생명공학과

(DEPARTMENT OF BIOTECHNOLOGY)

**1. Department Introduction**

Department of Biotechnology was built for research in genetics and physiology of living organisms at molecular level, the application of the knowledges and skills to bioindustry, and for training of graduate students to become high-skilled leading scientists in biotechnology. The education curriculum is based on basic studies related to biotechnology such as genetics, molecular biology, physiology, and biochemistry, etc, and on learning new techniques on cutting-edge fields in biotechnology in plants, animals and microorganisms, so as to train high quality research scientists in the field. Main classes to be taken in the graduate program of biotechnology are molecular biology, experimental designs, biochemistry, molecular biology technique, cell biology, protein engineering, immunology, advanced biotechnology, embryology, molecular genetics, molecular physiology, bioinformatics, plant metabolic physiology, signal transduction, metabolomics, endocrinology, animal genome analysis, genetic mechanisms in mammal, experimental design and data analysis, plant hormones, plant environmental physiology, plant developmental biology, animal physiology, quality improvement of plants, statistical genetics, animal breeding, natural pharmaceuticals, natural products analysis, instrumental analysis, human biology.

**2.** **List of Faculty Members** 학과 교수명단

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| position | Name | Last School Graduated | Degree | Major |
| Associate professor | Kang, Sang Gu | Iowa State Univ. | Ph.D | Genetics, Molecular Biology |
| Associate professor | Kim, Jong Joo | Texas A&M Univ. | Ph.D | Bioinformatics |
| Professor | Park, Euiho | Seoul National Univ. | Ph.D | Plant Molecular Breeding |
| Assistant Professor | Baek, Kwang Hyun | Washington State Univ. | Ph.D | Plant Molecular Physiology |
| Professor | Yeo,Jung Sou | Seoul National Univ. | Ph.D | Animal genetics |
| Assistant Professor | Shim, Sang Hee | Seoul National Univ. | Ph.D | Natural Products |
| Associate professor | Cho, Kyung Hyun | Kyung pook National Univ. | Ph.D | Biochemistry |
| Professor | Choi, Inho | Univ. of Florida | Ph.D | Molecular Biology |
| Professor | Choi, Chang Bon | Univ. of North Dakota | Ph.D | Physiology & Endocrinology |
| Assistant Professor | Bae, Han Hong | Iowa State Univ. | Ph.D | Plant Molecular Biology |
| Assistant Professor | Kim, Ji Hoe | Univ. of Phillips | Ph.D | Protein Biochemistry |

**3. Course Description**

**■ 기초공통(Basic Major Courses)**

동물 및 인체 유전학특론 3 credit

(ADVANCED ANIMAL AND HUMAN GENETICS)

The structure and function of the gene, a key molecule of heredity, will be taught in detail. In addition, genome stability, and its rearrangement and mutagenesis in human and animals, DNA repair, homologous and site specific recombination, chromosome segregation etc. will be covered through the classes. New research tools, lately developed techniques and future directions of the research in the field will also discussed.

동물생리학특론 3 credit

(ADVANCED ANIMAL PHYSIOLOGY)

Animal physiology class is designed for the new graduate students majoring in animal medical biotechnology to have them understand the basic theories of animal and human physiologies and eventually provide them informations necessary for taking advanced animal and medical biotechnology classes. Tissues of animal body and anatomy, nervous system, muscle and skeletal bones, digestive system, reproductive system, respiratory system, cardiovascular system, endocrine system, urinary system will be covered through the classes.

면역세포학특론 3 credit

(ADVANCED IMMUNOLOGY)

Immunology is a broad branch of biomedical science that covers the study of all aspects of the immune system in all organisms. The class will focus on the human immune system introducing its structure and components, in addition, the molecular mechanism and regulation of immune reactions will be covered.

분자생리학특론 3 credit

(ADVANCED MOLECULAR PHYSIOLOGY)

This course teaches the concepts of animal nutrition with understanding the molecular physiology of health, nutrition, and supplementation.

분자유전학특론 3 credit

(ADVANCED MOLECULAR GENETICS)

This advanced molecular genetics lectures for the principles of genetics in molecular levels for understanding gene structure and function at the molecular level, including regulation of gene expression, genetic rearrangement, and the organization of genetic information, genetic engineering, genomics, proteomics, gene mapping in prokaryotes and eukaryotes.

