
EUGENE O LEONARD
HALL
PHARMACY

College of Pharmacy

Joseph F. Steiner, Pharm.D., Dean
Paul S. Cady, Ph.D., Associate Dean

Degree Programs

The College of Pharmacy offers two graduate degrees: the Master of Science (M.S.) in Pharmaceutical Sciences and the Doctor of Philosophy (Ph.D.) in Pharmaceutical Sciences. The College also offers a professional doctorate degree, Doctor of Pharmacy (Pharm.D.). The Pharm.D. is described in the College of Pharmacy section of the Idaho State University Undergraduate Catalog.

Department of Pharmacy Practice and Administrative Sciences

Interim Chair and Professor Mason
Interim Assistant Chair and Assistant Professor Owens
Professors: Adamcik, Cady, Culbertson, Erramouspe, Lott,R. Force, Rhodes, Steiner
Associate Professors: Gould, Hefflinger, Heyneman, Hunt, Liday, Madaras-Kelly, Oliphant
Assistant Professor: Carr
Clinical Professor: Jue
Clinical Associate Professor: Woon
Clinical Assistant Professors: Casperson, Cleveland, Hachey, Mayne, Murdock, Pettinger
Clinical Instructor: W. Force
Visiting Clinical Assistant Professors: Borzadek, Eroschenko, Pugmire, Wadsworth
Adjunct Associate Professors: Hoagland, Robison
Clinical Affiliate Faculty: Bryon, Flowers, Gundlach, Munkelt, Payne, Reed, Rohner, Sawyer, Shea, Silcock, Stander, Vanden Bosch, Wilson

Department of Biomedical and Pharmaceutical Sciences

Chair and Professor Risinger
Assistant Chair and Professor Bhushan
Professors: Daniels, Diedrich, Dodson, Lai
Associate Professors: Bigelow, Eley, Wilson
Assistant Professor: Selvage

Program Goal:

- To train and prepare students to succeed in their chosen career path in the variety of areas in pharmaceutical sciences.

Program Objectives:

- To rigorously train students in the department focus areas;
- To train students to be effective communicators of their knowledge and scientific findings;
- To expose students to multidisciplinary approaches to problem-solving so that they can use them to solve scientific problems;
- To educate students to be competent practitioners of the scientific method;
- To expose students to a variety of professional strategies so that, upon finishing their training, they become adaptable and successful in achieving their long-range goals.

Doctor of Philosophy

Programs of study leading to the Doctor of Philosophy (Ph.D.) degree are offered through the Department of Biomedical and Pharmaceutical Sciences (emphasis areas of Biopharmaceutical Analysis, Drug Delivery, Medicinal Chemistry, or Pharmacology) and through the Department of Pharmacy Practice and Administrative Sciences (emphasis in Pharmacy Administration). The Ph.D. degree is a research degree and will be conferred upon the completion and report of a substantial body of original work.

Admission Requirements

The student must apply to, and meet all criteria for, admission to the Graduate School. In addition to the general requirements of the Graduate School, the student must comply with the following:

1. Baccalaureate degree in biology, chemistry, psychology, other scientific field, or a professional degree in pharmacy.
2. GPA of not less than 3.0 for all upper division courses.
3. Achieve at least the 50th percentile in one of the Graduate Record Examination aptitude section scores (Verbal, Quantitative, or Analytical).
4. Three letters of recommendation from individuals familiar with the applicant's academic ability and potential for graduate study.

Meeting minimum requirements does not guarantee admission. Students not meeting the minimum admission requirements for the Ph.D. program may reapply to continue on for the Ph.D. degree following successful completion of the M.S. in Pharmaceutical Sciences.

Each beginning graduate student will have a graduate advisor assigned from the graduate faculty upon entry into the program. The student's advisor will assist the student in preparing an appropriate program of study of course work. While there is no fixed credit requirement for the Ph.D. in Pharmaceutical Sciences, the overall program of study will include at least 72 semester hours of graduate course work. The student is expected to have selected a major advisor from the graduate faculty no later than the end of his/her second semester in residence.

A grade below B is unsatisfactory and will not be counted toward fulfilling the minimum requirements for the degree. Upon recommendation of the student's advisor, and with the approval of the Director of the Graduate Program, a student may be required to withdraw at any time for failure to maintain satisfactory progress toward the degree.

When course work is essentially complete, candidates for the Ph.D. degree complete

a series of written and oral comprehensive examinations that may include the defense of a written research proposal. