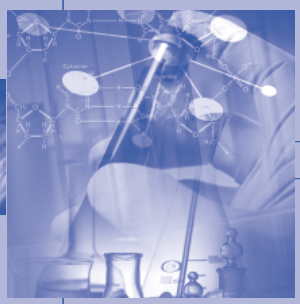

Course Description

1. General Description

The curriculum of SNU is derived from Article 56 of the Academic Regulations of the University. Various details prescribed in this curriculum are therefore effective as ancillary regulations of the Academic Regulations.
The undergraduate programs consist of general courses designated for general educations and major courses designated for specialization in various areas of study. The graduate programs comprise both the Master's program and the Doctoral program. However, such distinction is not made in the graduate curricula. In other words, departments may have their own requirements for the Master's or the Doctoral program. Nevertheless, both programs are integrated in the present curriculum.

2. Undergraduate Courses

Course Requirements in the Undergraduate Courses

The undergraduate course leading to the B.S. degree is a four-year program with 8 semesters of actual attendance required. The number of credits required for the completion of the undergraduate program is 140 or more. This must include a minimum of 113 credits in major required courses, and a minimum of 27 credits in major elective courses for Department of Pharmacy and Department of Manufacturing Pharmacy.
Major courses are listed in the curriculum of each department. There are required and elective courses, designated by the department. Major courses that are offered by the department but are not specified as requirements are the elective courses.

Experiential Pharmacy Practice Education

▶ The Goal of Pharmacy Practice Experience

The purpose of the pharmacy practice experience is to prepare future graduates with the professional competencies to enter pharmacy practice settings including community, institutional pharmacy, industry, and pharmaceutical health policy and management. The pharmacy practice experiences involve actual practice experiences in direct patient care settings as permitted by practice regulations to assume responsibilities under appropriate supervision of the pharmacist-preceptor or clinical pharmacy professor.

▶ The Contents of Pharmacy Practice Program

The experiential pharmacy practice program is developed to integrate, apply, reinforce, and advance the knowledge, skills, attitudes, and values developed through the other components of the curriculum.

▶ The Stages of Experiential Pharmacy Practice Education

The pharmacy practice experience is organized to provide a balanced series of required and elective experiences that cumulatively provide sustained experiences.

▶ Required Introductory Pharmacy Practice Experiences

Students participate in four required introductory pharmacy practice settings including community pharmacy, hospital pharmacy, industry, and health policy and management agencies to apply formal classroom training to the pharmacy practice, as appropriate. Through this experience, students can strengthen their patient care skills through a wide array of pharmacy practice experiences.

▶ Elective Advanced Pharmacy Practice Experiences

Through this elective pharmacy practice experiences, students can develop advanced clinical skills to function effectively in specialized pharmacy practice environments.

▶ Affiliated Practice Facilities and Institutions

Seoul National University College of Pharmacy has many affiliated practice facilities including, but not limited to, hospitals, retail pharmacy, industry, and health policy agencies for the education, research and clinical practice to improve the quality of pharmacy education and pharmaceutical care services.

3. Undergraduate Courses at a Glance

First year, First Semester

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
Major Required Courses				
370.1101	Introduction to pharmacy and pharmacy ethics	1	2	0
370.1102	Physical Pharmacy 1	3	3	0
370.1104	Pharmaceutical Analysis 1	3	3	0
370.1106	Pharmaceutical Chemistry 1	3	3	0
370.1108	Biochemistry 1	3	3	0
370.1110	Human Anatomy for Pharmacists	2	3	0
370.1111	Physiology for Pharmacists	2	3	0
370.1112	Cell Biology and Genetics	2	2	0
370.1113	Pharmaceutical Laboratory 1(Pharmaceutical Chemistry, Pharmaceutical Analysis, Physical Pharmacy.)	1	0	4

First year, Second Semester

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
Major Required Courses				
370.1103	Physical Pharmacy2	2	3	0
370.1105	Pharmaceutical Analysis 2	2	3	0
370.1107	Pharmaceutical Chemistry 2	2	3	0
370.1109	Biochemistry 2	2	3	0
370.1201	Synthetic pharmaceutical chemistry 1	3	3	0
370.1202	Pharmacognosy 1	3	3	0
370.1203	Microbiology and Imunology 1	3	3	0
370.1204	Preventive Pharmacy 1	2	3	0
370.1114	Pharmaceutical Laboratory 2(Pharmacognosy, Pharmaceutical Natural Products Synthetic, Pharmaceutical Chemistry)	1	0	4

Second year, First Semester

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
Major Required Courses				
370.2101	Synthetic Pharmaceutical Chemistry 2	2	3	0
370.2102	Pharmacognosy 2	2	3	0
370.2103	Microbiology and Imunology2	2	3	0
370.2104	Preventive Pharmacy 2	3	3	0
370.2105	Pharmacology 1	3	5	0
370.2107	Pharmaceutics 1	2	3	0
370.2109	Pathology for Pharmacists	2	3	0
370.2110	Pharmaceutical Statistics	2	2	0
370.2111	Pharmaceutical Laboratory 3(Microbiology and Imunology, Biochemistry, Preventive Pharmacy)	1	0	4

Second year, Second Semester

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
Major Required Courses				
370.2106	Pharmacology 2	2	3	0
370.2108	Pharmaceutics 2	2	3	0
370.2113	Introduction of Clinical Pharmacy 1	3	3	0
370.2114	Introduction of Clinical Pharmacy 2	3	3	0
370.2115	Medicinal Chemistry 1	2	2	0
370.2116	Industrial Pharmacy and Good Manufacturing Practice	2	2	0
370.2117	Pharmacopeia and Quality Control	2	2	0
370.2118	Law in Pharmacy Practice	1	2	0
370.2112	Pharmaceutical Laboratory 4(Anatomy-Physiology-Pathology, Pharmacology, Pharmacetics)	1	0	4

Course Description

Third year, First Semester

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
Major Required Courses				
370.3101	Pharmacotherapy 1	4	4	0
370.3102	Pharmacotherapy 2	4	4	0
370.3105	Herbal Therapeutics	2	3	0
370.3106	Practice Experience 1(Industry Pharmacy)	3	0	160
370.3109	Pharmacotherapy Laboratory 1	1	0	2
Major Elective Course				
Department of Pharmacy				
376.301	Molecular Oncology	3	3	0
376.302	Cellular Signal Transduction	3	3	0
376.303	Advanced Pharmacology in Biological Topics	3	3	0
376.304	Biotechnology in Pharmacy	3	3	0
376.305	Natural Product Chemistry	3	3	0
376.306	Medicinal Plants and Practice	3	3	0
376.307	Forensic Pharmacy	3	3	0
376.308	Neuropharmacology	3	3	0
376.309	Biochemical Pharmacology	3	3	0
376.310	Target Organ Toxicity	3	3	0
376.311	Free Radicals in Health and Diseases	3	3	0
376.312	Pediatrics Pharmaceutical Care	3	3	0
376.313	Medicinal Chemistry 2	3	3	0
376.314	Recent Pharmaceutical Chemistry	3	3	0
376.315	Pharmacy Adminstration	3	3	0
376.316	Introduction to Pharmacoeconomics	3	3	0
Department of Manufacturing Pharmacy				
372.301	Biological Drugs	3	3	0
372.302	Principles in Clinical Pharmacokinetics	3	3	0
372.303	Medicinal Immunobiology	3	3	0
372.304	Organic Pharmaceutical Chemistry	3	3	0
372.305	Dosage Form Design	3	3	0
372.306	NMR in Pharmacy	3	3	0
372.307	A History on Drug Discovery	3	3	0
372.308	Introduction to Bioactive Natural Products	3	3	0
372.309	Bioactivity of Natural Products	3	3	0
372.310	Microbial Natural Products Drugs	3	3	0
372.311	Medicinal Molecular and Cellular Genetics	3	3	0

Third year, Second Semester

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
Major Required Courses				
370.3103	Pharmacotherapy 3	4	4	0
370.3104	Pharmacotherapy 4	4	4	0
370.3107	Practice Experience 2 (Community Pharmacy)	3	0	160
370.3108	Practice Experience 3 (Hospital Pharmacy)	3	0	160
370.3110	Pharmacotherapy Laboratory 2	1	0	2

Fourth year, First Semester

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
Major Required Courses				
370.4101	Practice Experience 4 (Clinical Pharmacy)	3	0	160
370.4102	Practice Experience 5 (Inpatient Care)	3	0	160
Major Elective Courses				
Department of Pharmacy				
376.401	Biochemistry of Human Metabolism	3	3	0
376.402	Pharmaceutical endocrinology	3	3	0
376.403	Pharmacy of Cellular Functions	3	3	0
376.404	Herbal Medicinal Product Research	3	3	0
376.405	Bioactive Natural Products Research	3	3	0
376.406	Instrumental Analysis 1	3	3	0
376.407	Principles of Optical Diagnostic Contrast Agents	3	3	0
376.408	Toxicology	3	3	0
376.409	Geriatrics Pharmaceutical Care	3	3	0
376.410	Clinical Nutritional Science	3	3	0
376.411	Advanced Pharmaceutical Chemistry	3	3	0
376.412	Economics and Behavior of the Pharmaceutical Industry	3	3	0
Department of Manufacturing Pharmacy				
372.401	Biotransformation and Delivery of Drugs	3	3	0
372.402	Process Chemistry for Pharmaceutics	3	3	0
372.403	Organic Reaction Chemistry	3	3	0
372.404	Biopharmaceutics	3	3	0
372.405	Pharmaceutical Biomaterials	3	3	0
372.406	Pharmaco-Biophysics	3	3	0
372.407	Functional Foods and Nutraceuticals	3	3	0
372.408	Herbalogy	3	3	0
372.409	Marine Natural Products Drugs	3	3	0
372.410	Purification of Bioactive Natural Products	3	3	0
372.411	Human-Microbiome Interaction and Therapy	3	3	0

Course Description

Fourth year, Second Semester

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
Major Elective Courses				
370.4104	Pharmaceutical Research 1	6	0	320
370.4105	Pharmaceutical Research 2	6	0	320
Department of Pharmacy				
376.413	Pharmaceutical Molecular Biology	3	3	0
376.414	Advanced Pharmacognosy	3	3	0
376.415	Instrumental Analysis 2	3	3	0
376.416	Pharmacoproteomics and Pharmacometabolomics	3	3	0
376.417	Drug Receptor Theory	3	3	0
376.418	Molecular Pharmacology	3	3	0
376.419	Ion Channels and Diseases	3	3	0
376.420	Protein Therapeutics Development	3	3	0
376.421	Molecular Pathophysiology	3	3	0
376.422	Defense Mechanism against Chemical-induced Toxicity	3	3	0
376.423	Introduction to Clinical Pharmacogenomics	3	3	0
376.424	Clinical Trial Methodology	3	3	0
376.425	Drug & Society	3	3	0
Department of Manufacturing Pharmacy				
372.412	Methodology in Medicinal Immunology	3	3	0
372.413	Stereochemistry	3	3	0
372.414	Drug Delivery Systems	3	3	0
372.415	Introduction to Structure Determination of Natural Products	3	3	0
372.416	Cell Regulation of Bioactive Natural Products	3	3	0
372.417	Medicinal Systems Biology	3	3	0

4. Undergraduate Course Description

First year Courses

370.1101 Introduction to pharmacy and pharmacy ethics
This course provides the students with a survey of the profession of pharmacy including its history, development, scope of practice, educational requirements, ethical foundations, regulation, contemporary issues, career opportunities, and prospects for the future.

370.1102 Physical Pharmacy 1
Physical pharmacy has been associated with the area of pharmacy that deals with the quantitative and theoretical principles of science as they apply the practice of pharmacy to develop new drug spectroscopic methods, X-ray crystallography and thermodynamics in pharmaceutical systems.

370.1103 Physical Pharmacy 2
The course will cover the physicochemical properties of drugs, electrolytes, and theories of solutions, kinetics, surface phenomena, rheology, and fundamental principles of new drug design and evaluation. It is a continuation of the course, Physical Pharmacy 1.

370.1104 Pharmaceutical Analysis 1
This course is structured to provide students with the concept of general theory of analytical chemistry and its application for chemical characterization and impurity profiling of drugs.

370.1105 Pharmaceutical Analysis 2
This course will focus on the principles of separation and identification of drug molecules. Topics will include chemical characterization of drugs, analysis of pharmaceutical preparation using various spectroscopic methods such as NMR, IR, and mass spectroscopy, principles of chromatographic separation techniques such as HPLC, GC, CE etc, and analytical methods related to quality control.

370.1106 Pharmaceutical Chemistry 1
The course provides the basic principles of organic chemistry for the drug discovery and development. The lectures cover structures, nomenclatures, and physicochemical properties of chemicals as well as stereochemistry, spectroscopy, functional group reactivity and reactions.