생화학특론 3 credit

(ADVANCED BIOCHEMISTRY)

Advanced biochemistry course is designed for the graduate students who have already taken basic biochemistry or related classes during their undergraduate course and want to learn more higher level of biochemist as a graduate majoring in biotechnology. The organic structure and synthetic process of each biological material, and biochemical metabolic pathway of each nutrient in cell will be deeply discussed through the class.

세포생물학특론 3 credit

(ADVANCED CELL BIOLOGY)

The primary objective of this course is to provide graduate students majoring in biotechnology with the latest information such as the trends and theories in the field of cell biology. Cell division mechanism, cell differentiation, cell communication mechanism, apoptosis (programmed cell death), cancer cells and their regulation will be emphasized during the course.

세포생화학특론 3 credit

(ADVANCED CELLULAR BIOCHEMISTRY)

Understanding of molecular basis for biological phenomenon and chemical nature of biomolecules. Interaction of DNA and proteins, carbohydrate, and lipid will be elucidated on molecular level.

실험설계 및 자료분석 3 credit

(EXPERIMENTAL DESIGN AND DATA ANALYSIS)

The purpose of this class is to understand important terminologies regarding statistics for biological data, relevant to systematic and structured experiment designs and its data analysis, and to understand methods on analysis of variances, regression analysis and covariate & variance analysis. Also, this class deals with various methods about experimental designs such as one-way, two-way factor analysis, latin squares, split plot, split-split plot designs etc. Parallel to acquainting the knowledges on the experimental designs and analysis methods, statistical package, SAS, is also practiced to gain how to handle and analyze real data.

이차대사산물학 3 credit

(PLANT SECONDARY METABOLITES)

This course teaches sciences and applications for plant secondary metabolites. Secondary metablic products are more complex than primary metabolites. Therefore, physiology, biochemistry, biotechnology for secondary metabolites will be lectured in this course.

**■ 전공(Major Courses)**

개별연구(1) 3 credit

(INDEPENDENT STUDY (1))

개별연구(2) 3 credit

(INDEPENDENT STUDY (2))

생명공학과세미나 1 credit

(BILTECHNOLOGY SEMINAR)

Lecture for the advanced information and knowledge of Biotechnology by students and professors every week

특수문제연구(1) 3 credit

(SPECIAL STUDY(1))

**■ 분자유전 생명공학전공 (MOLECULAR GENETICS & BIOTECHNOLOGY)**

과학논문작성법 3 credit

(WRITING SCIENTIFIC THESIS)

Especially for the MS course students, and introduction and practices of thesis writing. Contents of thesis, collection and organization of literatures, development and logic of introduction, constitution and description of literature review, analysis and interpretation of obtained results, drawing and layout of tables and figures, the description of discussions and its importances, abstracts and summary of experiments, overall organization of scientific thesis and also additive data or contents.

기기분석특론 3 credit

(ADVANCED INSTRUMENTAL ANALYSIS)

The principle and instrumentation for qualitative and quantitative analyses of various materials; the practical application of spectroscopy, voltammetry, chromatography, etc.

논문실험계획법 3 credit

(ADVANCED EXPERIMENTAL DESIGNS)

This class covers advanced topics in performing experimental designs for graduate students majoring in biotechnology, such as one-way, two-way factorial analysis, ANOVA, ANCOVA, etc. Also covers some Statistical software, SAS, to learn how to handle and analyze data and interpret the results.

대사 공학 특론 3 credit

(ADVANCED METABOLIC ENGINEERING)

Study of metabolic pathways that are involved in the synthesis of useful biomaterials based of the understanding of biochemical, enzymological, molecular biological, and bioinformatical understanding.

대사체학특론3 credit

(ADVANCED METABOLOMICS)

Metabolomics is a newborn cousin to genomics and proteomics. Metabolomics uses analytical biochemical techniques to measure various metabolites. Specifically, metabolomics involves the rapid, high throughput characterization of the small molecule metabolites found in an organism. This course introduces students to diverse analytical techniques to measure metabolites and their biotechnological applications.

동물육종학3 credit

(ANIMAL BREEDING)

This lecture covers major topics in animal breeding; breeding goal and strategy in major farm animals, inbreeding and relationship matrix, H-W equilibrium, selection forces, selection, mating system, selection response, marker-assisted selection, genome selection, etc.

