

College of Pharmacy and Allied Health Professions

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Objectives

The Graduate Division of the College of Pharmacy and Allied Health Professions, in harmony with the mission of the University, prepares students for positions in industry, health care facilities, pharmacy practice, governmental agencies and education. The College provides an opportunity for students to develop and maintain scholarly growth in the pharmaceutical, industrial, biomedical and allied health sciences. In order to meet these objectives, the College offers programs at the master's level in pharmaceutical sciences, toxicology and pharmacy administration. Thesis and non-thesis options are available in all programs leading to the Master of Science degree except the specialty track in biopharmaceutical technology. The College of Pharmacy and Allied Health Professions also offers a program of study in pharmaceutical sciences leading to the Doctor of Philosophy degree and a program of study in pharmacy leading to the Doctor of Pharmacy degree.

Master of Science Degrees

Programs of Study

The programs leading to the Master of Science degree are designed to enable individuals to be skilled in the areas of pharmaceutical sciences, toxicology, basic and applied biomedical sciences and allied health. Graduates are prepared for positions in industry, research, education and health care settings. Master's students are equipped with the skills to interpret and critically review research and integrate theoretical knowledge to provide solutions to practical problems.

The Graduate Division of the College of Pharmacy and Allied Health Professions offers the following programs of study leading to the Master of Science degree:

Pharmaceutical Sciences

Specialization in: Biopharmaceutical Technology; Industrial Pharmacy; Medicinal Chemistry; Pharmacology; Pharmacotherapeutics

Pharmacy Administration

Specialization in: Pharmaceutical Marketing; Regulatory Affairs/Quality Assurance

Toxicology

Double Master's Degree Program

This leads to an M.S. in Pharmaceutical Sciences and an M.L.S. in Library Science. This dual master's program is offered in conjunction with the Division of Library and Information Sciences of the St. John's College Graduate Division of Liberal Arts and Science.

Entrance and Degree Requirements

Applicants with strong credentials in the sciences are considered for admission to the master's programs. All applicants to the master's programs must submit scores from the Graduate Record Examination, two letters of recommendation and a statement of goals in support of their application. Other specific requirements depend on the particular degree program chosen by the student. Graduate students who have certain deficiencies in their undergraduate curriculum may be required to enroll in graduate or undergraduate courses to remedy these deficiencies. These remedial courses provide no credit towards the master's degree. Students are notified of the specific requirements upon acceptance into the program.

Program Requirements

Pharmaceutical Sciences

Students who plan to undertake graduate work in the master's programs in pharmaceutical sciences must hold an appropriate baccalaureate degree with a major in pharmacy or in one of the physical, chemical or biological sciences.

For graduate study in pharmaceutical sciences with a specialization in pharmacotherapeutics, a baccalaureate degree with a major in pharmacy, nursing, or physician's assistant is required.

Pharmacy Administration

For graduate study in pharmacy administration with a specialization in pharmaceutical marketing, applicants should possess a baccalaureate degree in pharmacy; however, those possessing a bachelor's degree in business administration are considered. The latter may be required to take certain undergraduate pharmacy adminis-

tration courses in order to rectify any deficiencies.

The Regulatory Affairs/Quality Assurance Program provides comprehensive knowledge for Regulatory Affairs (RA) and Quality Assurance (QA) professionals seeking employment or career advancement in pharmaceutical companies, hospitals, governmental agencies, health care organizations and academia.

Toxicology

Students who plan to undertake graduate work in the master's programs in toxicology must hold an acceptable baccalaureate degree with a major in pharmacy or in one of the physical, chemical or biological sciences.

Double Master's Degree Program in Pharmaceutical Sciences and Library Science

Students with an appropriate bioscience background may apply for admission to the double master's program. The M.S. in pharmaceutical sciences is awarded with a specialization in pharmacology.

Degree Options

Two options are offered within most programs leading to the Master of Science degree. The thesis option (Plan A) requires 24 semester hours of coursework (exclusive of prerequisites) and a thesis project for which a minimum of six semester hours of credit are required. Students that are accepted under the thesis option are permitted to take more than 24 semester hours of coursework subject to approval of the Dean. The non-thesis option (Plan B) requires additional coursework in lieu of the thesis (a minimum total of 33 semester hours of coursework, exclusive of prerequisites). *Students are typically required to complete the degree program option (thesis or non-thesis) for which they have been accepted.*

Degree Requirements

Master of Science Programs

Residency*	One Year
Time Limit on Credit	Five Years
Minimum Credit in Semester Hours: Thesis Option	30 (24 Coursework; 6 Thesis Research)
Minimum Credit in Semester Hours: Non-Thesis Option	33 to 36 (Coursework)
Comprehensive Examination	Required (for Plan B)
Graduate Record Examination	Required

* Residency for the Master of Science degree requires completing six credits per semester for two consecutive semesters.

Double Master's Degree Program

Library Science	24 semester hours of credit
Pharmaceutical Sciences (Pharmacology)	21 semester hours
Exchange of credits applied toward the completion of both degrees	12 semester hours
TOTAL	57 semester hours

Doctor of Pharmacy Degree: Practitioner Option**Entrance Requirements**

- The candidate must be a graduate of an ACPE accredited Pharmacy program or have a B.S. degree in pharmacy with a license to practice pharmacy in the U.S. and have documented clinical experience equivalent to a community externship, hospital externship, inpatient clerkship and an elective rotation.
- The candidate must submit a University application, transcripts of all college coursework, three letters of recommendation and a personal statement of goals.
- Candidates must also supply a comprehensive curriculum vitae for evaluation.
- Selected applicants may be required to complete a personal interview.

Degree Requirements

Residency*	One Year
Time Limit	Five Years
Minimum Credit in Semester Hours:	37 credits
Comprehensive Examination:	Required
Graduate Record Examination:	Not Required

*Residency for the Doctor of Pharmacy degree requires completing two courses per semester for two consecutive semesters.

Curriculum

The curriculum consists of 37 credits. A total of 22 credits are didactic and 15 credits are experiential (rotations).

I. Didactic Coursework	Credits
CPP 301 Advanced Therapeutics I	3
CPP 302 Advanced Therapeutics II	3
CPP 303 Physical Assessment	1
CPP 304 Advanced Pathophysiology	3
CPP 308 Drug Information and Drug Literature Evaluation	3
CPP 322 Applied Clinical Pharmacokinetics	3
Elective	3
Elective	3
Total Credits	22

II. Clinical Experience	Credits
Inpatient Care	3
Ambulatory Care	3
Elective Rotation	3
Elective Rotation	3
Elective Rotation	3
Total Credits	15
Total program credits	37

Credit for Learning Derived From Experience

Credits are granted for life experience. Such credits are awarded based on review of the student's portfolio and evaluation by the clinical faculty. Life experience credits are awarded only in selected areas of clinical experiential training. The student may apply for a waiver of a maximum of one rotation.

Doctor of Philosophy Degree

The program in pharmaceutical sciences leading to the Doctor of Philosophy degree prepares graduates for leadership roles in meeting the evolving needs in pharmaceutical and biomedical education, research and industry. The Doctor of Philosophy degree program is offered with areas of specialization in:

- Industrial Pharmacy
- Pharmacology
- Toxicology
- Medicinal Chemistry

Entrance Requirements

An applicant seeking acceptance in the Doctor of Philosophy program must have completed an appropriate baccalaureate or master's degree program. This degree must be in the natural or physical sciences and may include degrees in the pharmaceutical sciences, toxicology, biology or chemistry. Other degree areas are considered on a case by case basis by the Admissions Committee.

- Basic minimum requirements for a student with an undergraduate degree include:
 - a) An undergraduate grade point average of 3.5 or better
 - b) Suitable Graduate Record Examination (General Exam) scores
 - c) Two letters of recommendation
 - Basic minimum requirements for a student with a suitable master's degree include:
 - a) A graduate grade point average of 3.0 or better
 - b) Suitable Graduate Record Examination (General Exam) scores
 - c) Two letters of recommendation
- Prior to registration, the student must receive written confirmation from the Office of Admission as to the approval of matriculation in the doctoral program. Post M.S. courses completed prior to acceptance in the Ph.D. program may not be applied toward the Ph.D. degree requirements. The admissions committee may require that certain deficiencies be

remedied during the first year of the Ph.D. program. Admission to the doctoral program does not imply advancement to candidacy for the degree. Additional requirements, including satisfactory completion of the core curriculum, passing the qualifying examination, passing the oral presentation of the research proposal and the establishment of the Ph.D. research committee must be fulfilled before a graduate student may be considered a candidate for a degree. The Ph.D. research committee is responsible for assisting the candidate in his/her research, but the primary responsibility for successfully completing the research and dissertation rests with the candidate.

Students must take PAS 265 Scientific Inquiry: Regulation and Ethical Challenges on a Pass/Fail basis. These credits do not apply toward degree.