Course Description

370.1107 Pharmaceutical Chemistry 2

The course provides the fundamental principles of organic chemistry for the drug design and discovery. The lectures cover functional group reactivity and reactions as well as physicochemical properties of organic chemicals and biomolecules and their structure-bioactivity relationships.

370.1108 Biochemistry 1

Biochemistry deals with the chemical processes that go on in living matters. As such, this course will focus on the chemistry of biological materials, the dynamics and energetics of biological systems.

370.1109 Biochemistry 2

This course concerns the metabolism of the organic constituents of living organisms, vitamins, coenzymes, biooxidation, metabolism of three essential nutrients (proteins, fats, and carbohydrates), and metabolic control by hormones as well as the basic principles of blood circulation, digestion, absorption by the gastrointestinal tract, functions of the liver and kidneys, metabolism of water and salts, chemistry of respiration, immunochemistry, and tissue chemistry.

370.1110 Human Anatomy for Pharmacists

This course introduces the morphology of our body parts. Thus, gross anatomy is a major course, which tells shapes, locations and functions of bones, muscles, nerves, arteries as well as internal organs. In addition, microanatomy that dissects out microstructures in tissues or organs will also be introduced. Introductory embryology is also introduced.

370.1111 Physiology for Pharmacists

This lecture introduces how organs work in our body. Specifically, cardiovascular system, respiratory system, renal physiology, endocrinology, and neurophysiology will be instructed. Integrated responses to various situations among organs are instructed. In addition, membrane potentials, transport mechanism through membrane, and muscle contraction will also be instructed in this course.

370.1112 Cell Biology and Genetics

The fundamental structures and functions of cells in higher organisms will be instructed. The molecular details of intracellular signal transduction pathways, which connect extracellular stimuli to gene expression, cell cycle progression and differentiation, will be lectured. Also,

human diseases that are associated with the aberrant regulation of important cellular structures and signals will be introduced with a focus on the pharmaceutical treatment.

370.1113 Pharmaceutical Laboratory 1

The course covers the basic experiments on Pharmaceutical Chemistry, Pharmaceutical Analysis, and Physical Pharmacy. 5 weeks will be assigned to each three areas.

370.1114 Pharmaceutical Laboratory 2

The course covers the basic experiments on Pharmacognosy, Pharmaceutical Natural Products, and Synthetic Pharmaceutical Chemistry. Five weeks will be assigned to each three areas.

370.1201 Synthetic Pharmaceutical Chemistry 1

The course provides the application of inorganic reactions, halogenation, nitration, sulfonation, amination, amidation, reaction of aromatic diazonium salt, and oxidation to the synthesis of basic medicine.

370.1202 Pharmacognosy 1

This course will cover the introduction of crude drugs and pharmacognosy, the history of crude drug and their chemistry, biosynthesis and pharmacological activities. This course will focus on the biosynthesis of secondary metabolites in crude drug

370.1203 Microbiology and Imunology 1

This course will cover pathogenic microorganisms essential for pharmacists to know and the microbes used to produce antibiotics and physiologically active constituents.

370.1204 Preventive Pharmacy 1

This course will provide general knowledge of toxicokinetics, mechanisms of actions, and toxicological evaluation of environmental chemicals in various media including foods, air, and drugs. Furthermore, risk assessment, which is the process of quantifying the probability of a harmful effect to individuals or populations exposed to certain chemicals, will be discussed in the context of public health,.

Course Description

Second year Courses

370.2101 Synthetic Pharmaceutical Chemistry 2
The course provides the application of inorganic reactions, halogenation, nitration, sulfonation, amination, amidation, reaction of aromatic diazonium salt, and oxidation to the synthesis of basic medicine.

370.2102 Pharmacognosy 2
As a continuation of the course Pharmacognosy 1, this course will focus on crude drug derived from leaves, flowers, fruits, seeds, herbs and extracts and their plant sources, morphological descriptions, chemical constituents and pharmacological activities.

370.2103 Microbiology and Imunology 2
This course will cover the essential knowledge of pathogenic microorganisms for pharmacists and microbes used to produce antibiotics and physiologically active constituents.

370.2104 Preventive Pharmacy 2
Foods contain nutrients that are essential for growth, health, and survival of organisms. This course will equip students with general knowledge on consuming a wide variety of balanced diet, the physiological importance of each nutrient in health and disease, and the interaction of drug-nutrient for the pharmacist in the future.

370.2105 Pharmacology 1
In this course, students will study the general principles and mechanisms of drug actions including those that influence the absorption, distribution, biotransformation (metabolism), and excretion of drugs. Clinical applications, adverse effects, drug toxicity, and structure-activity relationship will also be discussed. A focus will be made on the pharmacology of the autonomic nervous system, central nervous system, and autacoids.

370.2106 Pharmacology 2
As a continuation of the course Pharmacognosy I, this course will focus on the pharmacology of cardiovascular, renal, chemotherapeutic, and endocrine systems.

370.2107 Pharmaceutics 1
This course will deal with the principles and practices of dispensation, preparation, storage, and distribution of pharmaceuticals.

370.2108 Pharmaceutics 2

This course will deal with drug disposition and drug availability to the human or animal body from a given dosage form. The time course of drugs in the body and the quantification of drug concentration patterns will be explained through pharmacokinetics.

370.2109 Pathology for Pharmacists

A fundamental consideration of disease process is done in this course. An emphasis is placed on causative mechanism, the progress and effects of disease, and the structural and functional changes association with pathological disturbance.

370.2110 Pharmaceutical Statistics

This course will deal with fundamental statics for the scientific manipulation of the experimental data in the pharmaceutical sciences.

370.2111 Pharmaceutical Laboratory 3

The course covers the basic experiments on Microbiology and Immunology, Biochemistry, and Preventive Pharmacy. 5 weeks will be assigned to each three areas.

370.2112 Pharmaceutical Laboratory 4

The course covers the basic experiments on Anatomy-Physiology-Pathology, Pharmacology, and Pharmaceutics. Five weeks will be assigned to each of the three areas.

370.2113 Introduction of Clinical Pharmacy 1

This is an essential class in which students will master the basic concept and knowledge of pharmaceutical care and clinical pharmacy to establish the fundamentals and skills required as a clinical pharmacist. Students will master from the basics of pharmacist profession, clinical pharmacy and pharmaceutical care to medical terminology, prescription compounding system, drug utility review, comprehension and evaluation of laboratory values and patient drug monitoring -the principals required for a clinical pharmacist.

370.2114 Introduction of Clinical Pharmacy 2

In this class, students will master the basic concept of evidence based pharmacy (EBP) and learn how to practice EBP in the clinical setting. Students will not only master the skill to collect, analyze and evaluate drug information utilized in pharmacy fields, but also review the different types of clinical information, database and resources and their application in clinical practice.

Course Description

370.2115 Medicinal Chemistry 1

The course covers the basic principles of drug mechanism at the molecular level and overall understanding of drug discovery and development. This course deals with the structure analysis of drug targets, physicochemical properties of drug, drug-receptor interaction, quantitative structure activity relationship, drug design, molecular modeling, pharmacokinetics, drug metabolism, prodrug, new drug development process.

370.2116 Industrial Pharmacy and Good Manufacturing Practice

This course deals with the principles and practices of pharmaceutical operations and the technical implication of good manufacturing practices in Korea. These concern such things as buildings and facilities, personnel, components, production and control of records, standard operation procedures, packaging and labeling operation, laboratory control, distribution records, stability, and expiration date.

370.2117 Pharmacopeia and Quality Control

This course covers pharmacopeia, which is a collection of formularies that each nation standardizes to maintain the strength, purity, and quality of drugs.

370.2118 Law in Pharmacy Practice

The course covers laws that impact and regulate the practice of pharmacy. Topics include the regulation of medications, regulation of controlled substances, and regulation of pharmacy practice. A detailed evaluation of the regulations pertaining to pharmacy may help the students in preparing for their Pharmacy Examinations, and in understanding the diverse legal issues impacting future professional practice.

Third year Courses

370.3101 Pharmacotherapy 1

In this course about Gastrointestinal, Hepatic and Renal Disorder Pharmacotherapy, students will master clinical, pharmaceutical knowledge and skills of the scientific approach of monitoring drug effects/side-effects, and finding and managing drug induced diseases, to assure optimal pharmacotherapy in treating the diseases covered in this module. Case analysis and presentation class will proceed concurrently with each disease state to let students develop presentation skills and application skills of clinical pharmaceutical knowledge.

370.3102 Pharmacotherapy 2

In this course about Respiratory, Circulatory and Endocrinology Pharmacotherapy, students will master clinical pharmaceutical knowledge and skills of the scientific approach of monitoring drug effects/side-effects and finding and managing drug induced diseases, to assure optimal pharmacotherapy in treating the diseases covered in this module. Case analysis and presentation class will proceed concurrently with each disease state to let students develop presentation skills and application skills of clinical pharmaceutical knowledge.

370.3103 Pharmacotherapy 3

In this course about Nervous system, Psychiatry and Immune- Transplantation Pharmacotherapy, students will master clinical pharmaceutical knowledge and skills of the scientific approach of monitoring drug effects/side-effects and finding and managing drug induced diseases, to assure optimal pharmacotherapy in treating the diseases covered in this module. Case analysis and presentation class will proceed concurrently with each disease state to let students develop presentation skills and application skills of clinical pharmaceutical knowledge.

370.3104 Pharmacotherapy 4

In this course of Infectious Disease and Oncology Pharmacotherapy, students will master clinical pharmaceutical knowledge and skills of the scientific approach to monitoring drug effects/side-effects and finding and managing drug induced diseases, to assure optimal pharmacotherapy in treating the diseases covered in this module. Case analysis and presentation class will proceed concurrently with each disease state to let students develop presentation skills and application skills of clinical pharmaceutical knowledge.

370.3105 Herbal Therapeutics

The course covers herb-drug interactions, natural products as a resource for established and new drugs, alternative therapies, herbal therapeutics, relationship between traditional medicine and natural products, safety of herbal drugs, and dietary supplements.

370.3106 Industry Pharmacy Practicum

This is a four-week (160hours) course designed for students to gain hands on experience of drug development and drug administrative work. Students will learn to understand and master the roles of pharmacists working in this field. Students will undertake a 3 week (120 hours) field work at a pharmaceutical company to develop the knowledge, skills and attitudes

needed as a pharmacist working in new drug development, drug manufacturing, and quality assessment departments. Students will also have a one-week (60 hours) field experience at a drug administration agency to develop the knowledge, skills and attitudes needed as a pharmacist working in drug safety administration, drug cost and health insurance administration, drug exclusivity administration and public health administration departments.

370.3107 Community Pharmacy Practicum

This is a four-week (160 hours) practicum for community pharmacy practice in which students will master pharmaceutical knowledge and effective decision making skills to resolve pharmaceutical problems encountered in patient treatment. Students will develop the knowledge, skills and attitudes necessary of a post graduate community pharmacy pharmacist through practicing prescription review, compounding, patient education and OTC drug information provision services to patients.

370.3108 Hospital Pharmacy Practicum

This is a four-week (160 hours) practicum for hospital pharmacy practice in which students will master pharmaceutical knowledge and effective decision making skills needed to resolve pharmaceutical problems encountered in patient treatment. Students will develop the knowledge, skills and attitudes necessary of a post graduate healthcare system pharmacist through practicing inpatient, outpatient and parenteral prescription review, compounding, patient education, drug information and pharmacy administration services.

370.3109 Pharmacotherapy Laboratory 1

This problem-based laboratory course utilizes the basics of the Clinical Pharmacy and Pharmacotherapy for students to apply their clinical knowledge, skills and attitude to solve pharmaceutical care problems through effective decision making process to optimize the desired outcomes in patients with gastrointestinal, endocrinologic, cardiovascular, neurologic, rheumatologic, gynecologic and nutrition disorders.

370.3110 Pharmacotherapy Laboratory 2

This problem-based laboratory course is a continuation of Pharmacotherapy Laboratory I, that utilizes the basics of the Clinical Pharmacy and Pharmacotherapy for students to apply their clinical knowledge, skills and attitude to solve pharmaceutical care problems through effective decision making process to optimize the desired outcomes in patients with renal, oncologic, hematologic, infectious, respiratory, immunologic, dermatologic and ophthalmic disorders.

376.301 Molecular Oncology

Cancer is one of the most threatening diseases for the health of human beings in 21st century, and the incidence rate of cancer is growing more and more in this aging society. Characteristics of normal and cancer cells, causing factors of cancer, biochemical and molecular biological basis of carcinogenesis, functions of oncogenes and tumor suppressor genes, chemotherapy and prevention of cancer, mechanism of anti-cancer drug and its clinical applications will be discussed in depth in this class.

376.302 Cellular Signal Transduction

Cellular biological and biochemical researches and methodologies have been rapidly developed for understanding cellular signal transduction, which is essential in controlling cellular functions. Cellular growth and differentiation, cellar signal transduction, and its mechanism of control will be discussed in depth. Application of researches and clinical approaches will be connected and further understood on the basis of knowledge obtained from this class.