생명공학특론 3 credit

(ADVANCED BIOTECHNOLOGY)

This course lectures for advanced biotechnology strategies and methods for microbial, plant and animal biotechnology by reviewing best successful accomplished research projects and developed technologies. Lecture covers technologies including genetic engineering, protein engineering, and production of natural chemicals. Lecture also covers topics for mass production for medicine, foods, bioactive natural products and macromolecules.

생물정보학특론 3 credit

(SPECIAL TOPICS IN BIOINFORMATICS)

The basic theory of bioinformatics and their applications will be systematically discussed in the class. The following topics will be covered in the course. The history and introduction of bioinformatics, basic theory of computer system for bioinformatics, construction and application bioinformatic data base, structure of data base in GenBank and its utilization (EST data base, Genomic DNA, genetic map data base, protein data base). Students will learn not only the basic theories of bioinformatics but the current research directions in bioinformatics through the class.

식물대사생리학특론3 credit

(PLANT METABOLIC PHYSIOLOGY)

This course introduces students to the fundamentals of plant physiology and metabolism and provides a broad overview of the flow of energy captured from sunlight during photosynthesis in plants. This course will cover plant carbon metabolism (photosynthesis, respiration, lipid biosynthesis), cell wall biosynthesis, cellulose and sugar metabolism.

식물 발달 생물학 3 credit

(PLANT DEVELOLMENTAL BIOLOGY)

This course will explore the central concepts during the plant development from a seed including analysis of plant structure and developmental patterns and the molecular, genetic, genomic and physiological bases of plant form and function. The course will focus on plant cells, tissues, and organs with special emphasis on experimental evidence for mechanisms regulating developmental processes. Prerequisite: plant physiology, plant biochemistry, and plant molecular biology.

식물육종학3 credit

(QUALITY IMPROVEMENT OF PLANTS)

This course comprises the accumulation of metabolites and formation of seeds, chemical composition of useful plant parts, characteristics and composition of proteins, lipids, and carbohydrates. And also does eating tastes and processing properties. compositional changes by cultural practices. Experimental design of the quality improvement, selection of better genotypes, artificial crossing, sterility and recurrent selection, transformation technique, quality improvement of food crops, industrial and medicinal plants are included.

식물 호르몬 3 credit

(PLANT HORMONES)

Plant hormones are one of the most important regulatory mechanisms for plant development, growth and stress resistance. Plant hormones are synthesized in various tissues and transported to the target tissues for regulating the cellular metabolism. This course is designed to deliver the advanced knowledge about the roles of plant hormones, hormone biosynthesis and transport in cells, gene expression regulation at cellular, biochemical, and molecular levels.

식물 환경 생리학 3 credit

 (PLANT ENVIRONMENTAL PHYSIOLOGY)

As an autotrophic organism, plants provide nutrients and oxygen to heterotrophic organisms. This course is designed to teach the mechanism and the metabolic processes of photosynthesis, which provides nutrients and oxygen to heterotrophic organisms and is the enteral regulator for the Earth ecosystem. This course also covers the signal molecules and metabolic processes improving tolerance for environmental stresses.

신호전달체계 3 credit

(SIGNAL TRANSDUCTION)

Cells, the most fundamental unit for the life, are continuously exposed by external environment (light, air, temperature, etc) and by internal environment (hormones, neurotransmitters, nutrition and health status and stress, etc). Responding to the variety of environmental factors, cells try to continuously change the inside of the cells to survive.

A variety of signals from the environment are recognized by the specific-protein in the cells and transmitted into the nucleus through many of complicated signal transduction systems, which in turn triggerthe expression of a certain genes involved in cell modification responding to the environment. There are so many of different mechanisms by which the signals are sent to the cell. Therefore, the principle of the signal transduction mechanism being used by many of animal and plant cells will be deeply discussed in this course.

유전공학 3 credit

(GENETIC ENGINEERING)

This course will teach the various basic laboratory techniques relating modern biotechnology including the isolation and purification of nucleic acids, restriction analysis, gene cloning, PCR amplification, cDNA synthesis, DNA sequencing and gene expresssion, and further protein analysis, which are widely used in biotechnology research field.

유전체분석3 credit

(GENOME ANALYSIS)

Principles and methodology of molecular genetics in analysing and modifying in animal genomes included survey of statistical methods, mapping techniques of physical, linkage, and radiation hybrid panel, quantitative trait loci.