Program of Study

The program of study consists of a minimum of 60 semester hours beyond the bachelor's degree or a minimum of 30 semester hours beyond the master's degree, exclusive of prerequisites and dissertation research. The coursework for each student consists of a core curriculum and a specialization curriculum that is determined in consultation with the faculty mentor. In some cases, students may be required to complete more than the minimum number of credits in their area of specialization or a minor field of study in order to make up any deficiencies which may exist.

Curriculum

Core Curriculum:	Credits
PHS 212 Applied Biopharmaceutical Chemistry	3 cr.
or	
PAS 241 Advanced Biopharmaceutics	3 cr.
PAS 252 Biostatistics (industrial pharmacy only)	3 cr.
PHS 251 Seminar in the Pharmaceutical Sciences	0 cr.
PHS 253 Seminar in the Pharmaceutical Sciences	0 cr.
PHS 254 Seminar in the Pharmaceutical Sciences	1 cr.
PHS 256 Pharmaceutical Analysis Laboratory	3 cr.
Total	10 cr.

All core requirements must be completed within the first two years of study. The specific curriculum for a specialization area will be determined in consultation with the doctoral student's faculty mentor.

Degree Requirements

Residency	24 credits or equivalent in a 24-month period (including summer)
Time Limit on Credit	Seven years
Minimum Credit in Semester Hours	15 credits of coursework beyond the M.S. degree plus basic requirements in area of specialty subject to the Doctoral Committee; 45 credits of coursework beyond the baccalaureate degree.
Qualifying/Comprehensive Examination	Required
Graduate Record Examination	Required
Dissertation Research	Minimum of 15 credits of Dissertation Research (PAS 950, PHS 950)

The Research Tool consists of:
FRE 0101, 0102
GER 0101, 0102
MTH 165, 166
or
PAS 265.

Thesis and Dissertation Research

All candidates for the Ph.D. degree must conduct an original laboratory investigation. All master's students electing the thesis option, must conduct an original laboratory, administrative or clinical investigation. The results are reported in the form of a written dissertation that must be presented and defended at an oral examination. All thesis and dissertation candidates must take the appropriate 900 level research course each semester from completion of comprehensive examination requirements up to and including the semester in which the thesis or dissertation is defended. All laboratory research must be conducted at the University, unless explicitly authorized by the Ph.D. or master's committee.

Examinations and Grading

Graduate degree requirements for all programs include a required number of course credits with satisfactory grades indicative of scholarship. All master's and Pharm.D. students must take and pass a comprehensive examination. Master's students that are enrolled in the thesis option (Plan A) must satisfy the comprehensive examination requirement by completing a research project and submitting and orally defending the written thesis.* Ph.D. students are required to take and pass a qualifying comprehensive examination. Ph.D. students must also complete a research project and submit and successfully orally defend a written dissertation. (Ph.D. students should consult the College Doctoral Handbook for details concerning degree requirements.)

Academic Standing

Students in the graduate programs are required to receive at least a "B" grade in all courses. If a student receives a grade of less than a "B", or their G.P.A. falls below 3.0, the student's program will automatically become subject to review. Such a review may result in academic dismissal. Master's and Pharm.D. students who receive more than two grades less than "B" are typically considered for academic dismissal. Ph.D. students who receive more than one grade less than "B" are typically considered for academic dismissal. Ph.D. students should consult the College doctoral handbook for details concerning academic status review and dismissal.

*M.S. students should consult the M.S. candidate handbook for further details.

Department of Clinical Pharmacy Practice (CPP)

Program of Study

The objective of the Department of Clinical Pharmacy Practice is to prepare doctor of pharmacy students and practitioner option students for leadership roles in clinical pharmacy practice. The individual programs are designed to provide the student with the requisite knowledge, skills and attitudes to be an effective practitioner in the patient care setting.

Courses

CPP 205 Controversies in Therapeutics

This course is oriented to an overview of new issues in selected major disease classifications including infectious diseases, rheumatology, hematology, psychotherapeutics and neuropharmacology. *Credit: 3 semester hours.*

CPP 215 Cancer Chemotherapy

A review of the representative neoplastic disease states and modalities of treatment; the general principles of cancer chemotherapy and the essentials of monitoring and counseling cancer patients. *Credit: 3 semester hours.*

CPP 216 Psychotherapeutics

Psychotherapeutics covers the basic principles of psychiatric pharmacy practice. Emphasis is placed on the major psychiatric disorders including: psychosis, mood and anxiety disorders, substance abuse and dementia. *Credit: 3 semester hours.*

CPP 217 Antimicrobial Therapy

This course is intended to outline an approach to the management of bacterial infections through an understanding of pathophysiology, epidemiology and basic principles of infectious diseases. *Credit: 3 semester hours.*

CPP 221 Human Nutrition

Studied are the inherent properties of carbohydrates and proteins as basic nutrients, as are human needs in the catabolic process of sustaining bodily functions in homeostasis. *Credit: 3 semester hours.*

CPP 225 Pediatric Pharmacotherapeutics

Prerequisites: CPP 301, 304. Provides an overall background of pediatric pharmacotherapy encompassing developmental differences between various pediatric age groups and their effects on drug disposition. *Credit: 3 semester hours.*

CPP 301; 302 Advanced Therapeutics I; II
These courses focus on the therapeutic management of select disease states. Emphasis is placed on rational drug therapy, drug-induced diseases, therapeutic drug monitoring and the modification of drug therapy as dictated by changes in the patient's characteristics and/or physical condition. *Credit: 3 semester hours.*

CPP 303 Physical Assessment
This course is designed to provide the student with general concepts of physical examination of patients. *Credit: 1 credit hour.*

CPP 304 Pathophysiology
This course is designed to provide the student with a detailed understanding of the pathophysiology of the most common disease states. *Credit: 3 semester hours.*

CPP 308 Drug Information and Literature Analysis
The philosophy and fundamentals of drug information practice and the application of drug information skills in the delivery of pharmaceutical care are discussed. *Credit: 3 semester hours.*

CPP 309 Critical Care Therapeutics
This course focuses on the therapeutic management of patients in the critical care setting. Emphasis is placed on the pathophysiology of acute illnesses as well as on rational treatment modalities and therapeutic drug monitoring of critically ill patients. *Credits: 3 semester hours.*

CPP 310 Topics in Women's Health
Prerequisite/Corequisite: CPP 301. Various women's conditions and disease states are discussed with an emphasis on pathophysiology and pharmacotherapeutics. *Credit: 3 semester hours.*

CPP 322 Applied Clinical Pharmacokinetics
This course examines basic pharmacokinetic principles as they relate to design of optimum dosage regimens in the clinical environment. *Credit: 3 semester hours.*

CPP 323 Clinical Poison Management
Provides the student who has a strong background in clinical pharmacy with a detailed didactic course in clinical toxicology. *Credit: 3 semester hours.*

CPP 349 Life Experience Credit
Credits are allowed for life experience. Such credits are awarded based on review of the student's portfolio and evaluation by the clinical faculty. These credits are awarded only for selected areas. *Credit: 3 semester hours.* *Application should be submitted in last semester.*

CPP 350 Drug Information Rotation**
Prerequisites: CPP 301 or 302; CPP 303, 304. The rotation orients the student to the methods and techniques of drug literature review, abstracting, indexing, retrieval and provision for the primary purpose of answering drug information questions. *Credit: 3 semester hours.*

CPP 351 Cardiovascular Therapeutics Rotation**
Prerequisites: CPP 303, 304. The focus of this rotation is to gain a basic understanding of the role of the cardiovascular clinical pharmacist and to provide pharmaceutical care to patients with underlying cardiac disease. *Credit: 3 semester hours.*

CPP 352 Endocrine Rotation**
Prerequisites: CPP 301, 302, 303, 304, 308. The diagnosis, treatment and management of various endocrine disorders is explored during this rotation, in both the acute care and ambulatory patient settings. *Credit: 3 semester hours.*

CPP 353 Infectious Diseases Rotation**
Prerequisites: CPP 303, 304. The role of the pharmacist as an epidemiologist is emerging. This experience involves students with hospital patients in whom a broad spectrum of infectious diseases, including viral, rickettsial, bacterial, spirochetal, mycotic and protozoan, is visible. *Credit: 3 semester hours.*

CPP 354 Psychiatric Therapeutics Rotation**
Prerequisites: CPP 303, 304. Behavioral problems, neurogenic and psychogenic in nature, as well as organic and functional neurological disorders are the focus of this experience. *Credit: 3 semester hours.*

CPP 355 Geriatric/Long-Term Care Rotation**
Prerequisites: CPP 301 or 302; CPP 303, 304, 322. The focus of this elective rotation is the provision of pharmaceutical care to the elderly patient, particularly residents of long-term care facilities. *Credit: 3 semester hours.*

CPP 356 Emergency Medicine Rotation**
Prerequisites: CPP 303, 304. The emergency medicine rotation enables the student to practice clinical pharmacy in a large metropolitan emergency room setting. *Credit: 3 semester hours.*