376.303 Advanced Pharmacology in Biological Topics

This course covers the pharmacological effects of drugs at the levels of biochemistry, molecular and cellular biology, and bio-pharmaceutics. The goal of this course is to study the general mechanisms of drug actions and their side effects. Lectures are coordinated by different professors in different majors of biological pharmacy, covering the topics of biochemical effects of drugs, the role of nuclear receptors and drug transporters, cell signaling pathways, and physiological functions.

376.304 Biotechnology in Pharmacy

This course will provide students with applications of modern biotechnology to diverse areas including the development of pharmaceuticals, food production, control of environmental contamination, and forensic science. Topics will cover: introduction to the structures and functions of the DNA; basic principles and applications as well as historical perspectives of recombinant DNA technology; development and application of polymerase chain reaction and DNA finger printing; scientific, regulatory, and ethical issues related to the human genome project.

376.305 Natural Product Chemistry

This course will cover methods of separation, purification, and identification of various plant constituents. The historical development, structures and biosynthesis of plant active constituents will also be emphasized.

Course Description

376.306 Medicinal Plants and Practice

Medicinal plants are rapidly regaining the prominent position because they possess biologically active constituents, and are utilized to develop new drugs across the world. This course focuses on taxonomy, uses and application of medicinal plants

376.307 Forensic Pharmacy

Forensic pharmaceutical analysis is the application of pharmaceutical sciences that uses basic knowledge of pharmaceutical analytical chemistry to legal issues that are closely associated with the criminal justice system. This course is structured to provide the student with the basic concept of genetics and a strong foundation in the related analytical techniques for identification of individual genetic information. Various analytical techniques for investigation of toxicological properties of specific drugs will also be addressed.

376.308 Neuropharmacology

The course covers the basic principles of effects and adverse effects of drug in central nervous system (CNS). The goal of this course is to discuss the research skills and actions of drugs in CNS dependent biological phenomena. This course lectures on the structures, normal/abnormal functions of CNS and relating disorders and its' therapeutic approaches.

376.309 Biochemical Pharmacology

Biochemical Pharmacology focuses on the pharmacological and toxicological effects of xenobiotics at the levels of biochemistry, molecular and cellular biology. The goal of this course is to discuss the actions of drugs, toxicants and xenobiotics in living organisms. The course will deal will the topics of the set-up of hypothesis, the establishment of research systems, and the creativity in the science and the research tools and methods. Especially, this lecture will deals with the interactions of drugs and cellular macromolecules including enzymes and receptors at the molecular and cellular levels.

376.310 Target Organ Toxicity

A baffling array of different toxicities may be induced in various organs of the body by chemical substances to which we are exposed. All tissues are susceptible in varying degrees to these toxic effects, but many chemicals exhibit a marked propensity to damage specific organs. An understanding of the ability of some chemicals to cause these organ-specific lesions or target organ toxicities is the primary objective of this class. General principles of hepatotoxicity, nephrotoxicity, pulmonary toxicity, neurotoxicity, and carcinogenicity as well as factors contributing to organ specific toxicity such as toxicokinetics, metabolic activation, species difference, tissue-specific biochemistry will be introduced.

376.311 Free Radicals in Health and Diseases

Free radicals such as oxygen and carbon-centered radicals are generated endogeneously and/or exogeneously in humans. Due to their high reactivity with macromolecules including DNA, proteins, and lipids, they can damage cells and tissues, finally leading to various chronic degenerative diseases. This course will introduce the sources of free radicals generated in the cells and recent technology to detect free radicals, and provide a number of examples for toxic insults resulting from free radicals.

376.312 Pediatric Pharmaceutical Care

Pediatric patients are not adult miniatures: they have different physiological and pharmacokinetic (absorption, distribution, metabolism and excretion) characteristics from adults, showing a totally different effect/side-effects by the same drug. In this class, students will master the pharmacokinetic and pharmaco dynamic characteristics of pediatric patients and learn about the pediatrics based pharmacy service to be able to provide optimal pharmacotherapy in this set of population.

376.313 Medicinal Chemistry 2

The course covers the organic chemistry of drug design and drug action. This course covers drug discovery, design and development, receptor and ligands, enzyme mechanism, enzyme inhibitors, DNA interactive agents, drug metabolism, and prodrug.

376.314 Recent Pharmaceutical Chemistry

This course introduces advanced recent theories and technologies needed for the drug and target discovery. The principles of combinatorial chemistry and chemical biology together with the design and synthesis of chemical probe, chemical affinity matrix, and chemical library and their applications will be discussed in the class.

376.315 Pharmacy Adminstration

The purpose of this course is to introduce the pharmacy students, in an organized way, to the most vital, dynamic, challenging, and rewarding of the health professions and the health sciences. Students will be trained as a pharmaceutical scientist and you will have a general appreciation of not only the practice of pharmacy, but the environment in which pharmacy operates. This course focuses on issues related to the practice of pharmacy and issues related to the pharmaceutical industry (broadly defined).

Course Description

376.316 Introduction to Pharmacoeconomics

This course provides students with the current state-of-the-art valuing of pharmaceuticals. Pharmacoeconomics is widely used in the area of pharmaceutical industry and policy-making decision. After this course, student will be able to understand the identification, valuation, and the synthesis of costs and benefits of drug treatments. The principles of economics, assessment criteria of clinical literatures and methodologies like cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis are offered. Attention is also given on the discount, QALY, and decision rules of the economic evaluation results.

372.301 Biological drugs

A biological drug is a substance that is made from a living organism or its products to be used in the prevention, diagnosis, or treatment of various diseases. Biological drugs include recombinant proteins, antibodies, vaccines and gene therapy. We will discuss the current understanding of biological drugs and their prospect.

372.302 Principles in Clinical Pharmacokinetics

Absorption, distribution and elimination are the determinants for drug concentrations in the body; temporal profiles of the concentrations are typically expressed in forms of mathematical equations. In this lecture, theoretical basis and relevance will be discussed for major pharmacokinetic models. Furthermore, recent literatures on clinical pharmacokinetics will be presented.

372.303 Medicinal Immunobiology

This course will cover various immunotherapies, vaccines, and immunopathology focusing on recent theoretical advances in immunology.

372.304 Organic Pharmaceutical Chemistry

The course provides the fundamental principles of organic chemistry needed for the drug development and synthesis. The retrosynthetic analysis of bioactive chemicals and natural products is also important topic of this course. The structural features and synthetic approaches of olefin and 3-9 membered carbocycles will be discussed in this course. In addition, their synthetic applications to bioactive molecules including natural products will be discussed.

372.305 Dosage Form Design

Each particular pharmaceutical product is a formulation unique to a given product. In addition

to the active therapeutic ingredient(s), a pharmaceutical formulation contains a number of non-therapeutic ingredients (i.e., pharmaceutical excipients). Although these ingredients are generally intended to give a characteristic physical appearance, they also control therapeutic activity of the dosage form by affecting absorption, distribution, metabolism and excretion of active ingredient(s). Therefore, a thorough understanding on the performance and impacts of excipients is necessary for a successful formulation. Backgrounds and up-to-date information on formulation of dosage forms shall be discussed in this lecture.

372.306 NMR in Pharmacy

The theory and application of NMR spectroscopy concerning the structure determination of biological compounds (proteins and nucleic acids) will be studied in this course.

372.307 A History on Drug Discovery

The course covers the past history of the process of drug discovery and development of pharmaceutical companies. The stories of about 50 innovative drugs are covered in the lecture. The lecture also includes the understanding of the human stories of inventors and the impact on human life and the society brought by medicinal compounds.

372.308 Introduction to Bioactive Natural Products

Recently, attention to bioactive natural products originating from plants is gradually increasing. Attempts have been made to develop new drugs or nutraceuticals from these bioactive compounds. This lecture will be covered on the discussion of pharmacological activities of biaoactive natural products with high potentials as drug-likeness.

372.309 Bioactivity of Natural Products

This course will discuss the bioassay systems for the evaluation of bioactivity from natural products with the cell cultures and animal models. This course will encourage students to learn the principle of assay systems, analysis of experimental data and techniques, the appropriate designs for different experimental methods.

372.310 Microbial Natural Products Drugs

The course covers developed or developing drugs derived from microbial natural products. The goal of this course is to identify structural classes of microbial natural products and to study their chemistry and bioactivity. This course also discusses pharmaceutical and bioengineering applications of microbial natural products.

Course Description

372.311 Medicinal Molecular and Cellular Genetics
This class will address how human genome works at molecular and cellular levels and how genomic variations are linked to human diseases. The class will also discuss how the information and knowledge of human genomics are used for drug discovery.

Fourth year Courses

370.4101 Clinical Pharmacy Practicum
This is a four-week (160 hours) course of hands on learning in hospital pharmacy. Students will master pharmaceutical knowledge and effective decision making skills needed to resolve pharmaceutical problems encountered in patient treatment. Students will develop advanced knowledge, skills and attitudes required of a post graduate healthcare system pharmacist through experiencing clinical pharmacokinetics practice, total parenteral nutrition practice, anti-coagulant service practice, drug utilization and quality control practice, and clinical study monitoring practice.

370.4102 Inpatient Care Practicum
This is a four-week (160 hours) course of hands on learning in hospital pharmacy. Students will master pharmaceutical knowledge and effective decision making skills needed to resolve pharmaceutical problems encountered in patient treatment. Students will develop the knowledge, skills and attitudes necessary of a post graduate healthcare system pharmacist by participating in drug therapy and roundings at the department of internal medicine and general surgery, provision of drug information and drug utilization review to other medical staff, group patient education and clinical investigations.

370.4104 Pharmaceutical Research 1
This course consists of discussions during which faculty members and the student choose a research topic, which the student will follow through by carrying out experiments.

370.4105 Pharmaceutical Research 2
This course consists of discussions during which faculty members and the student choose a research topic, which the student will follow through by carrying out experiments.

376.401 Biochemistry of Human Metabolism
This class seeks to understand mechanistic action and regulation of hormone and enzymes of metabolism involved in human homeostasis, with emphasis on their roles in

carbohydrates, amino acids, and lipid synthesis and metabolism. In addition, the cases of human diseases and their cures and drug targets can be discussed.

376.402 Pharmaceutical Endocrinology

Pharmaceutical endocrinology focuses on hormones and endocrine glands, which play important roles in homeostasis, regulation of gene expression and control of growth and differentiation. The major hormone systems including peptide and steroid hormones, the mechanism of hormone action, the physiology of endocrine glands is instructed in this course. Also pathophysiological and molecular causes of the endocrine associated metabolic diseases such as obesity and diabetes, and the related pharmaceutics will be studied.

376.403 Pharmacy of Cellular Functions

These days the cutting-edge technologies responsible for rapid developments in cellular biological and biochemical researches have resulted in the accumulation of knowledge of cell itself in the levels of molecules and in a format of revealing of cellular mechanisms underlying for regulation of cell functions. This class will be based on review of the past research and current research, to update the scientific knowledge and methodology. This course will provide students with concrete understanding of cellular functions and their regulation mechanism in connection with or for understanding clinical approaches and information.

376.404 Herbal Medicinal Product Research

This course will cover all aspects of herbal medicinal product including quality control, efficacy and safety. This course will focus on an in-depth discussion of recent advances in knowledge and scientific techniques of herbal medicinal product research and development.

376.405 Bioactive Natural Products Research

This course will cover the principles and methods to screen the various activities from natural products. This course will focus on the in vitro and in vivo screening methods and bioactivity-guided fractionation techniques.

376.406 Instrumental Analysis 1

In pharmaceutical research, a wide and impressive array of powerful and elegant instrumental tools is used for obtaining qualitative and quantitative information about the composition and structure of matter. Development of an understanding of the basic principles of these instrumental tools and their practical applications is a must for solving analytical

problems in this field. This course will focus on the theoretical principles of instrumental analysis and their practical applications in pharmaceutical research. The fundamental principles of operation of modern analytical instruments and the basic theory of their applications are covered. These instruments include NMR, IR, UV/Vis, GC/MS, LC/MS, Fluorescence, Polarimeter, AA. ICP, ORD/CD, Thermal analyzer, Elemental analyzer, GC, HPLC, IC, Amino acid analyzer, SEM, Centrifuge, NO analyzer, Bio analyzer system, Flow cytometer, DNA sequencer, LSC, Gamma counter, Luminometer, Freeze dryer, Water purification system, Centrifugal evaporator, X-ray, and mp apparatus, etc. The objective of this course is to give students a thorough introduction to the basic principles of various analytical instruments, sample preparation, as well as to broaden their knowledge through literature search for making appropriate choices and efficient use of these instruments.