응용미생물학 특론3 credit

(ADVANCED MICROBIOLOGY)

This class will provide the knowledge of microorganism utilization in the production of wide range of beneficial materials, including enzymes, pharmaceuticals, foods, and in the application for clean technologies, especially waste treatment and pollution control. Molecular biology, biochemistry, and signal transduction of various microorganisms will be covered for delivering the information.

조직배양특론3 credit

(ADVANCED TISSUE CULTURE)

Tissue culture techniques can be applied to rapid propagation, virus-free stock production, and beneficial compound production. This class introduces the concept and the application of these tissue culture techniques, and also deals with the examples of real applications in industry.

천연물분석학특론3 credit

(NATURAL PRODUCTS ANALYSIS)

This class will provide the knowledge of instrumental analysis to identify natural compounds from natural sources, including EI-MS, LC-MS, GC-MS, 1H-NMR, 13C-NMR, 2D-NMR, UV, IR, etc.

천연약품학특론3 credit

(NATURAL PHAMACEUTICALS)

This lecture will introduce drugs which are derived from natural resources, for example, several antibiotics, anticancer agents such as taxol, etc. This lecture will emphasize on how they have been developed for new natural medicines and how important they are in new drug discoveries.

통계유전학3 credit

(STATISTICAL GENETICS)

This lecture covers basic theory in population and quantitative genetics, and statistical methodologies that are used in genetics; H-W equilibrium tests, F-statistics, phylogenetic tree construction, QTL (linkage and linkage disequilibrium) mapping methods, BLUP for genetic parameter estimation, genome-wide association analysis, genome selection, etc.

**■ 동물 및 의학 생명공학전공(ANIMAL AND MEDICAL BIOTECHNOLOGY)**

내분비학특론 3 credit

(ADVANCED ENDOCRINOLOGY)

The microstructure of the endocrine glands, characteristics of the each hormone, and their physiological functions in both animal and humans will be discussed in detail during the course. Especially, the updated research tools and research directions in each hormone will taught.

단백질공학특론 3 credit

(ADVANCED PROTEIN ENGINEERING)

Protein architecture, structural biology of proteins, and introduction to bioinformatics to sequences, and is intended to focus on protein function including integration and regulation based on biochemical background. Students will learn about the logic of life as about its chemistry, which are sequence, structure, and function, those are involved in incidence of human disease, cancer, heart, brain disease.

동물생명공학특론 3 credit

(ADVANCED ANIMAL BIOTECHNOLOGY)

Animal Biotechnology covers the identification and manipulation of genes and their products, stressing applications in domesticated animals. Application of genetic engineering techniques via recombinant DNA technology and embryo technology.

동물세포공학특론 3 credit

(ADVANCED ANIMAL CELL ENGINEERING)

Students learn about stem cell and cancer in this course. This course introduces cell structure, function and composition. In addition, technologies to expedite drug discovery and screening processes will be discussed based on recent stem cell researches for the ultimate goal of treating human disease.

동물영양화학특론 3 credit

(ADVANCED ANIMAL NUTRITION AND CHEMISTRY)

This subject provides students with contemporary biochemical/physiological aspects of nutrition and outlines the relationship between nutrients and health in animal. It presents techniques involved in the assessment of both requirements and deficiencies of particular nutrients and stresses the importance of nutritional interactions.

동물유전체학특론 3 credit

(ADVANCED ANIMAL GENOMICS)

Genomics is the one of the dramatically growing biological science fields. The objectives of the course is to have student understand the basic theory of the structure and function of human and animal genomes, research methods for genome research, and its application as well as future directions will be discussed in detail.

발생공학특론 3 credit

(ADVANCED EMBRYO ENGINEERING)

 The developmental process of animal as well as human embryonic cells derived from a fertilized egg and its completion of the body formation will be discussed in detail. In addition, genetic modification of embryonic cells by introduction of foreign genes, nuclear replacement using micromanipulator, and division and mixing of different embryonic cells will be taught for the creation of a new animal or for the treatment of genetic diseases.

분자생물학특론 3 credit

(ADVANCED MOLECULAR BIOLOGY)

This course is designed for the graduate students who have already taken basic molecular biology, cell biology, biochemistry, and physiology courses at the college level. More updated theories in the field of molecular biology and current issues will be discussed in detail. The primary objective of the course is to give students insight into the molecular mechanism by which genetic informations are able to maintain and regulate the life. The following topics will be discussed during the course. The structure of gene, replication, transcription, translation, gene regulation, current status and perspective of the genome project.