CPP 357 Oncology/Hematology Rotation**
Prerequisites: CPP 303, 304 and one other CPP course. The rotation is designed to introduce the student to the pharmaceutical care of the adult inpatient oncology/hematology population. Students integrate and interact with a multi-disciplinary team on daily rounds. *Credit: 3 semester hours.*

CPP 358 Pediatric Pharmacotherapy Rotation**
Prerequisites: CPP 301, 303, 304. The student gains an understanding and appreciation of the different challenges involved in the management of pediatric disease states. *Credit: 3 semester hours.*

CPP 359 Poison Control Rotation**
Prerequisites: CPP 303, 304. The student spends the rotational time in the New York City Poison Control Center. Emphasis is on history-taking, first aid, basic poison management, problem solving and involvement in ongoing research projects. *Credit: 3 semester hours.*

CPP 360 Education Rotation**
This rotation exposes the student to the role of the practitioner in the academic setting. Each student participates in student instruction in this program's practice laboratories. *Credit: 3 semester hours.*

CPP 361 Family Medicine Rotation**
Prerequisites: CPP 301, 303, 304, 308. The rotation focuses on the pharmacotherapy of adults on an inpatient, family medicine service. *Credit: 3 semester hours.*

CPP 362 Renal Pharmacotherapy Rotation**
Prerequisites: CPP 301 or 302; CPP 303, 304, 308. This rotation is designed to develop clinical experience and skills in the area of renal pharmacotherapy. *Credit: 3 semester hours.*

CPP 363 Critical Care Rotation**
Prerequisites: CPP 303, 304. The focus of this elective rotation is the provision of pharmaceutical care in the surgical intensive care unit. *Credit: 3 semester hours.*

CPP 364 Pharmacokinetics Rotation**
Prerequisites: CPP 303, 304, 322. The focus of this elective rotation is the provision of pharmacokinetic and pharmacodynamic monitoring in various types of patients. *Credit: 3 semester hours.*

CPP 365 Community Practice Rotation**
Prerequisites: CPP 303, 304. The student gains an understanding of the role of the community pharmacist in providing patient care. *Credit: 3 semester hours.*

CPP 366, CPP 367, CPP 368—Clinical Elective Rotation I; II; III**
Prerequisites: CPP 303, 304. *Corequisites or prerequisites:* CPP 301, 308. This rotation is an individualized clinical experience to meet the student's particular learning needs or learning interests. Course objectives, activities and assessment methods are developed between student and faculty. *Credit: 3 semester hours.*

CPP 369 Internal Medicine Rotation**
Prerequisites: CPP 303, 304. *Corequisites or prerequisites:* CPP 301, 308. This rotation includes a general study of drug therapy considerations for the adult patient population. The student is involved in rounds, patient care assessment and monitoring patients admitted to the medical service. *Credit: 3 semester hours.*

CPP 370 Ambulatory Care Rotation**
Prerequisites: CPP 301 or 302; CPP 303, 304. *Corequisite or prerequisite:* CPP 308. The special skills required for ambulatory care, such as interviewing techniques, adequate drug histories, counsel and advisement on use of drugs are further developed in this experience. *Credit: 3 semester hours.*

**Experiential rotations are restricted to Pharm.D. students.

Department of Pharmacy and Administrative Sciences (PAS)

Program of Study

The objectives of the Department of Pharmacy and Administrative Sciences are to prepare students interested in pharmacy administration for positions in pharmaceutical marketing and to prepare students interested in the pharmaceutical sciences for careers in industry, particularly in the area of industrial pharmacy. The programs are designed to provide students with the necessary knowledge, attitudes and skills that enable them to assume a leadership role in an industrial setting.

Courses

PAS 101 Special Problems

Prerequisite: Completion of 12 course credits. Laboratory and/or fieldwork in area of specialization in institutional, hospital, cosmetic or industrial pharmacy. *Credit:* 3 semester hours. *Laboratory fee:* \$120. *Every semester.*

PAS 204 Public and Private Health Care Systems

This course provides a working knowledge of those factors implicated in affecting the efficiency, access and quality of the U.S. health care delivery system. *Lecture.*
Credit: 3 semester hours.

PAS 211 Introduction to Pharmaceutical Marketing

This course covers topics including the modern pharmaceutical industry; the nature of pharmaceutical products; ad factors affecting marketing of pharmaceutical products. The U.S. pharmaceutical market is the focus for studying the above aspects. *Lecture.*
Credit: 3 semester hours.

PAS 212 Pharmaceutical Promotion

This course deals with the theoretical, practical and unique aspects and issues in pharmaceutical promotion. *Lecture.*
Credit: 3 semester hours.

PAS 213 Research Methods in Health Care Marketing

Prerequisite: PAS 252 or equivalent. This required course allows the student to understand the fundamental nature of the scientific approach to conducting research. *Lecture.*
Credit: 3 semester hours.

PAS 214 Management in the Health Care Industries

Management policies and procedures of those institutions organized to deliver health care services and related products to the consumer. *Credit:* 3 semester hours.

PAS 215 Foundations of Regulatory Affairs

This course provides the student with an understanding of the laws, regulations and procedures of federal and state guidelines that affect drugs and medical devices during their development, production and distribution stages. *Lecture. Credit:* 3 semester hours.

PAS 216 Consumer Behavior in Purchasing Drug Products

Sociological, psychological and anthropological factors affecting consumer buying tendencies. *Credit:* 3 semester hours.

PAS 217 Retail Pharmacy Management

This course deals with the theoretical and practical aspects of the activities involved in the retailing of pharmaceutical goods and services—specifically with respect to the places, times, prices and quantities that enable a retailer to reach its goals. *Lecture. Credit:* 3 semester hours.

PAS 218 Contemporary Administrative Principles

The evaluation of contemporary administrative concepts; the essentials of the planning, organizing, coordinating and controlling processes; and the techniques of interviewing, communicating, motivating and establishing performance criteria are explored in this course. *Lecture. Credit:* 3 semester hours.

PAS 219 Health Outcomes Assessment

The course is designed to provide a comprehensive review of health technology evaluation and health status assessment in the appraisal of health outcomes and therapeutic effectiveness in patient care. *Lecture.*
Credit: 3 semester hours.

PAS 220 Global Pharmaceutical Marketing

Prerequisite: PAS 211 or equivalent. This course covers the global pharmaceutical market and the economic, legal, cultural, political and competitive environment in which the global pharmaceutical market operates. *Credit:* 3 semester hours.

PAS 224 Microbiological Aspects of Pharmaceuticals and Cosmetics

The course starts with a review of the classification of microorganisms including structure, physiology, variability and immunological phenomena. *Lecture. Credit:* 3 semester hours.

PAS 225 Formulation of Aerosol Products

A consideration of the principles in the formulation and development of all types of aerosol products. Solution, dispersion, emulsion, semi-solid and powder systems are studied in conjunction with their application to pressurized packaging. *Lecture. Credit:* 3 semester hours.

PAS 231 Principles of Manufacturing Pharmacy I

Prerequisites: PAS 3101 and PAS 3103 or equivalent. A study of the process and equipment employed in the manufacture of solid pharmaceuticals. Operations on a pilot plant scale are utilized to demonstrate the common types of industrial equipment. *Lecture and laboratory. Credit:* 3 semester hours.

PAS 231L Laboratory for Principles of Manufacturing Pharmacy I

Credit: 3 semester hours; 1 credit hour.
Laboratory fee: \$120.

PAS 232 Pharmaceutical Engineering

Considerations of the working mechanisms of manufacturing equipment used in the production of pharmaceutical drug products. Particular emphasis is placed on what quality assurance personnel should check during pharmaceutical manufacturing. *Lecture.*
Credit: 3 semester hours.

PAS 234 Pharmaceutical Materials

A study of the raw materials employed in the preparation of dosage forms. *Credit:* 3 semester hours.

PAS 235; 235L Product Formulation

Prerequisites: PAS 3101 and PAS 3103 or equivalent. A study of the formulation and stability testing of dosage forms. *Lecture and laboratory. Credit:* 4 semester hours.
Laboratory fee: \$120.

PAS 236 Evaluation of Pharmaceutical Dosage Forms

Prerequisites: PAS 3101 and PAS 3103 or equivalent. Physical and physicochemical procedures used to evaluate pharmaceutical dosage forms are discussed. Factors affecting drug release from pharmaceutical products are covered along with in vitro and in vivo procedures for assessing drug absorption efficiency. *Lecture. Credit:* 3 semester hours.

PAS 237 Industrial Pharmacy

Prerequisites: PAS 3101 and PAS 3103 or equivalent. The basics of pharmaceutical processing and unit operations including both theory and practice of all the major operations underlying pharmaceutical production. *Lecture.*
Credit: 3 semester hours.

PAS 238 Principles of Quality Assurance: Control and Government Regulations

This course reviews the scope and function of quality in the pharmaceutical industry. Important legislation and the regulatory aspects of the Food and Drug Administration are considered with respect to quality control. *Credit:* 3 semester hours.

PAS 239 Homogeneous Pharmaceutical Systems

Prerequisite: PAS 3101 or equivalent. Application of selected physicochemical principles to homogeneous pharmaceutical systems. *Credit:* 3 semester hours.

PAS 240 Heterogeneous Pharmaceutical Systems

Prerequisite: PAS 3103 or equivalent. Application of selected physicochemical properties to heterogeneous pharmaceutical systems. *Credit:* 3 semester hours.

PAS 241; 242 Advanced Biopharmaceutics I; II

Prerequisite: PAS 5201 or PAS 4304; PAS 241 is a prerequisite for PAS 242. A study is made of optimized drug delivery systems for various routes of administration based on biopharmaceutical and pharmacokinetic considerations. *Credit: 3 hours per semester.*

PAS 243 Advanced Biopharmaceutics III

Prerequisites: PAS 241; 242. This course presents derivation of various pharmacokinetic equations representing common single and multi-compartment models. *Credit: 3 semester hours.*

PAS 245 Evaluation of Solid and Semi-Solid Dosage Forms and Processes

Physical and physicochemical procedures used in the evaluation of powders, tablets, lozenges, capsules, ointments, pastes, creams, gels and suppositories are covered along with in vitro and in vivo procedures for assessing drug absorption efficacy. Lecture. *Credit: 3 semester hours.*

PAS 246 Evaluation of Liquid Dosage Forms and Processes

Physical and physicochemical procedures used in the evaluation of sterile products, emulsions, suspensions, solutions and aerosols are covered. Principles of good manufacturing practices are discussed. Lecture. *Credit: 3 semester hours.*

PAS 247 Special Drug Delivery Systems

Prerequisites: PAS 3101 and PAS 3103 or equivalent. Considerations involved in the development and formulation of sustained and controlled release drug delivery systems are discussed. Lecture. *Credit: 3 semester hours.*

PAS 248 Principles of Manufacturing Pharmacy II

Prerequisite: PAS 231 or equivalent. A study of the process and equipment employed in the manufacture of liquid pharmaceuticals. Operations on a pilot plant scale are utilized to demonstrate the common types of industrial equipment. Lecture and Laboratory. *Credit: 4 semester hours. Laboratory Fee: \$120.*

PAS 250 Targeted Drug Delivery Systems

Prerequisites: PAS 3101, 3103 and 5201 or equivalent. This elective is designed to focus on different concepts and strategies involved in the design and development of targeted drug delivery systems to different organs and/or sites. *Credit: 3 semester hours.*

PAS 251 Ocular Drug Delivery

Prerequisites: PAS 3101, 3103 and 5201 or equivalent. This elective is designed to introduce the student to anatomy and physiology of the eye with a review of the current status of ophthalmic drugs followed by the considerations involved in the design, development, formulation and evaluation of ophthalmic drug delivery systems. *Credit: 3 semester hours.*

PAS 252 Biostatistics

Prerequisites: Undergraduate chemistry or biology and mathematics. Statistical methods used in drug evaluation. While principal emphasis is placed on animal studies, evaluation of techniques applicable to chemistry and pharmacy are also covered. *Credit: 3 semester hours.*

PAS 255 Biotechnological Drug Delivery Systems

Prerequisite: Undergraduate course in biological and chemical sciences. This course is designed to focus on various physicochemical, biological and pharmaceutical concepts and strategies involved in the design and development of invasive (parenteral) and noninvasive drug delivery systems for biotechnological drug molecules such as proteins and peptides. Lecture. *Credit: 3 semester hours.*

PAS 256 Principles of Experimental Design

Prerequisite: Undergraduate courses in biological and chemical sciences. This course is designed to develop competencies necessary to solve complex biological problems with efficient experiments using small sample size. Lecture. *Credit: 3 semester hours.*

PAS 260 Basic Concepts of Drug Development

This course is designed to study the modern drug development process in the pharmaceutical industry from drug discovery up to the Submission of NDA for FDA approval. *Credit: 3 semester hours.*

PAS 261 Foundations of GXP

This course introduces the fundamental concepts of GLP, GCO and GMP. It explores basic regulatory and quality assurance issues pertinent to pre-clinical safety research. *Credit: 3 semester hours.*

PAS 262 Regulatory Submissions and the Drug Approval Process

This course covers the development of IND and NDA submissions or FDA review. In addition, the most recently revised regulations governing IND, NDA, SNDA and ANDA are discussed as they relate to facilitation of the review process. *Credit: 3 semester hours.*

PAS 263 Generic Drug Regulation

Prerequisite: PAS 215. This course studies the FDA's regulations on generic drug manufacturing, clinical trial, application preparation and submission and marketing. It covers related guidance documents, policies, requirements and general procedures. *Credit: 3 semester hours.*

PAS 264 Advanced Food and Drug Law Regulation

Prerequisite: PAS 215. This course develops an in-depth understanding of the laws governing food and drugs. This course focuses on the laws and regulations promulgated by the federal government, especially the Food and Drug Administration, related to drug development, manufacturing marketing and distribution. *Credit: 3 semester hours.*

PAS 265 Scientific Inquiry: Regulation and Ethical Challenges

This course considers the nature of the scientific enterprise and both the legal and ethical restrictions placed on its methods and products by the government through imposition of regulation and society at large through moral suasion. *Credit: 3 semester hours.*

PAS 266 Bio-Pharmaceutical Statistics-II

Prerequisites: PAS 262 or equivalent. This course will provide the student with explanation of the approaches and solutions to commonly encountered statistical problems, with examples that are relevant to scientists involved in pharmaceutical and related research. *Credit: 3 semester hours.*

PAS 267 Post Approval Affairs

This course reviews FDA guidelines for Scale Up Post Approval changes (SUPAC) developed by the Center for Drug Evaluation and Research (CDER). The FDA guidelines, published workshop reports and applicable scientific literature will be discussed. *Credit: 3 semester hours.*

PAS 268 Good Manufacturing Practices

This course will provide the students with a comprehensive understanding of the requirements described in the Food and Drug Administration's (FDA) regulations on GMPs as they pertain to pharmaceutical drugs and medical devices. *Credit: 3 semester hours.*

PAS 270; 270B Industrial Pharmacy Colloquium

Prerequisites: PAS 3101, PAS 3103 and PAS 4304 or equivalent. This course is composed of research seminars for graduate students pursuing a M.S./Ph.D. degree in Industrial Pharmacy in which discussion will focus on interpretation, analysis and critical evaluation of research data in published research articles and unpublished research data generated by the graduate students during their dissertation research. *Credit: 0 credit for the first semester, thereafter 1 credit at the end of second semester.*

Department of Pharmaceutical Sciences (PHS)

Program of Study

The Department of Pharmaceutical Sciences is committed to educating research scientists for educational, governmental and industrial institutions. The program is designed to provide the student with critical learning skills, research expertise and a fundamental knowledge base that enables scientists to remain current with scientific literature, to carry out laboratory investigations and to analyze research findings. Students will acquire the necessary skills in a chosen area of concentration (medicinal chemistry, physiology, toxicology, pharmacology and biopharmaceutical technology) that are essential to enable them to assume leadership positions in the pharmaceutical and biomedical sciences.

Courses

PHS 101 Special Problems

Prerequisites: At least 12 credits of graduate courses. Conferences on specialized topics accompanied by laboratory work in pharmacology, medicinal chemistry. *Credit:* 3 semester hours. *Laboratory fee:* \$120.

PHS 102; 103 Principles of Pharmacology I; II

Prerequisites: Undergraduate biological and chemical sciences. PHS 102 is prerequisite for 103. Introduction to the science of pharmacology with emphasis on the basic principles. There is in-depth consideration of the factors modifying drug responses and dose-response relationships. *Credit:* 3 semester hours. (*No credit applied toward graduate degree.*) Cf. PHS 4301 and 4303.

PHS 201 Pharmacology of the Autonomic Nervous System

Prerequisites: PHS 102; 103 or equivalent. An overview of the established pharmacology of the autonomic nervous system is presented as well as a comparison with the pharmacology of the somatic nervous system. *Credit:* 3 semester hours.

PHS 202 Advanced Pharmacology

Prerequisites: PHS 102, 103 or equivalent. A detailed discussion of therapeutic uses and drug mechanisms in pharmacology therapeutics, excluding the nervous system. Emphasis is placed on the clinical use of selected classes of drugs. *Credit:* 3 semester hours.

PAS 271 Degradation and Stability of Pharmaceutical Systems

Prerequisites: PAS 3101 and PAS 3103 or equivalent. This course involves study of physical and chemical factors affecting stability of drugs in pharmaceutical dosage forms and approaches to enhance their stability and shelf-life. *Credit:* 3 semester hours.

PAS 272 Process Validation

This course will provide the students with an understanding of the scientific principles and regulatory requirements for pharmaceutical companies that are legally mandated to validate their manufacturing processes. *Credit:* 3 semester hours.

PAS 273 Pharmacokinetic and Pharmacodynamic Data Analysis

Prerequisites: PAS 241 or equivalent. This course is designed to develop a basic understanding of the pharmacokinetic and pharmacodynamics concepts and their model applications governing the time course of drug absorption, distribution and elimination as well as drug action. *Credit:* 3 semester hours.