376.407 Principles of Optical Diagnostic Contrast Agents

This subject deals with synthetic methods and applications of multifuntional optical contrast agents used for cancer diagnosis and monitoring of drug efficacy. As diagnostic non-invasive imaging techniques such as magnetic resonance(MR), positron emission tomography(PET) and single photon emission computed tomography(SPECT) develop relevant contrast agents are being actively developed to improve diagnostic sensitivity and accuracy. Recently, nanoparticle-based optical constrast agents are used for drug screening based on optical imaging. Quantum dot, gold and silica nanoparticles are highly sensitive, photostable, non-invasive, and non-ionizing. They are capable of being biocompatible and selectively delivered to specific target molecules by surface functionalization, and this leads to their effective use for cancer diagnosis and relevant anticancer drug screening. The optical contrast agents have intrinsic therapeutic property or can be conjugated to therapeutic agents. This allows for the optical contrast agents to be used as multifunctional agents that enable both diagnosis and therapy simultaneously. This subject provides understanding of fundamental principles involved in syntheses and surface functionalization of optical contrast agents and introduces their applications to drug screening and biomedical field.

376.408 Toxicology

Numerous xenobiotics, such as drugs and environmental chemicals, play a role in controlling physiological activity and are known to closely correlate with cellular toxicity and diseases, including inflammation and cancer. This course aims at providing students with a better understanding of the fundamental physiological mechanisms by new endogenous molecules and the relevant evaluation for its biological safety.

376.409 Geriatrics Pharmaceutical Care

With aging, geriatric subjects undergo physiological changes and record higher rates of chronic diseases. These changes affect the absorption, distribution, metabolism and excretion of drugs, leading to totally different effect/side-effects from normal adults. In this class, students will master the pharmacokinetic and pharmacodynamic characteristics of geriatric patients and learn about geriatric based pharmacy service so as to provide optimal pharmacotherapy to this population.

376.410 Clinical Nutritional Science

Nutrition is crucial in clinical practice not only because poor nutrition can lead to disease state, but also because nutrients can affect drug absorption, distribution, metabolism and excretion in human body, causing different drug effect/side-effects. In this class, students will master the causes, clinical symptoms, diagnosis, and treatments of water, electrolyte and acid-base imbalance. Students will also learn about the concept and method of total parenteral nutrition(TPN) to be able to supply appropriate calories, carbohydrates, proteins, lipids, micro-nutrients and vitamins to patients according to their disease status.

376.411 Advanced Pharmaceutical Chemistry

The course provides fundamental principles of organic chemistry needed for drug design and synthesis. The physicochemical properties of organic chemicals and biomolecules, their structure-bioactivity relationships and metabolic transformation of drugs are basic topics of lectures. The retrosynthetic analysis of complex chemicals is also an important topic of this course.

376.412 Economics and Behavior of the Pharmaceutical Industry

The pharmaceutical industry has played an important role in the intellectual industry of modern society. This course introduces various topics in economics of pharmaceutical industry, including market structure, R&D, regulation, and economic impact of pharmaceuticals. Students will understand policy issues pertaining to the pharmaceutical sectors, together with evaluations of the industry performance.

376.413 Pharmaceutical Molecular Biology

This course includes the characterization of human diseases and newly developed therapies. The course also focuses on a variety of technologies to develop new drugs on the basis of molecular biology and functional genomics. Especially, the functions and interactions among the genes and/or proteins elucidated by the completion of the human genome project will be

discussed. New concepts of technologies for drug development such as molecular prevention from complex human diseases and gene therapy will be included.

376.414 Advanced Pharmacognosy

This course will cover an in-depth discussion of recent advances in our knowledge of pharmacognosy and natural product industry.

376.415 Instrumental Analysis 2

Analysis of drug formulations, structural analysis, and separation and impurity profiling of bulk drugs are not only important for drug discovery, but also for their production and quality control. This course emphasizes the application of modern spectroscopic techniques such as NMR, IR, UV/Vis, and Mass for structural analysis of substances. This course aims to impart knowledge on how to obtain structural information using spectroscopic references. This course introduces students to the basic principles of instrumental analysis, with a special emphasis on gaining an advanced knowledge of spectroscopy. The curriculum includes the following topics: the theory of various separation technology including solvent extraction, column chromatography, planar chromatography, HPLC, GC, SFC, CE, IC, counter current chromatography, sample preparation, optimization of separation process, data analysis and interpretation.

376.416 Pharmacoproteomics and Pharmacometabolomics

Pharmaceutical sciences need to be understood at the molecular level and an analytical method that can be used to quantify the interactions and biological activities of proteome and metabolome are important for this purpose. Pharmacoproteomics and pharmacometabolomics, which will be discussed in this class, are two fields of analytical chemistry that delineate the interactions between drugs and proteome and/or metabolome through global or targeted analysis of proteome and metabolome in a biological system when drug is administered as an external stimulus. To aid the understanding of these research fields, important concepts on a variety of key topics will be introduced and the topics to be covered are as follows: extraction of proteome/metabolome, 2-dimensional electrophoresis, nano high performance liquid chromatography (HPLC) - mass spectrometry, high throughput screening using nuclear magnetic resonance spectroscopy (NMR), identification and quantification of proteome using proteome database, identification and quantification of metabolome using metabolome library, and application of systems biology-related statistical algorithm.

376.417 Drug Receptor Theory

The goal of this course is to understand the receptor concept as the primary information transmission system. This course covers information on the receptors that are expressed in tissues, cells and other physiological system. In this course, students are encouraged to discuss recent articles published in international journals relating to Drug Receptor Theories.

376.418 Molecular Pharmacology

Molecular Pharmacology is the science that focuses on the drug actions and toxicities at the levels of molecules. This course focuses on the drug-macromolecular interactions (i.e. drug-receptor interaction and drug-enzyme interaction) and lectures on the receptor theory, the biochemistry of drug metabolism, cellular signaling pathways, protein-nucleic acids interaction, drug-induced gene regulation and so on.

376.419 Ion Channels and Diseases

Membrane potential is the potential difference between cell membrane. Action potentials are required for the functions of neurons, muscle cells and glandular cells. Thus, in this course, how membrane potential is formed and how one can predict the change in membrane potentials. Ion channels are critical in changing or shaping membrane potentials. Therefore, various ion channels and their shapes, functions and biophysical properties are introduced in this course. In addition, chronic diseases caused by mal-functions of ion channels are also introduced.

376.420 Protein Therapeutics Development

Biopharmaceutics refer to macromolecules derived from living organisms, therapeutic proteins generally taking the most of the part. At present, high market growth rate of such therapeutic proteins is attracting many companies to thrust into the market. In this course, the characteristics of the development of recent protein therapeutics are summarized, and the series of developing process is discussed in industrial, academic, and regulatory point of view.

376.421 Molecular Pathophysiology

The Molecular pathophysiology is the study of elucidating disease process at the molecular level and explains the sequence of events in the response of the cells or tissues to etiologic agent by means of interaction with molecules. This course introduces recent research trends classified according to their main theme and presents pathophysiological understandings of disease.

Course Description

376.422 Defense Mechanism against Chemical-induced Toxicity

The chemicals exposed to human undergo metabolic activation and free radical generation leading to functional alterations, structural damages, and chronic diseases. This course will review several recent technology including toxicogenomics, metabolomics, etc to detect chemical-induced toxicity, and discuss the important current issues related on defense mechanism against its toxicity.

376.423 Introduction to Clinical Pharmacogenomics

Clinical pharmacogenomics is an important component of personalized medicine which utilizes the understanding of individual genetic characteristics to predict the inter-individual variability in drug effect/side-effects. In this class, students will master the basic concept and history of clinical pharmacogenomics and learn how to practice clinical pharmacogenomics in the drug development and clinical setting. Also, to develop presentation skills and application skills of clinical pharmacogenomics knowledge and techniques, students will concurrently proceed with the curricular education with presentation classes based on important genes for disease progression and pharmacotherapy.

376.424 Clinical Trial Methodology

In this class, students will master the basic concepts of clinical trials and clinical trial data management, and perform basic statistical analysis with the collected data. Students will also learn how to run a clinical trial(determine study design and number of subjects) and develop the ability to evaluate and review clinical trial literatures.

376.425 Drug & Society

This course deals with historical development of the profession, its growth and development, emphasizing forces of education, professionalization, attitude modification and changes occurring as a product of legal and organizational forces in society. This course is for those interested in careers as drug researcher, clinical pharmacist and drug policy maker in the future.

372.401 Biotransformation and Delivery of Drugs

Drug-drug interactions (DDIs) are one of the major reasons for withdrawal from market during post marketing surveillance and/or for complication in pharmacotherapy; underlying reasons for DDI are interactions at levels of carrier-mediated transport and/or biotransformation. In this lecture, biological characteristics and pharmacokinetic/ pharmacological relevances of carrier-mediated transports and biotransformations will be discussed. Furthermore, recent literatures on transporters and metabolizing enzymes will be presented.

372.402 Process Chemistry for Pharmaceutics

This course will cover the development of economically and enviromentally optimal synthetic process for the synthesis of pharmaceuticals by using synthetic unit reactions such as carbon-carbon, carbon- oxygen, and carbon-nitrogen bond formations.

372.403 Organic Reaction Chemistry

This course introduces advanced recent theories and technologies needed for the drug and target discovery. The principles of combinatorial chemistry and chemical biology together with the design and synthesis of chemical probe, chemical affinity matrix, and chemical library and their applications will be discussed in the class. The general organic reaction mechanisms will be studied in this course through an introduction to the physical, organic, and chemical properties of organic reaction such as substitution and elimination reactions. New organic reaction mechanisms and their applications will be studied in this course through an introduction to the physical, organic, and chemical properties of new organic reactions.

372.404 Biopharmaceutics

Pharmacokinetics, a major determinant of therapeutic activity, is primarily governed by the characteristics of absorption, distribution, metabolism and excretion (ADME). Such characteristics are a result of complex interactions between drug and body, mainly drug transporters and metabolizing enzymes. Therefore, understanding the function and diversity of drug transporters and metabolizing enzymes is essential not only in the prediction of therapeutic activity and its variation, but also in setting strategies for successful drug discovery/development. Up-to-date biopharmaceutical information on drug transporters and metabolizing enzyme shall be discussed in this lecture.

372.405 Pharmaceutical Biomaterials

The purpose of this course is to introduce students to biomaterials used for drug delivery systems and medical devices so that they can understand the role and function of materials used in the biomedical field. In particular, students will learn about such biopolymers as proteins and polysaccarides, as well as synthetic polymers such as polyethylene glycols. Materials to be taught will be separated based on characteristics and structure. For Characteristics, biodegradable polymers, watersoluble polymer and hydrogels will be introduced, and structurally linear and crosslinked polymers will be introduced. The course will deal with the structure of biomaterials, and interaction between matter and drugs. Using examples, students will learn to analyze function of materials, which is to decrease toxicity and increase drug efficiency. In particular, the course will focus on the material

characteristics of implantable materials and their interactions with biological systems upon contact. Through this course, students will learn to predict and solve problems in developing drug delivery materials with respect to possible side effects or toxicity from the perspective of materials.

372.406 Pharmaco-Biophysics

According to the completion of human and pathogenic organism, protein, which is final product of gene, is very important for new drug discovery. Cost and time needed for new drug development can be reduced by using SBDD (Structure Based Drug Discovery) technique, in which three-dimensional structures of disease related proteins become very important. This course covers information on X-ray crystallography and NMR methods for SBDD

372.407 Functional Foods and Nutraceuticals

This course introduces functional properties of dietary supplements. It also includes of a global trend and regulations by government agencies.

372.408 Herbalogy

This course will cover the history, pharmaceutical properties, therapeutic effects, application for clinical use, and preparation of herbal medicine that can be applied to pharmaceutical science.

372.409 Marine Natural Products Drugs

The course covers the basic principles of marine natural products and drug developments based on them. The goal of this course is to discuss the diverse aspects of marine natural products as an emerging sources of bioactive compounds. This course consists of the chemical, biological and pharmacological characteristics of marine natural products based on comparison with those of terrestrial metabolites as well as diverse approaches toward drug developments from marine.

372.410 Purification of Bioactive Natural Products

The course covers the methods to isolate natural products with bioactivity. The goal of this course is to understand the principle and methods of extraction, chromatography-based isolation and purification, scale-up, and analysis of purity. This course will raise ability to design isolation schemes of natural products systematically in natural product-based drug development.

372.411 Human-Microbiome Interaction and Therapy

This class will teach the interaction between human and normal or pathological micribiome and study the immunological and infectious diseases. The working mechanims of current and future anti-infective drugs will be also addressed.

372.412 Methodology in Medicinal Immunology

Based on the essential knowledge of 『Medicinal Immunology』, this course will cover the theoretical background and experimental methodology of recently published theses.

372.413 Stereochemistry

This course will cover sterochemical concepts including the characteristics of chemical bonds, steroisomerism and absolute configuration, asymmetric carbon and enantiomer, configurational notations, the symmetry of molecules, and asymmetric synthetic methods of optically active organic compounds.

