Biological Sciences	BIO5096	Cellular Application1	Graduate (Master/PhD)	Theory	3	6	3	Major	The course discuss about technical method of doing research that usually performed in each subject of cell-based applications. Applications include bioenergy, gene therapy, cell-based therapy, antibody therapeutics, protein therapeutics, gene circuit engineering, & tissue-engineering. Quantitative principles, computational methods, and experimental methods will be integrated into lectures. The course discussed about improving skill of planning and doing research in biology, by applying advanced technology based on recently literatures in line with the research topic proposed by the instructor and invited speakers.

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Biological Sciences	BIO5097	Cellular Application2	Graduate (Master/PhD)	Theory	3	6	3	Major	This class provides an advanced knowledge to the technical method of doing research that usually performed in each subject of cell-based applications. In order to take the "Cell Applications II" class, you must first have completed the "Cell Applications I" class. This is an in depth course focused on current applications of cell-based technology in the biomedical and pharmaceutical company. The course discussed about improving skill of planning and doing research in biology, by applying advanced technology based on recently literatures in line with the research topic proposed by the instructor and invited speakers.
Biological Sciences	BIO5098	Molecular Cancer Biology	Graduate (Master/PhD)	Theory	3	6	3	Major	What is cancer and how does it arise? This course is designed to provide molecular dissection of development, promotion and metastasis of cancer as well as its control methods. It will be pointed out that mechanism of cellular transformation involves abnormal expression of genes involved in the signal transduction process of cell growth regulation. The diverse approaches for cancer prevention and therapeutics will be also discussed with a special emphasis on the recent understanding of tumor-immune interaction in tumor micro-environment.
Biological Sciences	BIO5101	Research Design and Analysis	Graduate (Master/PhD)	Theory	3	6	3	Major	The effective experimental design and precise analysis is essential parts in various researches in ecology, physiology, genetics and medicine. Common errors such as pseudo-replication in research design are reviewed in detail. The course helps students to establish their own research design independently afterward.
Biological Sciences	BIO5103	Topics in Protein Interactions	Graduate (Master/PhD)	Theory	3	6	3	Major	Proteins act in the cell mostly by interacting each other at some point. Here we will discuss computational and experimental methods to detect protein interactions. Principles and limitations of each method will be discussed.

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Biological Sciences	BIO5105	Experimental Medical Sciences	Graduate (Master/PhD)	Theory	3	6	3	Major	This course will focus on understanding the principles of advanced experimental methods in molecular medicine and their protocols to study various human diseases. Furthermore, students will understand the basic concepts about the pathophysiology of human diseases. Also, emphasis will be placed on current papers using these experimental methods. Through this course, students will understand the concepts of target-oriented molecular therapeutics for human diseases.
Biological Sciences	BIO5107	Special Topics In Structural Biology	Graduate (Master/PhD)	Theory	3	6	3	Major	The purpose of this class is to enhance understanding of the structure-function relationship for biological macromolecules through reviews on technical tools such as X-ray crystallography, nuclear magnetic resonance, cryoelectromicroscopy and mass spectrometry and the latest research papers.
Biological Sciences	BIO5108	Advances In Molecular Medicine	Graduate (Master/PhD)	Theory	3	6	3	Major	This course will emphasize the molecular basis of human diseases through recent achievements in molecular medicine. Through this course, students will understand the fundamental theme of cell injuries causing various human diseases and the molecular mechanisms of cellular signal transductions responding to extracellular stimuli, pathological infections, oxidative and genotoxic stresses. This course ultimately provides students the core backgrounds of pathogenesis of human diseases and the concepts of target-oriented molecular therapeutics for human diseases.
Biological Sciences	BIO5109	Topics in Molecular Neurogenetics	Graduate (Master/PhD)	Theory	3	6	3	Major	Molecular Neurogenetics merges concepts and techniques from neurobiology and genetics to study the molecular basis of behavior and neural function. Here we will discuss several new developments in the field, including developmental neurobehavioral genetics, gene-gene interaction, new approaches in bioinformatics, gene expression based on various studies of model organisms ranging from rodents to invertebrates.

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Biological Sciences	BIO5110	Development of Bioactive Molecules	Graduate (Master/PhD)	Theory	3	6	3	Major	We will study about various kinds of bioactive molecules which regulate human physiological responses. The mechanism of action of bioactive molecule will be treated. The scientific approaches to apply knowledge on bioactive molecule for the development of therapeutic agents against human diseases will be covered. Current topic on bioactive molecule will be covered too.
Biological Sciences	BIO5111	Advanced Evolutionary Biology	Graduate (Master/PhD)	Theory	3	6	3	Major	All living organisms are evolving continuously. Evolutionary biology is the study of the mechanisms of evolutionary changes, a history of life and biodiversity. The objective of this course is the understanding of evolutionary processes by introducing principles through recent and classical studies of evolutionary theory, method, and interpretations of biological phenomena. The student will be expected to be understanding of the biodiversity, evolutionary patterns, Darwinian natural selection, mutation and genetic variation, populational genetics, adaptation and selection, endosymbiosis, and organelle evolution.
Biological Sciences	BIO5112	Plant Growth and Development	Graduate (Master/PhD)	Theory	3	6	3	Major	Principles of plant growth and development are the main theme of this course. We discuss how various transcription factors and plant hormones are involved in growth and development. We also discuss recent advances of the contemporary research and related research tools.
Biological Sciences	BIO5114	Advances in Molecular and Environmental Biology	Graduate (Master/PhD)	Theory	3	6	3	Major	With development of integrated multidisciplinary research area, graduate students in biological science learn general molecular biology. In this class, students learn how environmental biology can be integrated with molecular biology based on gene structure and expression and also genome in response to environmental pollutants in the levels of organisms to molecular response. This class will be taught by lecture and seminar.

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Biological Sciences	BIO5115	Advanced Phycology	Graduate (Master/PhD)	Theory	3	6	3	Major	Photosynthetic organisms has a long evolutionary history as old as the origin first life on Earth. Started from a cyanobacterium, photosynthesis has been spread into primary plastid groups via primary endosymbiosis, then transferred to diverse algal groups through secondary endosymbiosis. The objective of this course is the understanding of evolutionary relationships and distinct features of diverse photosynthetic algal groups. By introducing principles of evolutionary hypothesis and origin of photosynthesis with updated research results and methodologies, students will be experienced the diversity of the Tree of Life.