PAS 274 Career Experience in Industrial Pharmacy

Prerequisites: PAS 3101, 3103, 4304 and PHR 4108 or equivalent plus a minimum of two semesters of graduate studies in Industrial Pharmacy. This course is comprised of rotations through a pharmaceutical company's various departments, specifically the areas of formulation, product development, production, analytical testing and quality control. *Credit:* 3 semester hours.

PAS 900 Master's Research

Supervised research leading to the preparation and completion of a thesis in partial fulfillment of the master's degree requirements. All master's candidates must register for this course until research is completed in order to satisfy research requirements. Although students may register for more than six hours, no more than six credits may be applied towards the degree. *Credit:* 3–6 hours per semester. *Laboratory fee:* \$120 per semester.

PAS 925 Maintaining Matriculation – Master's

All master's students who are not registered for any other courses must maintain enrollment in the University by registering for this course. Eligibility for thesis option students is typically limited to students who have satisfied all research and degree requirements but have not completed the written and oral components of the thesis. Thesis option students must have written approval from their advisor, department chairman and permission from the graduate dean to register for this course. *No credit.* *Fee:* \$50 per semester.

PAS 940 Maintaining Matriculation – Ph.D.

Ph.D. students must maintain matriculation if they have NOT passed comprehensives and are NOT taking courses. Limit: two semesters. Students who have passed comprehensives and are not taking courses must register for 950 until degree is granted. *No credit.* *Fee:* \$50 per semester.

PAS 950 Doctoral Research

Original research leading to the doctoral degree. All doctoral candidates must register for this course in order to satisfy research requirements until research is completed and degree is granted. No more than 24 credits may be earned in doctoral research and applied toward the degree. *Credit:* 3 hours per semester. *Laboratory fee:* \$120 per semester.

PHS 203 Research Methods in Pharmacology

Prerequisites: PHS 102, 103 or equivalent. This course intends to introduce the student to select in vivo and in vitro techniques used in quantitative evaluation of pharmacological agents. *Credit:* 3 semester hours. *Laboratory fee:* \$120.

PHS 205 Amino Acids, Peptides and Proteins

Prerequisites: Strong background in chemistry or biochemistry. Synthesis of biologically active peptides, molecular modification and biologically active relationship of peptide hormones. Secondary structure of proteins and modes of substrate binding. *Credit:* 3 semester hours.

PHS 206 Antibiotics and Steroidal Drugs

Prerequisites: Undergraduate biological and chemical sciences. Structurally active relationships and biogenetic origins of important categories of antibiotics are considered. Nomenclature, biosynthesis, partial synthesis and structurally active relationships of cholesterol, gluco, mineralo-corticoids, sex hormones, oral antifertility agents and cardiac glycosides are considered. *Credit:* 3 semester hours.

PHS 209 Pharmacological Aspects of Respiratory Disease

Prerequisite: PHS 102; 103 or equivalent. Pulmonary physiology will be reviewed; anatomy and the process of respiration, gas exchange, control of respiration and acid base balance will be included. The anatomical, physiological and biochemical basis of respiratory disease (or pathology) will be discussed. *Credit:* 3 semester hours.

PHS 211 Biochemical Neuropharmacology

Prerequisites: PHS 102, 103 or equivalent. The biochemical bases of the action of drugs in the nervous system are examined. The molecular and biochemical pharmacology of the acute and chronic effects of a wide range of pharmacologic agents are examined and new techniques and findings are discussed. *Credit:* 3 semester hours.

PHS 212; 213 Applied Biochemistry I; II

Prerequisite: Undergraduate biochemistry. PHS 212 is prerequisite for PHS 213. A course dealing with those aspects of biochemistry of special relevance to students of the health sciences. Emphasis is placed on fundamental metabolic cycles and processes and on biochemical concepts needed to understand drug action and metabolism, biogenetic pathways and various disease states. *Credit:* 3 hours per semester.

PHS 216 Applied Psychopharmacology

Prerequisite: PHS 102; 103 or equivalent. This course provides an introduction to the neuropharmacological bases of behavior and drugs used to treat behavior disorders. The role that specific neurochemical systems play in regulating behavior is considered and discussed. The molecular, biochemical and behavioral mechanism of action of many psychotropic drugs is covered. *Credit:* 3 semester hours.

PHS 221 Clinical Pharmacology

Prerequisites: PHS 102;103 or equivalent. Discussion and demonstration of the clinical basis for the therapeutic application of drugs. Toxicity and adverse reactions are considered. Case material from actual patient populations is used to illustrate and support this information. *Credit:* 3 semester hours.

PHS 223 Design of Nucleoside Analogs

Prerequisite: Undergraduate medicinal chemistry or equivalent. The chemistry of nucleic acids, nucleotides, nucleosides, purine and pyrimidines is discussed with respect to their structures, syntheses and properties. *Credit:* 3 semester hours.

PHS 224 Design of Enzyme Inhibitors

Prerequisite: Undergraduate medicinal chemistry or equivalent. The modification of proteins or protein activity by irreversible binding of drugs and other small chemical molecules is discussed. *Credit:* 3 semester hours.

PHS 231 Medicinal Chemistry Journal Club

Prerequisite: PHS 102; 103 or TOX 102; 103 or equivalent. Seminar for graduate students in pharmaceutical sciences in which discussions focus on published experimental results with a view toward evaluation of methodology and a presentation of data. Participation by graduate faculty and students. *Credit:* 2 semester hours.

PHS 232 Pharmacology Journal Club

Prerequisite: PHS 102; 103 or TOX 102; 103 or equivalent. Seminar for graduate students in pharmaceutical sciences in which discussions focus on published experimental results with a view toward evaluation of methodology and a presentation of data. Participation by graduate faculty and students. *Credit:* 2 semester hours.

PHS 239 Functional Neuroanatomy and Neuropathology

Prerequisites: Undergraduate anatomy and physiology. This course instructs the student in the anatomy and physiology of the central and peripheral nervous systems and describes the processes by which these systems undergo pathological change. *Credits:* 3 semester hours.

PHS 240 Principles of Electron Microscopy

Prerequisites: Undergraduate biological and/or biochemical sciences. *Corequisite:* PHS 240L. This course is intended to instruct the student in the basic techniques of electron microscopy. It also describes the analytical methods used to identify various biological systems. *Credit:* 3 semester hours.

PHS 240L Electron Microscopy Laboratory

Corequisite: PHS 240. This course instructs the student in the preparation of tissue for electron microscopy and the interpretation and analysis of electron micrographs. *Laboratory fee:* \$120. *Credit:* 3 semester hours; 1 credit hour.

PHS 245 Laboratory Use of Radiotracers

Prerequisite: Undergraduate biological and chemical sciences. A course designed to present the fundamentals of the use of radiotracers in the modern laboratory. Emphasis is placed on safety, experimental design and the variety of special techniques in use today in pharmaceutical research. *Credit:* 3 semester hours.

PHS 246 Pharmacology of Drug Abuse

Prerequisite: PHS 102; 103 or equivalent. A study of the various chemical agents of dependence with in-depth consideration of the mechanisms and nature of the chemical agents involved in this phenomenon. *Credit:* 3 semester hours.

PHS 247 Reproductive Pharmacology

Prerequisites: PHS 102; 103 or equivalent. A consideration of the effect of drugs on the reproductive system during the periods of development, maturation and aging. *Credit:* 3 semester hours.

PHS 248 Receptors and Mechanism of Drug Action

Prerequisites: Undergraduate biological and chemical sciences. Discussion is focused on the concept and theories of receptors as an explanation for drug action and design of new therapeutic agents. Special emphasis is placed on the mechanism of action and drug interaction with important categories of drugs. *Credit:* 3 semester hours.

PHS 249 Cardiovascular Pharmacology

Prerequisites: PHS 102; 103 or equivalent. The course considers the mechanism of action of myocardial stimulants and depressants as well as anti-arrhythmic drugs. *Credit:* 3 semester hours.

PHS 250 Cell and Tissue Culture

Student is acquainted with cell culture technology as well as biochemical and biophysical characteristics and capabilities of mammalian cells in culture. *Credit:* 3 semester hours.

PHS 250L Cell and Tissue Culture Laboratory

Co-requisite: PHS 250. This course is the laboratory component of PHS 250. Hands-on laboratory experiments in cell culture technology are performed by the students. The objective of the laboratory assignments is to expose the student to the biological, biophysical, and toxicological characteristics of mammalian cells in culture. *Credit:* 1 semester hour. *Lab fee:* \$120.

PHS 251 Doctoral Seminar in the Pharmaceutical Sciences I

A monthly seminar of two hours for all students pursuing the Ph.D. The seminar consists of scheduled presentations given by scholars in the pharmaceutical sciences. 8 hours per semester. *Credit:* No credit.