372.414 Drug Delivery Systems

This course will consist of lectures on theoretical methodology and the selection, application method, and time-release of preparation in order to evaluate, guarantee, and enhance the quality of drugs. Also, this course will cover the factors relevant to the preformulation of pharmaceuticals. Topics will include the solubilization, design of dosage forms, which can control the absorption and distribution of drugs.

372.415 Introduction to Structure Determination of Natural Products

The goal of this course is comprehensive understanding of diverse spectroscopic and chemical methods toward the structure determination of complicate organic compounds e. g. natural products. This course covers the definition and combined application of mostly modern spectroscopic techniques such as NMR, MS, IR, UV, and CD as well as diverse organo-chemical methods applicable to the structure determination.

372.416 Cell Regulation of Bioactive Natural Products

The course covers the cell regulation systems, including intracellular signal transduction, cell cycle regulation, programmed cell death, in relation with the enzymatic action and molecular biochemical effects, to study the functional bioactive natural products.

372.417 Medicinal Systems Biology

Life is complex system operated through diverse interactions between molecules and cells.

Course Description

This class is designed to explain human physiology and pathology at the system level and how systems biology can help to understand human diseases and design the ways to cure diseases.

5. Graduate Courses

The College of Pharmacy, in cooperation with the Graduate School, offers courses leading to M.S. and Ph.D. degrees in the basic and clinical sciences. These courses are directed through the University's Graduate School. In the graduate course, credits are given for the completion of regular courses or seminars and to the individual research performed under the supervision of the graduate advisor. The minimum credit requirements for the graduate courses are as follows.

Upon recommendation of the graduate advisor, and subject to the approval of the department chairman, graduate students may take some of the courses offered in the graduate or undergraduate programs of a department other than their own. These courses are applicable to the fulfillment of the credit requirements. In such case, those courses must be approved as equivalent to the major courses of the student's department. The permitted number of credits thus taken will be determined by the department regulation, but in no cases can the credits earned in undergraduate courses exceed six credits. However, if the department requires some of the undergraduate courses of the department as pre-requisites to the graduate program, these courses will not be applied to the credit requirement of the program, though they will be counted toward the computation of the grade point average of the student's graduate program.

6. Graduate Courses at a Glance

Required Courses for All Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.501	Seminar in Pharmacy 1	1	2	0
375.502	Seminar in Pharmacy 2	1	2	0
375.601	Seminar in Pharmacy 3	1	2	0
375.602	Seminar in Pharmacy 4	1	2	0

Elective Courses for All Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.505	Topics in Pharmaceutical Sciences 1	1	2	0
375.506	Topics in Pharmaceutical Sciences 2	1	2	0

Pharmaceutical Bioscience Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.510	Topics in Biochemistry	3	3	0
375.538	Advanced Pharmacal Microbiology	3	3	0
375.541	Topics in Pharmaco-Molecular and Cellular Signal Transduction	3	3	0
375.542	Topics in Pharmaceutical Molecular Biology	3	3	0
375.642	Advanced Antibiotic Chemistry	3	3	0
375.643A	Topics in Immunological Products	3	3	0
375.647	Actinomycetal Metabolites and Laboratory	3	2	4
375.648A	Topics in Genetics and Genomics	3	3	0
375.737A	Topics in Medicinal immunology	3	3	0
375.783	Molecular Endocrinology	3	3	0
375.795A	Advanced Oncology	3	3	0

Pharmacognosy and Pharmaceutical Analysis Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.536	Biosynthesis of Plant Constituents	3	3	0
375.537	Medicinal Plants Taxonomy	3	3	0
375.580	Advanced Pharmaceutical Analysis I	3	3	0
375.582	Analysis of Pharmaceutical Preparation I	3	3	0
375.585	Instrumental Analysis I	3	3	0
375.587	Principles of multifunctional optical contrast agents	3	3	0
375.682	Advanced Pharmaceutical Analysis II	3	3	0
375.684	Analysis of Pharmaceutical Preparation II	3	3	0
375.686	Instrumental Analysis II	3	3	0
375.696	Studies in Pharmacoproteomics	3	3	0
375.697	Natural Product Derived Pharmaceuticals 1	3	3	0
375.698	Natural Product Derived Pharmaceuticals 2	3	3	0
375.796	Screening Methods for Bioactive Natural Products I	3	2	2
375.797	Screening Methods for Bioactive Natural Products II	3	2	2
375.798	Chemical Structure Analysis of Medicinal Plant Constit	3	3	0
375.799	Chemistry in Pharmacognosy and Lab	3	2	2
375.800	Advanced Pharmacognosy	3	3	0
375.805	Preservation of Natural Resources	3	3	0
375.811	Methods in Bioactive Natural Products Research I	3	3	0
375.812	Methods in Bioactive Natural Products Research II	3	3	0

Course Description

Pharmacology Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.513	Advanced Pharmacology I and Laboratory	3	2	4
375.514	Advanced Pharmacology II and Laboratory	3	2	4
375.516	Clinical Pharmacokinetics and Laboratory	3	2	2
375.517	Drug-Receptor Interaction and Laboratory	3	2	4
375.589	Topics in transcriptomics	3	3	0
375.618	Biochemical Pharmacology	3	3	0
375.620	Neuropharmacology and Laboratory	3	2	4
375.668	Topics in Molecular Pathophysiology	3	3	0
375.669	Phenomics of Model of Organisms	3	3	0
375.670	Topics in Protein Therapeutics Development	3	3	0
375.721	Topics in Cellular Pathosphysiology	3	3	0
375.786	Advanced Pharmacokinetics	3	3	0
375.787	Membrane Potentials and Ion Channels	3	3	0
375.813	Molecular Pharmacology	3	3	0
802.901	Advanced Physiology I	3	3	0

Pharmaceutical Health Science Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.518	Advanced Hygienic Chemistry	3	3	0
375.523	Industrial Toxicology	3	3	0
375.622	Drug Induced Diseases	2	2	0
375.623	Clinical Pharmacy Practice I	2	0	8
375.624	Clinical Pharmacy Practice II	2	0	8
375.625	Environmental Hygiene and Lab	3	2	2
375.629A	Pesticide Toxicology 1	3	3	0
375.711	Biological Self-Defense Mechanism	3	3	0
375.716	Methods in Biological Safety Evaluation	3	3	0
375.718	Molecular Toxicology	3	3	0
375.719	Clinical Pharmacogenormics	3	3	0
375.720	Clinical Trial Methodology	3	3	0
375.808	Free Radicals in Biology and Medicine	3	3	0
375.810	Advanced Pharmacotherapy	3	3	0
375.815	Patient Education	3	2	4
375.816	IV Admixture of TPN and Clinical Application	2	2	4

Pharmaceutical Health Science Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.817	Topics in Drug Information	2	2	4
375.818	Pediatric Pharmacy	2	2	4
375.819	Geriatric Pharmacy	2	2	4
375.820	Seminar in Clinical Pharmacy	2	0	4
375.821	Topics in Pharmaceutical Affairs	3	3	0
375.822	Drugs in Society	3	3	0
375.823	Pharmaceutical Economics and Policy	3	3	0
375.834	Research Methods in Social & Administrative Pharmacy	3	3	0
375.835	Introduction to Carbohydrate-based Drugs	3	3	0
375.837	Clinical Pharmacometrics	3	2	2

Pharmaceutical Chemistry Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.571	Advanced Pharmaceutical Chemistry I	3	3	0
375.573	Chemistry of Chemotherapeutic Agents I	3	3	0
375.579	Stereochemistry I	3	3	0
375.678	Stereochemistry II	3	3	0
375.771	Chemistry of Chemotherapeutic Agents II	3	3	0
375.772A	Advanced Medicinal Chemistry 1	3	3	0
375.774	Advanced Pharmaceutical Chemistry II	3	3	0
375.789A	Advanced Medicinal Chemistry	3	3	0
375.791	Physical Organic Pharmaceutical Chemistry 1	3	3	0
375.792	Physical Organic Pharmaceutical Chemistry 2	3	3	0
375.793	Advanced Organic Pharmaceutical Chemistry I	3	3	0
375.794	Advanced Organic Pharmaceutical Chemistry II	3	3	0

Pharmaceutics Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
371.688	Biomedical Biomaterials	3	3	0
371.689	Advanced Macromolecular Drug Delivery	3	3	0
375.555	Advanced Pharmaceutics I	3	3	0
375.556	Advanced Physical Pharmacy I	3	3	0
375.557	Pharmaco-Biophysics	3	3	0

Course Description

Pharmaceutics Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
375.561	Preformulation and formulation of pharmaceuticals	3	3	0
375.657	Advanced Pharmaceutics II	3	3	0
375.659	Advanced Physical Pharmacy II	3	3	0
375.660	Advanced Industrial Pharmacy	3	3	0
375.809	NMR in Pharmacy	3	3	0
375.824	Topics in Drug Transporters in Biological Membranes	3	3	0
375.825	Topics in Tissue Specific Drug Transport	3	3	0
375.826	Topics in Pharmacokinetic Drug Interaction	3	3	0
375.827	Advanced Pharmacokinetics	3	3	0
375.828	Topics in Pharmacokinetics Analysis	3	3	0
375.829	Advanced Biopharmaceutics	3	3	0
375.830	Topics in Experimental Biopharmaceutics	3	3	0
375.831	Topics in Bioactive Delivery Systems	3	3	0

Natural Products Science Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
371.514	Natural Medicines	3	3	0
375.836	Introduction to Carbohydrate-based Drugs	3	3	0
821.510	Special Research in Chemistry of Natural Products	3	2	2
821.511	Natural Products Chemistry	3	3	0
821.512	Separation Techniques in Bioactive Natural Products	3	3	0
821.520	Special Research in Biological Functions of Natural Products	3	2	2
821.521	Natural Products Biochemistry	3	3	0
821.522	Natural Products Pharmacology and Toxicology	3	3	0
821.523	Biological Functions of Natural Products	3	3	0
821.531	Natural Resources	3	3	0
821.612	Topics in Natural Products Chemistry	3	3	0
821.624	Natural Products Biotechnology	3	3	0
821.625	Topics in Natural Products Biochemistry	3	3	0
821.626	Topics in Natural Products Pharmacology and Toxicology	3	3	0
821.627	Topics in Biological Functions of Natural Products	3	3	0
821.632	Topics in Natural Resources	3	3	0
821.642	Topics in Natural Products Information	3	3	0
821.711	Structure Elucidation of Natural Products	3	3	0

Natural Products Science Major

Code No.	Course Name	Credit	Hours/Week	
			Lec	Lab
821.713	Natural Products Synthesis	3	3	0
821.715	Marine Natural Products Chemistry	3	3	0
821.716	Topics in Natural Products Synthesis	3	3	0
821.721	Cell Function Regulations from Natural Products	3	3	0
821.731	Taxonomy of Economic Plants	3	3	0
821.734	Studies in Bioactive Natural Product Evaluation	3	3	0
821.735	Microbial Secondary Metabolite Chemistry	3	3	0

7. Graduate Courses Description

375.501 Seminar in Pharmacy 1

This course will consist of lectures given by faculty members, visiting scholars, and graduate students, followed by discussions that will cover the latest trends in research and pharmacy. It is intended for students in the MS program.

375.502 Seminar in Pharmacy 2

As a continuation of the course, Seminar in Pharmacy I, this course will consist of lectures given by faculty members, visiting scholars, and graduate students, followed by discussions that will cover the latest trends in research and pharmacy. It is intended for students in the MS program.

375.503 Instruments in Pharmaceutical Research

This is an introductory course to various instruments widely used in pharmaceutical research. This course includes basic principles of the instruments, their applications, interpretation of data, and sample preparation methods.

375.505 Topics in Pharmaceutical Sciences 1

The course aims to provide students with the latest developments in new drug development in the pharmaceutical industry. International as well as domestic professionals specializing in various fields in biotechnology will be invited to lecture and lead discussions on advanced biopharmaceutical subjects. Topics include target development, gene and protein functions and interactions, biological mechanism of various diseases, immune reactions and Mechanism of bioactive materials. The medium of instruction is English and all presentations and discussions should be in English.

Course Description

375.506 Topics in Pharmaceutical Sciences 2

The course aims to provide students with the latest developments in new drug development in the pharmaceutical industry. International as well as domestic professionals specializing in various fields in biotechnology will be invited to lecture and lead discussions on advanced pharmaceutical chemistry. Topics include design and synthesis of novel bioactive compounds, natural products chemistry, analysis of bioactive compounds, formulation and preformulation studies, and design of dosage forms for optimizing therapy. The medium of instruction is English and all presentations and discussions should be in English.

375.601 Seminar in Pharmacy 3

This course is intended for the students in Ph D program. The course consists of lectures given by faculty members, visiting scholars, and graduate students. Lectures will be followed by discussion covering the latest trends and advances in research on pharmacy.