생물통계분석특론 3 credit

(ADVANCED BIOSTATISTICS)

Biostatistics can be defined as the application of the mathematical tools used in statistics to the fields of biological sciences and medicine. Biostatistics is a growing field with applications in many areas of biology including epidemiology, medical sciences, health sciences, educational research and environmental sciences. Basic concepts and methods in statistics will be introduced and applications in biology will be discussed.

생식생물학특론 3 credit

(ADVANCED REPRODUCTIVE BIOLOGY)

This course is designed for graduate students to learn about the detail structures of male and female reproductive systems, functions of each cells and tissues in reproductive organs, and hormonal controls of reproductive oragans in human as well as animal. Besides, hot issues currently facing in reproductive medecine will be also discussed in depth.

생식세포학특론 3 credit

(ADVANCED ANIMAL REPRODUCTIVE CELL)

Learning the advanced physiological processes and development of reproductive cells of animals included human and their in-vitro manipulation for the genetic improvement and production of transgenic animals. Moreover, study the theores and practical application of embryo stem cell to medical area and biotechnical utilization in animal improvement.

실험동물학특론 3 credit

(ADVANCED LABORATORY ANIMAL CARE)

This course is designed to have student precisely understand the physiological characteristics of the laboratory animals and their maintenance condition for the research. Practice of animal caring and dissection will make the student better understand on optical way to take care of laboratory animals.

암생물학특론 3 credit

(ADVANCED CANCER BIOLOGY)

This course is an understanding, diagnosis and treatment of cancer. This course is opened to oncologists, specialist clinicians dealing with cancer. many areas such as pathology and genetics of human cancers (cervical, breast, head and neck, gastric, lung and urogenital cancers), childhood cancer, cancer stem cells, cancer vaccines, pharmacogenomics and personalized medicine, functional genomics, oncogenes and tumor suppressor genes, cell cycle and apoptosis, cancer susceptibility and RNAi and cancer therapeutics.

유전자발현특론 3 credit

(ADVANCED GENE REGULATION)

Learning the advanced physiological processes and development of reproductive cells of animals included human and their in-vitro manipulation for the genetic improvement and production of transgenic animals. Moreover, study the theores and practical application of embryo stem cell to medical area and biotechnical utilization in animal improvement.

의생명공학특론 3 credit

(ADVANCED BIOMEDICAL ENGINEERING)

Students learn concepts of human diseases caused by defective metabolisms and genetic disorders etc. In addition, biomedical engineering of genes, proteins and cells for therapeutic applications will be covered.

인체대사생화학특론 3 credit

(ADVANCED BIOCHEMISTRY IN HUMAN METABOLISM)

Metabolism is the mechanism of living cells to maintain their survival extracting energy from nutrients. Metabolism is a complex network of chemical reactions. Metabolic pathways in human for energy production will be introduced and metabolic diseases and therapeutic methods will be discussed based on recent research articles.

인체생물학특론 3 credit

(ADVANCED HUMAN BIOLOGY)

This course is designed for the new graduate students who have taken a variety of biological science classes during college years to provide students with the basic concepts of life, especially human beings. Structure and function of each organ in the human body will be discussed with the emphasis on relevant disease in each organ. The following topics will be covered in the class: basic structure and function of tissues, skeletal and muscular tissues, cardiovascular system, immune system, respiratory system, endocrine system, digestive system, urinary system, cancer development, aging process. Especially topics related to cancer will be discussed in detail during the lectures.

인체생화학특론 3 credit

(ADVANCED HUMAN BIOCHEMISTRY)

With knowledge of biochemical structures of DNA and proteins, carbohydrates and lipids, students will be familiar to principle of biochemistry. Student can apply the Biochemical knowledge for their future in industry.

체외진단기기특론 3 credit

(ADVANCED POINT OF CARE INSTRUMENT)

Point-of-care(POC) is defined as diagnostic testing at or near the site of patient care. The driving notion behind POC is to bring the test conveniently and immediately to the patient. This increases the likelihood that the patient will receive the results in a timely manner.

POC is accomplished through the use of transportable, portable, and handheld instruments (e.g., blood glucose meter, nerve conduction study device) and test kits.

효소화학특론 3 credit

(ADVANCED ENZYME CHEMISTRY)

All living organisms are composed of cells, a basic unit. Furthermore, all events in cells follows basic laws in chemistry. Therefore, the study about reactions in cells on chemistry level will help to understand living organisms.