PHS 252 Doctoral Seminar in the Pharmaceutical Sciences II

A monthly seminar of two hours for all students pursuing the Ph.D. The seminar consists of scheduled presentations given by scholars in the pharmaceutical sciences. *8 hours per semester. Credit: No credit.*

PHS 253 Doctoral Seminar in the Pharmaceutical Sciences III

A monthly seminar of two hours for all students pursuing the Ph.D. The seminar consists of scheduled presentations given by scholars in the pharmaceutical sciences. *8 hours per semester. Credit: No credit.*

PHS 254 Doctoral Seminar in the Pharmaceutical Sciences IV

Prerequisites: PHS 251, 252, 253. A monthly seminar of two hours for all students pursuing the Ph.D. The seminar consists of scheduled presentations given by scholars in the pharmaceutical sciences. *8 hours per semester. Credit: 1 credit will be given upon submission of an acceptable paper to the seminar Chair.*

PHS 255 Chemical Aspects of Drug Metabolism

Prerequisite: Undergraduate Medicinal Chemistry or equivalent. A detailed discussion of drug metabolizing enzyme systems and reactions. The relationship between chemical structure and drug metabolism is particularly emphasized. Drug metabolism related toxicity is also considered. *Credit: 3 semester hours.*

PHS 256 Pharmaceutical Analysis Laboratory

Prerequisite: A course or experience in chemical analysis. A detailed discussion of the basic principles of pharmaceutical analysis. Special emphasis is placed on the selection and development of qualitative and quantitative methodology for the analysis of drug molecules in a variety of sample environments. *Credit: 3 semester hours.*

PHS 257 Gene Technology in the Pharmaceutical and Health Sciences

Prerequisite: Undergraduate biochemistry or the equivalent. Course presents the basic mechanism underlying the expression of the information encoded in the DNA: transcription, translation and replication. *Credit: 3 semester hours.*

PHS 259 Cell Signals and Regulatory Systems

A course covering the elements of regulation at the level of the cell. The intracellular events of signaling, i.e. post-receptor events, are the focus. *Credit: 3 semester hours.*

PHS 260 Clinical Immunology

A detailed discussion of the basic concepts of immunology, immunity and immuno-pathology. Special emphasis is placed on the aspects of clinical immunology with reference to the theory which underlies laboratory tests and methods of procedure. *Credit: 3 semester hours.*

PHS 261 Laboratory in Gene Technology for the Pharmaceutical and Allied Health Professions

The use of modern databases to mine known information and synthesize new conclusions from combined resources is used as a starting point. The class is divided into groups, each working with a different protein or a mutant of the target protein. *Credit: 1 semester hour.*

PHS 263 Laboratory in Analysis of Biomacromolecules

A course designed to present the fundamentals of the use of modern analytical techniques for the identification and isolation of biomacromolecules. Emphasis is placed on protein purification methods. *Credit: 3 semester hours.*

PHS 264 Analysis of Cell Structure and Function

A study of cell structure and function including discussions of membrane transport, respiration, cell division and cell motility. Additional topics include enzyme function. DNA, RNA and protein synthesis and their control. Discussion of methods of cell study will be incorporated in specific lecture topics, i.e., membranes, and in laboratory sessions. *Credit: 3 semester hours.*

PHS 264L Analysis of Cell Structure and Function Laboratory

Co-requisite: PHS 263
Laboratory component of PHS 264. *3 semester hours. Credit: 1 credit hour. Laboratory fee \$120.*

PHS 265; 266 Principles of Drug Design I; II

Prerequisite: Undergraduate medicinal chemistry or equivalent. Required course designed to present an overview of the basic principles involved in medicinal chemistry. *Credit: 3 semester hours.*

PHS 270 Introduction to Biotechnology

This course discusses the basic mechanisms underlying the expression of information encoded in the DNA, i.e. transcription, translation and replication. *Credit: 3 semester hours.*

PHS 271 Oxidants, Antioxidants and Free Radicals

The involvement of free radicals/reactive oxygen species (ROS) in the pathogenesis of a wide variety of human diseases has been increasingly recognized over the last two decades. *Credit: 3 semester hours.*

PHS 278 Human Physiology

An examination of the principles of human physiology, starting with cellular physiology principles such as membrane transporters and action potentials, and covering several of the key topics of physiology: endocrine, neural, muscle, cardiovascular, respiratory, gastrointestinal, and renal. *Credit: 3 semester hours.*

PHS 900 Master's Research

Supervised research leading to the preparation and completion of a thesis in partial fulfillment of the master's degree requirements. All master's candidates must register for this course until research is completed in order to satisfy research requirements. Although students may register for more than six hours, no more than

six credits may be applied toward the degree. *Credit: 3–6 hours per semester. Laboratory fee: \$120 per semester.*

PHS 925 Maintaining Matriculation–Master's

All master's students who are not registered for any other courses must maintain enrollment in the University by registering for this course. Eligibility for thesis option students is typically limited to students who have satisfied all research and degree requirements but have not completed the written and oral components of the thesis. Thesis option students must have written approval from their advisor, department chairman and permission from the graduate dean to register for this course. *No credit. Fee: \$50 per semester.*

PHS 940 Maintaining Matriculation–Ph.D.

Ph.D. students must maintain matriculation if they are not registered for courses or have not yet passed their comprehensives. Limit: 2 semesters. *No credit. Fee: \$50.*

PHS 950 Doctoral Research

Original research leading to the doctoral degree. Doctoral students may register for 950 while completing degree requirements; however, upon the successful completion of formal courses, language requirement and comprehensive examination, doctoral candidates must register for PHS 950 until the dissertation is completed and the degree is awarded. *Credit: 3 semester hours. Laboratory fee: \$120 per semester.*

TOX 101 Special Problems

Prerequisite: At least 12 credits of graduate courses. Conferences on specialized topics accompanied by laboratory work in toxicology. *Credit: 3 semester hours. Laboratory fee: \$120.*

TOX 102; 103 Toxicology I; II

Prerequisite: Undergraduate chemical or biological sciences. TOX 102 is a prerequisite for 103. The source, chemical composition action, tests and antidotes of toxic substances. First semester consideration is given to materials of inorganic origin; second semester is devoted to substances of organic nature, both natural and synthetic in origin. Lecture. *Credit: 3 semester hours. No credits applied toward graduate degree. Cf. PHS 2401; 2402.*

TOX 201 Methods in Toxicologic Evaluation

Prerequisite: TOX 102; 103 or equivalent. Experimental toxicology and pathology deals with the variety of experimental methods utilized to determine the safety and toxicity of materials administered by mouth, applied topically to the skin or mucous membranes, or administered by inhalation of gases or aerosols. *Credit: 3 semester hours.*

TOX 205 Neurotoxicology

Prerequisite: TOX 102 and 103 or equivalent. This course examines the various classes of neurotoxins, their mechanism of toxicity and experimental models used to assess neurotoxic mechanisms. *Credit: 3 semester hours.*

TOX 207 Recent Advances in Forensic Toxicology

Prerequisites: TOX 102 and 103 or equivalent. A survey emphasizing recent developments in the field of forensic toxicology. Emphasis is placed on documentation and interpretation of analytical results. *Credit: 3 semester hours.*

TOX 209 Recent Advances in Clinical Toxicology

Prerequisites: TOX 102; 103 or equivalent. A survey of current literature, emphasizing recent advances in clinical toxicology. *Credit: 3 semester hours.*

TOX 210 Biochemical Toxicology

Prerequisites: TOX 102, 103 or PHS 102, 103 or equivalent and undergraduate biochemistry or equivalent. An advanced study of the biochemical principles and mechanisms underlying the toxicity of xenobiotics at the cellular level. Biotransformation pathways and the subcellular toxicity of selected toxicants are examined in depth. *Credit: 3 semester hours.*

TOX 215 Analytical Methods in Toxicology

Prerequisites: TOX 102; 103 or equivalent. This course considers methods of specimen and sample preparations and extraction and analytical chemical techniques used to solve problems confronting the analytical toxicologist. *Credit: 3 semester hours.*

TOX 216 Environmental and Occupational Toxicology

Prerequisites: TOX 102; 103 or equivalent. The chemical and regulatory aspects of environmental and occupational hazards are presented, with an overview of methods in epidemiology and risk assessment. *Credit: 3 semester hours.*

TOX 217 Toxicology of the Hematopoietic and Immune System

Prerequisites: TOX 102; 103 or equivalent. Focuses upon the effects of toxic substances on hematologic and immunologic function. *Credit: 3 semester hours.*

TOX 218 Pathophysiology of Organ Systems (CPP 304)

Prerequisite: Undergraduate Anatomy and Physiology. This course is designed to explain the abnormal physiological processes which result when normal metabolic functions are disturbed. Mechanisms of normal function are described as well as the resulting effect of altered homeostasis. *Credit: 3 semester hours.*

TOX 219 Molecular Toxicology

Prerequisites: TOX 102, 103; PHS 102, 103 or equivalent. This is an advanced study of the specific molecular, biochemical and cellular mechanisms of toxic injury. *Credit: 3 semester hours.*