375.602 Seminar in Pharmacy 4

As a continuation of Seminar in Pharmacy III, the course is intended for the students in Ph D program. The course consists of lectures given by faculty members, visiting scholars, and graduate students. They will be followed by discussions covering the latest trends and advances in research.

Courses in Pharmaceutical Bioscience Major

375.510 Topics in Biochemistry

The course will cover progress in modern biochemistry and molecular biology. Selected topics will be discussed.

375.538 Advanced Pharmacal Microbiology

The latest findings and progress in microorganisms associated with the production of pharmaceuticals will be discussed in this course.

375.541 Topics in Pharmaco-Molecular and Cellular Signal Transduction

These days, the cutting-edge technologies responsible for rapid developments in cellular biological and biochemical researches and methodologies result in accumulation of knowledge of cell itself in the levels of molecules and in a format of revealing of cellular mechanisms underlying for regulation of cell functions. In addition to recent textbooks describing the information observed in fast years, this class would be based on review and research papers, for updating the scientific knowledge and methodology of the possible

students, probably leading to helping them with concrete understanding of cellular functions and their regulation mechanisms and with connecting or understanding of clinical approaches and information.

375.542 Topics in Pharmaceutical Molecular Biology

The achievement of the completed human genome has been widely utilized as the basis for drug development. Accordingly, novel functions and interactions among a variety of genes and/or proteins will be introduced in this course. Furthermore, newly developed concepts for drug development including the molecular prevention of human diseases and pharmacogenomics will be discussed. The course will also include recent movements in and the future of postgenomic research in pharmaceutical science.

375.642 Advanced Antibiotic Chemistry

This course will cover the chemical structures, action mechanisms, resistance mechanisms, and antibacterial activities of new antibiotics.

375.643A Topics in Immunological Products

This introductory course will cover the latest advances in immunology and their application to new immunological product development.

375.647 Actinomycetal Metabolites and Laboratory

In this course, important metabolites of actinomycetes will be discussed and the isolation and physiological activities of these metabolites will be examined through experiments.

375.648A Topics in Genetics and Genomics

This course covers updated information and research trends in the main subjects of genetics and genomics, with a focus on the applications of genetic and genomics to biotechnology and pharmaceutical sciences. Specific issues include DNA replication, transcription, decoding genetic information, molecular structure, mutation and evolution, genomic analysis and information.

375.737A Topics in Medicinal Immunology

Recent advances and applications in immunology are discussed.

375.783 Molecular Endocrinology

This course will cover the latest advances in biochemistry and molecular biology in terms of

modern endocrinology. It will provide the general concepts of modern endocrinology: action mechanisms of hormones, disease and endocrinology, signal transduction pathways leading to cell proliferation, cell cycle control, and programmed cell death. Seminars on selected topics from recent issues of major journals are also planned.

375.795A Advanced Oncology
This course will introduce the characteristics of cancer cells, causes of cancer, principles of carcinogenesis, cellular and molecular mechanisms underlying viral, chemical, and physical carcinogenesis, functions of oncogenes and tumor suppressor genes, and current strategies applied to cancer prevention and therapy.

Courses in Pharmacognosy and Pharmaceutical Analysis Major

375.536 Biosynthesis of Plant Constituents
In this course, the primary and secondary plant metabolites and the biosynthetic pathway of these substances will be discussed.

375.537 Medicinal Plants Taxonomy
General information on the taxonomy of medicinal plants will be covered in this course

375.580 Advanced Pharmaceutical Analysis 1
This course is for the development of physical, chemical, and mathematical models for applications to various theories of compound separations. Emphasis will be placed on the theory of chemical equilibrium in terms of pharmaceutical analysis as well as ionic equilibrium, complex-forming reactions, solvent extraction processes, and all chromatographic applications.

375.582 Analysis of Pharmaceutical Preparation 1
In this course, the entire pharmaceutical manufacturing process from the quantitative and qualitative analysis of raw materials to standardization, manufacturing equipmenting, and final product assays and stability studies will be taught.

375.585 Instrumental Analysis 1
This course will consist of lectures on the theories and applications of NMR, IR, UV, MASS, and other spectroscopy for the analysis of pharmaceuticals.

375.587 Principles of Multifunctional Optical Contrast Agents

This subject deals with synthetic methods and applications of multifunctional optical contrast agents used for cancer diagnosis and monitoring of drug efficacy. As diagnostic non-invasive imaging techniques such as magnetic resonance(MR), positron emission tomography(PET) and single photon emission computed tomography(SPECT) develop relevant contrast agents are being actively developed to improve diagnostic sensitivity and accuracy. Recently nanoparticle-based optical constrast agents are used for drug screening based on optical imaging. Quantum dot, gold and silica nanoparticles are highly sensitive, photostable, non-invasive, and non-ionizing. They are capable of being biocompatible and selectively delivered to specific target molecules by surface functionalization, and this leads to their effective use for cancer diagnosis and relevant anticancer drug screening. The optical contrast agents have intrinsic therapeutic property or can be conjugated to therapeutic agents. This allows for the optical contrast agents to be used as multifunctional agents that enable both diagnosis and therapy simultaneously. This subject provides understanding of fundamental principles involved in syntheses and surface functionalization of optical contrast agents and introduces their applications to drug screening and biomedical field.

375.682 Advanced Pharmaceutical Analysis 2

This course will consist of an introduction to theories on and their applications to up-to-date methods of pharmaceutical analysis as well as a presentation of the new processes and a comparison with the existing methods in order to formulate more reasonable and improved methodology for analysis.

375.684 Analysis of Pharmaceutical Preparation 2

The principles and applications of the separative analysis of each component of compounded pharmaceuticals and selective analysis using specific reactions will be considered in this course. Emphasis will be placed on the particular analytical procedures and techniques of official methods of pharmaceutical analysis.

375.686 Instrumental Analysis 2

The fundamental theories of chromatographic separation and quantitation of pharmaceuticals will be taught in this course.

375.696 Studies in Pharmacoproteomics

This class contains actually everything a researcher would try to find in pharmacoproteomics field such as deep theory of instruments, background knowledge, practical protocols, and

published data. Also it would be a precious information tool for the researchers who study the proteome related field. By focusing on what is currently issued, graduate students will be able to grasp the available information filtered from numerous primary literatures at the end of the class.

375.697 Natural Product Derived Pharmaceuticals 1
This course covers all aspects of natural products as pharmaceuticals including both plant derived and microbial derived.

375.698 Natural Product Derived Pharmaceuticals 2
An in-depth discussion of recent advanced in knowledge and scientific techniques of natural products as pharmaceuticals including both plant derived and microbial derived

375.796 Screening Methods for Bioactive Natural Products 1
This course provides lectures, discussions, and laboratory experiments on principles for methods to screen compounds with a variety of bioactivity from natural sources.

375.797 Screening Methods for Bioactive Natural Products 2
This course will provide lectures on the principles for methods to screen compounds with various bioactivity from natural sources and laboratory experiments.

375.798 Chemical Structure Analysis of Medicinal Plant Constituents
In this course, students will discuss techniques used for the identification and determination of the structures of substances of natural origin. Discussion topics include physical methods and spectroscopic techniques of structure elucidation.

375.799 Chemistry in Pharmacognosy and Laboratory
This course will cover a comprehensive consideration of the chemistry and pharmacology of plant constituents that are important because of their biological activities. Included will be the bread classes, alkaloids, terpenoids, steroids, flavonoids, and other related groups.

375.800 Advanced Pharmacognosy
This course will cover an in-depth discussion of recent advances in our knowledge of plant and animal materials with biological properties of interest to pharmaceutical scientists.

375.805 Preservation of Natural Resources
This course will offer the origin, classification, distribution, and biological activities of natural pharmaceutical plants.

375.811 Methods in Bioactive Natural Products Research 1
This course will provide lectures on the screening of natural products for biological activities, instruction of pre-screening methods, screening methods to assay certain natural product activities, isolation of active compounds using activity-guided fractionation, and structural elucidation. The animal cell and plant tissue culture systems will be introduced as techniques for enhancing the yield of secondary products

375.812 Methods in Bioactive Natural Products Research 2
This course will provide lectures on the methods to isolate pure compounds with various bioactivity from natural sources. The major subjects will include carcinogens, anti-cancer, anti-inflammatory, anti-conceptive, antibacterial agents, radioimmune assay, affinity chromatography, prostaglandins, phytoalexines, phytohormones, and pheromones.

Courses in Pharmacology Major

375.513 Advanced Pharmacology 1 and Laboratory
This course will cover the action of autonomic and cardiovascular drugs at the cellular level and the current concepts of the mechanism of drug action.

375.514 Advanced Pharmacology 2 and Laboratory
This course will cover the current research trends, new developments in drugs and pharmacodynamic concepts, and the mechanism of the action of cardiovascular drugs, centrally acting drugs, and chemotherapeutic agents.

375.516 Clinical Pharmacokinetics and Laboratory
This course will cover the methods of applying pharmacokinetics for the safe and effective therapeutic management of individual patients.

375.517 Drug-receptor Interaction and Laboratory
This course will cover the concepts of receptors involved in physiological phenomena, theoretical and experimental classification of receptors, and handling processes such as the purification, characterization, and cloning of receptors with biological activities.

Course Description

375.589 Topics in Transcriptomics

Transcriptional gene regulation is the major mechanism that controls gene expression in normal physiology as well as pathological conditions. In this course, transcriptomics in prokaryotes and eukaryotes including basal transcriptional machinery, transcription activator complexes, and chromatin remodeling complexes will be instructed. Experts in this field will be invited to review the recent trends in transcriptomics and to discuss the current topics and advanced experimental approaches in gene regulation. Also students are encouraged to present and discuss hot topics in this field in the class.

375.618 Biochemical Pharmacology

This course will take a theoretical approach to the study of the cellular and sub-cellular actions of drugs and the relationship between these actions and the pharmacological properties of medicinal agents in intact organisms.

375.620 Neuropharmacology and Laboratory

This course will cover the concepts of the role of the nervous system in controlling biological activities via the central or peripheral nervous system, the mechanisms through which each biological function is controlled by the nervous system, and the experimental methods to test these issues.

375.668 Topics in Molecular Pathophysiology

The molecular pathophysiology is the study, which elucidates disease process at the molecular level and explains the sequence of events in the response of the cells or tissues to etiologic agent by means of interaction with molecules. This course introduces the recent research trends classified according to their main theme and presents pathophysiological understandings of disease.

375.669 Phenomics of Model of Organisms

The discovery of genetic data of Model organism opens the systematic phenotype identification of organisms. Especially, phenotype of model organisms, including genetically--engineered mouse or mutants, is essential for the construction of a great biological atlas of gene map. This course was built on the conceptual basis of "the diagnostic clinic for mice" and also presents the understandings of the comprehensive systematic analysis of genetically engineered mouse.

375.670 Topics in Protein Therapeutics Development

Biopharmaceutics refer to macromolecules derived from living organisms, therapeutic proteins generally taking the most of the part. At present, high market growth rate of such therapeutic proteins is attracting many companies to thrust into the market. In this subject, the characteristics of the development of recent protein therapeutics are summarized, and the series of developing process is discussed in industrial, academic, and regulatory point of view.

375.695 Cardiovascular Pharmacology and Laboratory

This course will consist of a consideration of the nature of the normal homeostatic regulation of the cardiovascular system and of its modification by drugs, and of the sites and characteristics of drug actions affecting the cardiovascular system.

375.721 Topics in Cellular Pathophysiology

The fundamental structures and functions of cells in higher organisms and the molecular mechanisms of intracellular signal transduction pathways which connect extracellular stimuli to gene expression will be instructed. Also, recent advances in cell physiology and the related human diseases and therapy will be introduced and discussed.

375.786 Advanced Pharmacokinetics

This course will cover the basic and latest topics in pharmacokinetics.

375.787 Membrane Potentials & Ion Channels

The membrane potential is the potential difference across the membrane, which is caused by the activities of various ion channels. In addition to controlling internal millieu such as osmosis, volume, and signal transduction, the membrane potential determines the excitability of muscle and neurons. Ion channels are excitable elements in the cell membrane and determine the electrical signals of muscles and nerves. Because of the latest advances in biochemistry, molecular biology, and electrophysiology, the genetic information on and structures of the ion channels are largely known. In this course, the definition of the membrane potential with a concomitant introduction to classical biophysical experiments will be discussed. The properties, genetic codes, structures, and functions of ion channels in relation to various diseases will also be explored.

375.813 Molecular Pharmacology

The course of molecular pharmacology provides information on drug action or selective toxicity at the molecular level. Molecular Pharmacology includes the studies of drug

receptors, drug-enzymes, molecular biology of drug metabolism, signaling pathways, protein-nucleic acids interaction, and drug-induced gene regulation. Students are encouraged to discuss components of biological experimentation and recent reports on molecular pharmacology. This course is offered to the students in Ph.D. and M.S. programs.

802.901 Advanced Physiology I
This is a systemic study of the functions of various body systems, such as cardiovascular, gastrointestinal, respiratory and endocrine systems. Lectures emphasize various mechanisms involved in maintaining a proper internal environment for the normal existence of body.

Courses in Pharmaceutical Health Science Major

375.518 Advanced Hygienic Chemistry
This course will review the latest literature on hygienic chemistry, with an emphasis on the disposition of xenobiotics, toxic mechanism, and biological self-defense mechanism.

375.523 Industrial Toxicology
This course will introduce the general principles of industrial toxicology. Topics will cover the toxicity of air-borne industrial chemicals such as solvents, gases, and particulates. Special emphasis will be placed on industrial hygiene practice.

375.622 Drug Induced Disease
This course will cover the diseases that result from extended drug treatment and misuse from theoretical and practical viewpoints.

375.623 Clinical Pharmacy Clerkship 1
This course will consist of field practice in selected hospitals that possess in-patient care facilities so as to provide students with a chance for practical experience as future clinical pharmacists.

375.624 Clinical Pharmacy Clerkship 2
This course will consist of field practice in selected hospitals that possess in-patient care facilities so as to provide students with a chance for practical experience as future clinical pharmacists.

375.625 Environmental Hygiene and Laboratory

In this course, students will survey and conduct experiments on the current state of environmental elements such as air, water, and earth as well as the physical and chemical substances in these elements.

375.629A Pesticide Toxicology 1

This course will cover the latest developments in insect physiology and biochemistry. Also, it will examine the mode of action of major pesticides in both insect and vertebrate systems.

375.711 Biological Self-defense Mechanism

The course will review several important current issues including cellular defense mechanisms in free radical toxicology.

375.716 Methods in Biological Safety Evaluation

This course aims at providing students with a better understanding of the fundamental physiological mechanisms for biological safety evaluation.

375.718 Molecular Toxicology

In the course of molecular toxicology, students are learning about the toxicology of xenobiotics at the molecular level. In this course, metabolic activation (biotransformation) of xenobiotics, interaction of xenobiotics with genes, gene expression and signal transduction as well as the health effects caused by the series of the events.

375.719 Clinical Pharmacogenomics

Recently, the rapid development of pharmacogenomics have provided extensive information regarding on the genetic background on the wide inter-individual variation of drug responses, which is expected to lead to the era of personalized pharmacotherapy. Pharmacogenetics is a science that is interesting to the inherited variants of genes related to pharmacokinetics (drug metabolizing enzymes, drug transporters etc.) and pharmacodynamics (receptor, ion channel, target enzyme etc.), which are associated to the susceptibility of an individual to the higher risk of ADR or therapeutic failure. In this course, students will learn the role of pharmacogenomics in relation to wide inter-individual variation of drug disposition and to the possible contribution to the personalized pharmacotherapy.

375.720 Clinical Trial Methodology

Clinical pharmaceutical trial is a research activity with the potential to improve the quality of

health care and control costs through careful comparison of alternative treatments. The importance of clinical pharmaceutical trial in drug approval as well as bioequivalence of generic drug and the acquisition of foreign currencies through multi-national pharmaceutical trial caused social attention. In this course, students will learn the fundamental concepts and how to design, develop and evaluate all phases of a clinical pharmaceutical trial.

375.808 Free Radicals in Biology and Medicine

Free radicals such as oxygen and carbon-centered radicals are generated endogenously and/or exogenously in humans. Due to their high reactivity with macromolecules including DNA, proteins, and lipids, they can damage cells and tissues, finally leading to various chronic degenerative diseases. This course will introduce the sources of free radicals generated in the cells and recent technology to detect free radicals, and provide a number of examples for toxic insults resulting from free radicals.

375.810 Advanced Pharmacotherapy

This is a course on pharmacotherapy for more advanced disease states. It will focus on the considerations and precautions required for the proper selection, dosage, and monitoring of drugs and the recognition of clinically significant, efficacious, and/or toxic drug interactions, in order to provide safe, effective, and rational drug therapy based on the current medical and pharmacy literature. Emphasis will be placed on problem-solving by analyzing actual patient cases.

375.815 Patient Education

Students will acquire knowledge needed for patient education with focuses on drug products, drug regimen, side effects, cautions, dietary considerations, etc.

375.816 iv Admixture of TPN and Clinical Application

Students are exposed to the preparation of aseptic parenteral nutrition products while considering their safety, stability, and drug interactions. This course will focus on nutritional assessment, pediatric/adult nutritional considerations, drug-nutrient interactions, enteral nutrition, and their proper monitoring.

375.817 Topics in Drug Information

This course introduces students to drug information sources and how to access them, systematic drug literature searches, and how to answer drug information questions. The course emphasizes clinical services, focusing on actual experience in literature retrieval, analysis, and dissemination of drug information.

375.818 Pediatric Pharmacy
This is a course on the application of clinical principles of pharmacology, biopharmaceutics, and toxicology to optimize disease management for pediatric patients.

375.819 Geriatric Pharmacy
This is a course on the application of clinical principles of pharmacology, biopharmaceutics, and toxicology to optimize disease management for geriatric patients.

375.820 Seminar in Clinical Pharmacy
Students are involved with discussions and practical sessions that enhance their understanding and skill levels in selected areas of clinical practice. Students enhance their verbal presentation, communication, writing, and problem-solving skills. They also work on the critical analysis of data and the provision of care through a weekly conference and projects.

375.821 Topics in Pharmaceutical Affairs
This course has students analyzing the practice and implementation of pharmaceutical care. Students confront their assumptions about the pharmacy profession, pharmacy practice, and pharmaceutical care. The course includes discussions, guest speakers, intensive literature searches, and evaluations.

375.822 Drugs in Society
This course covers the following topics: cultural foundations of pharmacy; development of the present state of pharmacy practice; the role of the pharmacist as a health practitioner in relation to other health practitioners; and the identification of factors (health policy, regulation, economics, research and development, promotion) that affect individual responses to drug therapy.

375.823 Pharmaceutical Economics & Policy
This course covers the following topics: economic analysis of the pharmaceutical sector of health care systems; problems of pricing production and distribution of pharmaceuticals; and domestic or international policy issues relevant to price and access of pharmaceuticals.

375.834 Research Methods in Social & Administrative Pharmacy
This course aims to provide the practical knowledge and techniques for economic evaluation. Students learn modeling techniques as decision-analysis and Markov modeling, and various

methods and computations of health state preference elicitation and willingness-to-pay. This course helps students to enhance basic skills of literature collect and computer programming in economic evaluation. This course is run as a lecture and seminar with student' s project involving pharmacoeconomic study.

375.835 Introduction to Carbohydrate-based Drugs

This course will cover methods and research design as related to pharmacy administration. It will combine an overview of research methods and more in depth examination of specific research methods that may be used to complete research done in the field.

375.837 Clinical Pharmacometrics

Pharmacokinetics is the study of mathematically quantifying a drug's pharmacodynamic/ pharmacokinetic phenomenon. The existing method of predicting a drug's efficacy or side effect is based on the plasma concentration of a drug. However, it is becoming evident that the relationship between plasma concentration and the actual efficacy or side effects of a drug is imperfect. This has brought into light the concept of pharmacometrics, which is the combined science of pharmacodynamics and pharmacokinetics, to yield a more precise and refined result. Pharmacometrics encompassess each area of Population PK, PK/PD modelling and simulations; making it have a wide range of uses. Through this course, students will get a deeper understanding of pharmacometrics and the practical skill to apply it in their research. The ultimate purpose of teaching clinical pharmacometrics is to educate each student to be able to produce a research outcome that indicates an optimum dosage and directions of drugs for an "individualized pharmacotherapy".

Courses in Pharmaceutical Chemistry Major

375.571 Advanced Pharmaceutical Chemistry 1

This course will cover the chemical bond theory and the chemical structural theory. It will take an instructional approach to carbonium ion, carbanion, radical, benzene, and nitrene.

375.573 Chemistry of Chemotherapeutic Agents 1

This course will cover the development of new chemotherapeutics and theoretical approaches to the relationship between chemical structures and pharmaceutical actions (anticancer agents, sulfa drugs, and fungicidal drugs) in pharmaceutical synthesis, anticancer agents, and antibiotics.

375.579 Stereochemistry 1

This course will introduce sterochemical concepts including the characteristics of chemical bonds, steroisomerism and absolute configuration, asymmetric carbon and enantiomer, configurational notations, and structures of molecules and symmetry.

375.678 Stereochemistry 2

This course will cover the application of modern stereochemical concepts to the preparation of optically active compounds including the resolution of racemic compounds, stereoselective reactions, asymmetric synthesis, stereochemistry of substitution reactions, sterochemistry of pericyclic reactions, stereochemistry of double bonds, and optically active compounds without asymmetric carbons.

375.771 Chemistry of Chemotherapeutic Agents 2

This course will consist of instruction on the synthesis and chemistry of antimicrobial chemotherapeutics such as β-lactam antibiotics and aminoglycoside antibiotics.

375.772A Advanced Medicinal Chemistry 1

The purpose of this course is to explain the mode of action of drugs at the molecular level including receptor, enzyme and DNA, and to introduce the concept of pharmacophore, bioisosteres, quantitative structure activity relationship and molecular modeling in order to understand the structure activity relationship of drugs. The contents include drug discovery and development, receptor ligands, enzyme inhibitors, DNA-interactive agents, drug metabolism, prodrugs and drug delivery systems.

375.774 Advanced Pharmaceutical Chemistry 2

The applications to organic synthesis, reaction mechanisms, and recent achievements of organic transition metals will be covered in this course. The course will also include topics on recent organic reactions.

375.789A Advanced Medicinal Chemistry

This course covers the up-to-date methods and technology related to lead discovery and optimization for new drug development and provides the individual seminars with the topics of updated information about new drug development based on diseases. The contents of lecture include the rational drug design and molecular modeling and the topic of seminar covers the update information of new drug development including CNS diseases, cardiovascular and metabolic diseases, inflammatory diseases, and cancer and infectious diseases.

375.791 Physical Organic Pharmaceutical Chemistry 1
The general organic reaction mechanisms will be studied in this course through an introduction to the physical, organic, and chemical properties of organic reaction such as substitution and elimination reactions.

375.792 Physical Organic Pharmaceutical Chemistry 2
New organic reaction mechanisms and their applications will be studied in this course through an introduction to the physical, organic, and chemical properties of new organic reactions.

375.793 Advanced Organic Pharmaceutical Chemistry 1
The structural features and preparation of olefin and 3-9 membered carboncycles will be discussed in this course. In addition, their synthetic applications to bioactive molecules including natural products will be discussed.

375.794 Advanced Organic Pharmaceutical Chemistry 2
The structural features and preparation of olefin and 3~9 membered carboncycles will be discussed in this course. In addition, their synthetic applications to bioactive molecules including natural products will be discussed.

Courses in Pharmaceutics Major

371.688 Biomedical Biomaterials
The purpose of this course is to introduce students to biomaterials used for drug delivery systems and medical devices so that they can understand the role and function of materials used in the biomedical field. In particular, students will learn about such biopolymers as proteins and polysaccarides, as well as synthetic polymers such as polyethylene glycols. Materials to be taught will be separated based on characteristics and structure. For characteristics, biodegradable polymers, water soluble polymer and hydrogels will be introduced, and structurally linear polymer and crosslinked polymers will be introduced. The course will deal with the structure of biomaterials, and interaction between matter and drugs. Using examples, students will learn to analyze function of materials, which is to decrease toxicity and increase drug efficiency. In particular, the course will focus on the material characteristics of implantable materials and their interactions with biological systems upon contact. Through this course, students will learn to predict and solve problems in developing drug delivery materials with respect to possible side effects or toxicity from the perspective of materials.

371.689 Advanced Macromolecular Drug Delivery

The purpose of this course is to explore the problems involved with administration of macromolecular drugs; through analyzing and solving such problem, students will understand problem solving techniques using drug delivery system and build on knowledge to create new technologies. Macromolecular drugs to be dealt with in this course refer to protein and polysaccharide drugs and DNA used in treatment of diseases. For protein drugs, Students will learn about drug delivery systems using chemically/physically combined technologies, manipulative technologies, formulation and device technologies. For polyssacharide drugs, students will learn about non-invasive delivery using chemical derivatives, and for genetic drugs, viral or non-viral vector systems. Furthermore, students will learn about cell delivery technology using the DNA manipulative cell technology. The course focuses on the understanding of the basic principles of the above and the analysis of recent technologies being researched in the field.

375.555 Advanced Pharmaceutics 1

This course will consist of lectures on theoretical methodology and the selection, application methods, and timed release of preparations in order to evaluate, guarantee, and enhance the quality of drugs.