TOX 220 Dermal Toxicology

Prerequisites: Tox 102, 103 or their equivalent. An advanced study of the principles of dermal toxicity emphasize the effects of xenobiotic agent on the integument system and the function of this system as a barrier to penetrations of such agents in the body. Topics included in this study include transdermal absorption, bio-transformation, immunologic reaction to toxic agents, phototoxicity, carcinogenesis and testing methods. *Credits: 3 semester hours.*

TOX 221 Hematologic Pathology

Prerequisite: General Physiology. A study of the hematopoietic system. Topics covered include anemias, leukemias, coagulation defects with consideration of etiology, physiologic and cellular manifestations and therapeutic modalities. *Credit: 3 semester hours.*

TOX 222 Cellular Pathophysiology

Prerequisite: Undergraduate Anatomy and Physiology. This course is designed to explain the cellular response to injury. Molecular, biochemical and organelle pathology is discussed in relation to normal cell function. *Credit: 3 semester hours.*

TOX 230 Toxicology Journal Club

Prerequisite: PHS 102; 103 or TOX 102; 103 or equivalent. Seminar for graduate students in pharmaceutical sciences in which discussions focus on published experimental results with a view toward evaluation of methodology and a presentation of data. Participation by graduate faculty and students. *Credit: 2 semester hours.*

TOX 900 Master's Research

Supervised research leading to the preparation and completion of a thesis in partial fulfillment of the master's degree requirements. All master's candidates must register for this course until research is completed in order to satisfy research requirements. Although students may register for more than six hours, no more than six credits may be applied towards the degree. *Credits: 3-6 semester hours. Laboratory fee: \$120 per semester.*

TOX 925 Maintaining Matriculation

All master's students who are not registered for any other courses must maintain enrollment in the University by registering for this course. Eligibility for thesis option students is typically limited to students who have satisfied all research and degree requirements but have not completed the written and oral components of the thesis. Thesis option students must have written approval from their advisor, department chairman and permission from the graduate dean to register for this course. *No credit. Fee: \$50 per semester.*

For complete listing of approved courses, please contact your Dean's office.

Madhu Agrawal, Associate Professor of Pharmacy and Administrative Sciences, B.S. Phm., Bombay University; M.S., Ohio State University; Ph.D., Michigan State University; Global competition in pharmaceutical industry; developing pharmaceutical services; pharmaceutical marketing.

Emily M. Ambizas, Assistant Clinical Professor of Clinical Pharmacy Practice, B.S., Phm., Pharm.D., St. John's University; Ambulatory care.

Charles R. Ashby, Professor of Pharmaceutical Sciences, B.A., Ph.D., University of Louisville; Neurophysiology and neurochemical studies of 5-HT and DA interaction; genetic vulnerability to drug abuse in rats; mechanism of action of antipsychotic drugs.

Kenneth Balbi, Adjunct Assistant Professor of Pharmaceutical Sciences, B.S. Albany University; M.D., Universidad Central del Este, San Pedro de Macoris, Dominican Republic; Research on environmental health issues, assessments and measurements of environmental toxins.

Ebrahim Balbisi, Assistant Clinical Professor of Clinical Pharmacy Practice, B.S., Phm., St. John's University; Pharm.D., Nova Southeastern University; Ambulatory care.

Frank Barile, Associate Professor of Pharmaceutical Sciences, B.S., M.S., Ph.D., St John's University; In vitro toxicology

Michael Barletta, Professor of Pharmaceutical Sciences, B.S. Phm., M.S., St. John's University; Ph.D., New York Medical College; Cardiovascular pharmacology using animal models for myocardial infarction, cardiac arrhythmias, ischemic heart disease and thrombosis.

Andrew J. Bartilucci, Dean Emeritus and Executive Vice President Emeritus, B.S. Phm., St. John's University; M.S., Rutgers University; Ph.D., University of Maryland.

Nesrine Z. Baturay, Associate Professor of Pharmaceutical Sciences, B.A., Douglass College; M.S., Seton Hall University; Ph.D., New York University; Investigation of environmental influences on cancer potentiation and the relationship of subcellular components to tumor promotion.

Judith L. Beizer, Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., St. Louis College of Pharmacy; Pharm.D., University of Tennessee; Geriatric therapeutics.

Blase C. Billack, Assistant Professor of Pharmaceutical Sciences, B.S., University of Richmond; Ph.D., Rutgers University; Role of BRCA1 in DNA damage repair and transcription.

Joseph M. Brocovich, Associate Dean and Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Philadelphia College of Pharmacy and Science; Pharm.D. Duquesne University; Infectious diseases; pharmacoeconomics; curricular design.

Jerome Cantor, Associate Professor of Pharmaceutical Science, B.A., Columbia University; M.D., University of Pennsylvania; Experimental lung pathology.

Joanne M. Carroll, Associate Professor of Pharmaceutical Sciences, B.S. Molloy College; M.A., CUNY, Hunter College; Ph.D. CUNY; Molecular mechanisms regulating gene expression in neural and endocrine cells.

Joseph M. Cerreta, Associate Professor of Pharmaceutical Sciences, B.S., M.S., Ph.D., Fordham University; Molecular biology of connective tissue alterations in the lung

Lisa Charneski, Assistant Clinical Professor of Clinical Pharmacy Practice, Pharm.D., Nesbitt School of Pharmacy; Internal medicine.

Zhe-Sheng Chen, Assistant Professor of Pharmaceutical Sciences, M.S., Sun Yat-Sen University of Medical Sciences, P.R.China; M.D., Guangdong Medical & Pharmaceutical College, Guangdong Province, China; Ph.D., Institute for Cancer Research, Kagoshima University, Japan; Cancer pharmacology and experimental therapeutics, especially cellular mechanisms of multi-drug resistance and its reversal.

Mary Choy, Assistant Clinical Professor of Clinical Pharmacy Practice, Pharm.D., St. John's University; Internal medicine.

Kenneth R. Cohen, RPh, Adjunct Associate Professor of Pharmacy and Administrative Sciences, B.S., Arnold and Marie Schwartz College of Pharmacy; M.S., St. John's University; Ph.D. California Coast University; Management in the health care industries.

Peter Colaninno, Adjunct Assistant Professor of Allied Health, B.S. M.T., M.S., St. John's University.

John Conry, Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., St. John's University; Ambulatory care.

Karen Costa, Adjunct Assistant Professor, B.S., Caldwell College; M.S., Ph.D., St. John's University; Dermal toxicology.

Conrad Dhing, Assistant Professor of Pharmacy and Administrative Sciences, B.S., Northeast Louisiana University; Ph.D., University of Louisiana at Monroe; pharmaco-economics; pharmacy education; pharmacy management.

Candis Edwards, Adjunct Assistant Professor of Pharmacy and Administrative Sciences, B.S., Wagner College; M.S. St. John's University; RA, R&D, project management, QA and cGMP compliance.

Henry Eisen, Professor Emeritus, B.S. Phm., St. John's University; M.S., Rutgers University; Ph.D., University of Connecticut.

Gladys M. El-Chaar, Associate Clinical Professor of Clinical Pharmacy Practice, B.A., East Stroudsburg University; B.S. Phm., St. John's University; Pharm.D., Medical University of South Carolina; Pediatric therapeutics.

Joseph V. Etzel, Assistant Dean, Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., St. John's University; Infectious disease pharmacotherapy.

Danielle C. Ezzo, Assistant Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., St. John's University; Ambulatory care.

Sue M. Ford, Associate Professor of Pharmaceutical Sciences, B.S., Cornell University; M.S., Ph.D., Michigan State University; Use of cell culture to study responses of kidney to toxicants; nutrition.

Gerard Frunzi, Adjunct Associate Professor of Pharmacy and Administrative Sciences, B.S., M.S., Ph.D., St. John's University.

Corinne L. Gamper, Adjunct Assistant Professor of Pharmacy and Administrative Sciences, B.A., St. Joseph's College; M.S., The University of Connecticut; M.B.A., St. John's University; Regulatory Affairs/Quality Assurance.

Laura M. Gianni Augusto, Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., St. John's University; Drug information.

Marc Gillespie, Associate Professor of Pharmaceutical Sciences, B.A., University of Vermont, Ph.D., University of Utah; The development of a simple biochemical system that allows us to evaluate the function assembly and disassembly of neuronal SNARE complex.

Regina Ginzburg, Assistant Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., St. John's University; Ambulatory care.

Dennis Guilfoyle, Adjunct Associate Professor of Pharmacy and Administrative Sciences, B.A., Hunter College, CUNY; M.S., Wagner College; Ph.D., St. John's University; National expert for the U.S. Food & Drug Administration in the field of pharmaceutical microbiology for drugs and biotechnology products.

Diane Hardej, Adjunct Assistant Professor, B.A., Queens College; M.S., Ph.D., St. John's University; The use of antioxidants in the treatment of neurotoxicity and stress proteins as biomarkers.

Olga Hilas, Assistant Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., St. John's University; Internal medicine.

MaryAnn Howland, Clinical Professor of Clinical Pharmacy Practice, B.S., Wake Forest University; B.S. Phm., Rutgers University; Pharm.D., Philadelphia College of Pharmacy and Science; Clinical toxicology; poison control expertise; clinical toxicological management.

Tomasz Jodlowski, Assistant Clinical Professor of Clinical Pharmacy Practice, Pharm.D., St. John's University; Internal medicine.

Amrit Lal Kapoor, Professor of Pharmaceutical Sciences, B.S. Phm., M.S., Punjab University, India; Dr.Sc.Nat., Eidgenossische Technische Hochschule, Zurich, Switzerland; Binding and displacement studies in vivo and in vitro to evaluate drug interactions.

Kwon H. Kim, Associate Professor of Pharmacy and Administrative Sciences, B.S. Phm., Chung-Ang University; M.S., Ph.D., St. John's University; Transdermal and transmucosal drug delivery, controlled release and targeted delivery systems.

Tina Kanmaz, Associate Clinical Professor of Clinical Pharmacy Practice, B.A., Hofstra University; B.S. Phm., Pharm.D., St. John's University; Ambulatory care.

Vijaya L. Korlipara, Associate Professor of Pharmaceutical Sciences, B.S. Phm., Banaras Hindu University; Ph.D., University of Minnesota; Design and synthesis of receptor selective probes for opioid and neurokinin receptors.

Chul-Hoon-Kwon, Professor of Pharmaceutical Sciences, B.S., Phm., Howard University; Ph.D., University of Minnesota; Design, synthesis and evaluation of pro-drugs, especially in anti-tumor agents and anticonvulsants; chemical aspects of drug metabolism and toxicology

Matthew Lacroix, Assistant Clinical Professor of Clinical Pharmacy Practice, Pharm.D., University of Rhode Island; Internal medicine.

Sum Lam, Assistant Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., University of Connecticut; Geriatric Therapeutics.

Cesar A. Lau-Cam, Professor of Pharmaceutical Sciences, B.S. Phm., University of San Marcos, Peru; M.S., Ph.D., University of Rhode Island; Effect of natural product (amino acids, carbohydrates, vitamins, plant constituents) on the biochemistry, pharmacology and toxicology of ethanol.

Senshang Lin, Associate Professor of Pharmacy and Administrative Sciences, B.S. Phm., Taipei Medical College, Ph.D., Temple University; Pharmacokinetic, pharmacodynamic, transmucosal drug delivery.

Martha L. Mackey, Associate Professor of Pharmacy and Administrative Sciences, B.A., M.A., J.D., St. John's University; Pharmacy law; pharmacy education.

Lin Mantell, Associate Professor of Pharmaceutical Sciences, M.D., Beijing University; Ph.D., Stony Brook University; Identifying and characterizing molecular and cellular mechanisms underlying the increased lung injury and infection due to oxidative stress during oxygen therapy.

Parshotam L. Madan, Professor of Pharmacy and Administrative Sciences, B.S. Phm., Birla College, India; M.S., Ph.D., University of Georgia; Controlled and targeted drug delivery systems; bio-erodible polymers as drug delivery systems.

Nicole M. Maisch, Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., Albany College of Pharmacy; Internal medicine.

Bimal K. Malhotra, Adjunct Associate Professor of Pharmacy and Administrative Sciences, B.S. Birla Institute of Technology & Science; Ph.D., University of Minnesota; Clinical Pharmacokinetics/Biopharmaceutics in drug development.

Robert A. Mangione, Dean and Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., M.S., P.D., Ed.D., St. John's University; Pharmacy education; organizational theory, pharmaceutical care for disadvantaged patients.

Rajesh Nayak, Associate Professor of Pharmacy and Administrative Sciences, B.S. Phm., M.S. Phm., Mangalore University; Ph.D. University of Florida; Pharmaceutical outcomes research; evaluation of health care policies and programs; pharmacoeconomics.

Judith A. O'Brien, Adjunct Associate Professor of Pharmaceutical Sciences, B.S., Lemoine College; M.S., St. John's University; Medical technology.

Raymond S. Ochs, Professor of Pharmaceutical Sciences, B.S., Purdue University; Ph.D., Indiana University; The control of metabolic pathways by hormones and energy supply; muscle cell culture line and computer modeling

Sang-ki Park, Assistant Professor of Pharmaceutical Sciences, B.S., M.S., Seoul National University; Ph.D., University of Rochester; Environmental stress-regulated transcription factors and gene expression in molecular toxicology.

Somnath Pal, Professor of Pharmacy and Administrative Sciences, B.S. Phm., M.S., Jadavpur University; M.B.A., Calcutta University; Ph.D., University of Iowa; Drug utilization studies.

Priti N. Patel, Assistant Clinical Professor of Clinical Pharmacy Practice, Pharm.D., Philadelphia College of Pharmacy; Drug information.

Nicholas Pantaleo, Adjunct Associate Professor of Pharmacy and Administrative Sciences, B.S., Phm., M.S., St. John's University.

Sandra E. Reznik, Associate Professor of Pharmaceutical Sciences, A.B., Harvard University; M.D., Ph.D., Mount Sinai School of Medicine; Developmental and placental pathology, specifically the role of several placental peptidases and proteinases in perinatal pathology.

Bhagwan D. Rohera, Professor of Pharmacy and Administrative Sciences, B.S. Phm., M.S., Saugar University; Ph.D., University of Basel, Switzerland; Compaction of powder systems; controlled drug delivery; formulation and process optimization.

Joseph Sarra, Adjunct Assistant Professor of Pharmaceutical Sciences, B.S., M.S. Long Island University Arnold and Marie Schwartz College of Pharmacy; Ph.D., St. John's University; Synthesis and pharmacological evaluation of new anticonvulsants and anxiolytics.

Francis A.X. Schanne, Associate Professor of Pharmaceutical Sciences, B.A., La Salle College; Ph.D., Temple University; Molecular mechanisms of cellular injury and protection.

Niels Schmidt, Adjunct Assistant Professor, B.S., NY Institute of Technology, M.B.A., St. John's University.

Sharon See, Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., Rutgers University; Family medicine.

Jun Shao, Associate Professor of Pharmacy and Administrative Sciences, B.S. Phm., Zhejiang University; M.S., China Pharmaceutical University, Ph.D. West Virginia University; Biotechnology and drug delivery; traditional Chinese medicine for cancer.

J. Andrew Skirvin, Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Oregon State University; Pharm.D., University of Texas; Oncology.

Candace J. Smith, Associate Clinical Professor of Clinical Pharmacy Practice, B.S., San Jose State University; B.S. Phm., Pharm.D., St. John's University; Pharmacokinetics.

Emilio Squillante, Associate Professor of Pharmacy and Administrative Sciences, B.S. Phm., M.S., Ph.D., University of Rhode Island; Supercritical fluids; dissolution, pharmacokinetic and bioavailability to studies; drug analysis; transdermal absorption studies.

Ralph A. Stephani, Professor of Pharmaceutical Sciences, B.S., Holy Cross College; Ph.D., SUNY, Buffalo; Synthesis and evaluation of new analgesic agents; synthesis and evaluation of new anti-bacterial agents; development of new oral hypoglycemic agents.

Maria Sulli, Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., St. John's University; Community pharmacy practice; patient education.

Donna Sym, Assistant Clinical Professor of Clinical Pharmacy Practice, B.S., Pharm.D., St. John's University; Infectious diseases.

Rabia Tahir, Assistant Clinical Professor of Clinical Pharmacy Practice, Pharm.D., St. John's University; Internal medicine.

Tanaji Talele, Assistant Professor of Pharmaceutical Sciences, B.S., University of Pune, India; M.S., Ph.D., Mumbai University; India; Computer-aided design (docking-3D-QSAR) and development of anticancer and antifungal compounds.

Michael S. Torre, Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., M.S. St. John's University; Endocrine disorders; diabetes.

Damary Torres, Associate Clinical Professor of Clinical Pharmacy Practice, B.S. Phm., Pharm.D., St. John's University; Internal medicine.

Louis Trombetta, Professor of Pharmaceutical Sciences, B.S., M.S., Ph.D., Fordham University; Metal neurotoxicology and oxidative stress.

Kenneth Wu, Associate Professor of Pharmacy and Administrative Sciences, B.S., Taipei Medical College; M.B.A., Ph.D., University of Minnesota; Pharmacoeconomics; computer applications in pharmacy; pharmacy management.

John N.D. Wurpel, Associate Professor of Pharmaceutical Sciences, B.S., Belmont Abbey College; M.S. Fairleigh Dickinson University; Ph.D., Pennsylvania State University; Effects of neuropeptides on CNS; neurophysiology of seizures.

Byron C. Yoburn, Professor of Pharmaceutical Sciences, B.A. Boston University; M.A., Hollins College; Ph.D., Northeastern University; Molecular aspects of opioid receptor regulation, drug tolerance and dependence.

S. William Zito, Professor of Pharmaceutical Sciences, B.S. Phm., St. John's University; Ph.D., University of Connecticut; Biosynthesis of pyrethrins; tissue culture as a method to study drug metabolism.