375.556 Advanced Physical Pharmacy 1

This course presents the following major topics; 1) an overview of molecular structure and molecular interaction of drugs. 2) The application of spectroscopic methods and X-ray crystallography to the pharmaceutical system. 3) General principle of electrolytes and solution system and dispersion system in pharmacy.

375.557 Pharmaco-biophysics

This course will include various physicochemical characteristics that can be studied though pharmacologically active compounds, various organs, and bioavailable substances.

375.559 Advanced Dispersion System

This course will study dispersion systems including small particle technology, interfacial phenomena, and electrokinetic and rheological properties of materials in colloidal and coarse dispersions.

375.561 Preformulation and Formulation of Pharmaceuticals

The aim of this course is to increase the understanding of the students to the area of preformulation and formulation technologies of pharmaceuticals including chemical and

biological drugs. For chemical drugs, the physichochemical preformulation and route-specific formulation technologies will be covered. For biological drugs such as antibodies and nucleic acids, the injectable formulations and noninvasive formulations will be emphasized. Moreover, besides conventional pharmaceutical formulations technologies, the cutting-edge technologies applied to protein, nucleic acid, and cell-based pharmaceuticals will be introduced.

375.657 Advanced Pharmaceutics 2

This course will cover the factors relevant to the preformulation of pharmaceuticals. Topics will include the solubilization, dissolution, absorption, and excipients of active ingredients.

375.659 Advanced Physical Pharmacy 2

The study of the thermodynamic properties of drugs in solutions and the application of thermodynamics and kinetics to the decomposition and stabilization of medical agents will be included in this course.

375.660 Advanced Industrial Pharmacy

The topics to be discussed in this course are the principles and production schemes of new drug delivery systems.

375.809 NMR in Pharmacy

The theory and application of NMR spectroscopy concerning the structure determination of biological compounds (proteins and nucleic acids) will be studied in this course.

375.824 Topics in Drug Transporters in Biological Membranes

This course includes topics relevant to the drug transport phenomenon, which affects absorption, distribution and excretion. Characteristics of transporters, methodologies in such studies, and practical application will be discussed and updated regularly.

375.825 Topics in Tissue Specific Drug Transport

Various strategies for tissue-specific drug targeting will be discussed. The strategies that utilize the characteristics of transporters will be the primary focus for the course discussion. Particular emphasis will be on tissues that interface polarized epithelial cells such as brain and kidney cells.

375.826 Topics in Pharmacokinetic Drug Interaction

A drug interaction generally refers to a modification of the expected drug response in the

patient, due to the exposure of the patient to another drug or substance. Some unintentional drug interactions produce adverse reactions in the patient, whereas some drug interactions may be intentional to provide an improved therapeutic response or to decrease adverse drug effects. Drug interactions may include drug-drug interactions, food-drug interactions or chemical-drug interactions, such as the interaction of a drug with alcohol and tobacco. In this lecture, the risk of a drug interaction in association with multiple drug therapy, multiple prescribers, poor patient compliance, and patient risk factors will be discussed. Screening for drug interactions, significance of the interaction, mechanisms of drug interactions during the processes of absorption, metabolism, disposition, biliary and/or renal excretion will also be discussed using appropriate examples.

375.827 Topics in Pharmacokinetics

Pharmacokinetics is the study of the time course and concentrations of drugs in biological fluids, tissues, and excreta. Physiological, biochemical, and mathematical knowledge will be applied to model the temporal relations of drug concentrations. Topics will include kinetic characterizations relevant to the processes of absorption, distribution, metabolism, and excretion. Updated literature information will be evaluated in relevant topics.

375.828 Topics in Pharmacokinetics Analysis

This course covers the estimation of kinetic parameters. Particular attention will be paid to the statistical estimation of the parameters using computers and nonlinear least square methods. The estimates will be applicable in 1) understanding the kinetic processes; 2) prediction of dose and dosing rates for optimal clinical response; and 3)ultimate development of safe and effective therapeutics.

375.829 Topics in Biopharmaceutics

The course will discuss topics in pharmaceutics including factors that affect the absorption, distribution, metabolism, and excretion of drugs.

375.830 Topics in Experimental Biopharmaceutics

This course will include topics such as the routes of administration, distribution, and disposition of pharmaceuticals and bioavailability. Particularly, the methodologies in the literature relevant to these topics will be discussed and evaluated.

375.831 Topics in Bioactives Delivery Systems

This course covers the methods of preparation, evaluation and application of delivery

systems, as well as physicochemical interactions between bioactives and delivery systems, and physiological considerations of delivery systems.

Courses in Natural Products Science Major

371.514 Natural Medicines

This course is intend to provide the students with the broad range of knowledge concerning complimentary and alternative medicine (CAM). The potential benefits and the safety issues of CAM are to be discussed. The problems concerning the drug interactions among CAM and with conventional therapies are also to be discussed. The recent research progress on the inter-complementary effects of CAM and conventional medicines are to be reviewed with examples.

375.836 Introduction to Carbohydrate-based Drugs

Carbohydrate is one of the biopolymers with protein and nucleic acid in the body. Nowadays it draws a lot of attention owing to diverse roles including signaling bridge, receptor binding, and cell-cell communications. This lecture will be focused on the structure, analysis, polysaccharides from natural products, plant glycobiology, microbial glycobiology, animal lectins, glycosylation and diseases, and carbohydrate therapeutics.

821.510 Special Research in Chemistry of Natural Products

This lecture is designed to help students interpret spectral data for the identification and characterization of the structures of natural compounds obtained through fractionation, isolation, and purification.

821.511 Natural Products Chemistry

This course provides a comprehensive and balanced introduction to natural products. This course builds upon both fundamental chemical principles for natural products and a wealth of diverse secondary metabolites, and guides the graduates to acquire or expand their knowledge in the field of natural products chemistry.

821.512 Separation Techniques in Bioactive Natural Products

Principles and applications of modern separation methods necessary for the isolation of biologically active agents will be studied. It is recommended that students take Natural Products Chemistry and Biochemistry before taking this course.

821.520 Special Research in Biological Functions of Natural Products

This course is designed to provide students with information on existing methods and experimental techniques concerning models for searching biological activities including physiological, pharmaceutical and toxic activities. The contents include establishing new models for searching activities, and their applications.

821.521 Natural Products Biochemistry

This course will cover the following topics: understanding of molecules within cells; interactions between cells that allow for the construction of multi-cellular organisms; concepts and processes of molecular cell biology; gene control pathways; understanding of gene control during development and disease states; experimental tools that allow the study of living cells and organisms; and analyzing DNA and protein sequences. New discoveries and new methodologies covered are bioinformatics, DNA chip microarray technology, apoptosis, and signaling pathways. This course will demonstrate the dynamic nature of science and prepare the students not only to engage actively in scientific research and teaching but also to become educated members of a public that is increasingly asked to deal with complex issues such as environmental toxins, genetically modified foods, and human gene technology.

821.522 Natural Products Pharmacology and Toxicology

The course provides basic knowledge on general pharmacology related with natural products and traditional Chinese herbs. Students learn the following: interaction of receptors with drug molecules; physiological and anatomical structures of human cells, tissues and organs; and pharmacokinetics on natural products' absorption, distribution, metabolism and elimination. Additional focuses of the course will be toxicological aspects of natural constituents derived from herbal materials and screening methodologies of toxic effects.

821.523 Biological Functions of Natural Products

Basic chemical, biochemical, and pharmacological aspects of biologically active compounds will be studied in this course.

821.531 Natural Resources

The general uses and economic values of important natural resources will be reviewed to obtain overall ideas on the history and processes in the development of natural products. Natural resources with potential uses and the issue of under development are also discussed to accumulate the comprehensive knowledge on the development of natural products.

Course Description

821.612 Topics in Natural Products Chemistry

This course provides expanded coverage of many topics on natural products chemistry. This course focuses on information on possible leads to new natural products, such as screening methods, and the surveys on modern HPLC hyphenated techniques or NMR methods in structure elucidation.

821.624 Natural Products Biotechnology

In recent years, there has been a heightened public awareness of the fast-growing field of biotechnology. Natural products biotechnology covers an explanation of the genetic foundation of biotechnology known as the tools approach. The ability to manipulate the genetic make-up of organisms has led to explosive progress in all areas of this field. This lecture examines the fundamental principles and facts that underlie current practical applications of various organisms, describes those applications, structure and biosynthesis of the biologically active metabolites, and examines future prospects for related technologies.

821.625 Topics in Natural Products Biochemistry

This lecture concentrates on the relationship between active natural compounds' function toward cell membrane and various functions of membrane proteins & enzymes for the understanding of the biological activity of active compounds at the level of biological cell membrane.

821.626 Topics in Natural Products Pharmacology and Toxicology

It is recommended that students who take this course have prior knowledge of general pharmacology, physiology, biochemistry and anatomy. Knowledge of individual natural drugs and their constituents on pharmacology and toxicology will be emphasized. In addition, pharmacology, toxicology and drug-interaction of traditional herbal drugs such as traditional Chinese drugs will be studied as well. By taking this course, students will learn how to develop useful natural drugs and related products such as dietary supplements, and functional cosmetics.

821.627 Topics in Biological Functions of Natural Products

Recent articles on special topics in Natural Products Science will be discussed in this course.

821.632 Topics in Natural Resources

In order to learn about the uses and developments of useful natural products, various groups of natural resources will be discussed in depth, in regards to their characteristics and processes of development. Current approaches to the development and research of natural resources will be also discussed.

821.642 Topics in Natural Products Information

In this class, students will search the Internet for information on the natural products industry, regulatory agencies, and natural products sciences. Throughout the course, students will learn database construction techniques using HTML. Based on such basic information technology, all students will have access to information on regulatory agencies over the world, such as the American FDA, and other agencies in the EU, Japan, China, Korea, etc. Students will first learn about regulations regarding the registration process and requirements of various natural products like natural drugs, dietary supplements, functional cosmetics and related products. Then, the students will practice the registration process with a model item of their own to obtain registration permission. Through on-line training, students will construct their own databases on natural products information.

821.711 Structure Elucidation of Natural Products

The development of spectroscopic methods has enabled the structure elucidation of secondary metabolites. The identification of natural products by spectrometry is greatly facilitated by ready access to reference spectra. Therefore, this course provides many exercises for structure elucidation of natural products by spectroscopic data obtained from reference spectra.

821.713 Natural Products Synthesis

This course covers selected topics including both the partial and total synthesis of natural products. A wide-ranging survey of organic syntheses with an emphasis on important functional group transformations and carbon-carbon bond-forming reactions are provided. The course also includes retro-synthetic analysis and the method for selective synthesis of optically active compounds and heterocycles.

821.715 Marine Natural Products Chemistry

Marine organisms produce a wide variety of biologically active and structurally unique metabolites. This course focuses on the chemical, biological, and pharmacological features of marine natural products compared to those derived from terrestrial organisms. Theoretical and experimental approaches to these compounds are also covered, as well as their pharmaceutical and biotechnological potentials.

821.716 Topics in Natural Products Synthesis

Biologically active natural products are rich sources of medicines. This course will provide advanced knowledge of natural products focusing on their structure, chemistry, biological

activity, and synthesis. The focus will be on the chemical synthesis of biologically active natural products with complex structures. Topics include retro-synthetic analysis and designing synthetic pathways using recent chemical databases and journals.

821.721 Cell Function Regulations from Natural Products

This course concentrates on a small number of organisms and the critical experiments that have advanced our understanding of the cell cycle. The topics include the following: origin of the different experimental approaches to the cell cycle: principles of cell cycle regulation, especially focusing on the roles of the cyclin dependent protein kinases; their contribution to our current picture of cell growth and division; how different organisms have specialized in regulating particular aspects of cell cycle control, resulting in the emergence of a great plethora of proteins that govern cell cycle progression; and the question of cancer and other important medical problems. This course also focuses on the field of “signal transduction”, which has revealed almost unimaginable diversity and complexity within large families of proteins involved in the production and destruction of second messenger molecules, and information transfer via kinase cascades and their associated regulatory proteins.

821.731 Taxonomy of Economic Plants

In this course, students are introduced to general classification systems on organisms with an emphasis on economically important biological resources. Basic concepts of biological classification will be discussed in detail, such as rules on biological nomenclature, scientific names, characters, and phylogeny. In addition, organisms with important economic value will be introduced to provide general understanding on important natural resources.

821.734 Studies in Bioactive Natural Product Evaluation

The purpose of this course is to study the principle and biochemical and pharmacological mechanisms of action of bioassay systems in the identification of the biologically active natural products with potential pharmacological effects.

821.735 Microbial Secondary Metabolite Chemistry

Microbial secondary metabolites have been platforms of drug discovery and provided natural products with diverse structures and biological activities. Microbial secondary metabolites also mediate important chemical interactions between organisms in nature. This course discusses chemical and biological characteristics of natural products derived from microorganism by classifying their structures. This course also teaches the pharmacological applications and the fundamental roles of microbial natural products.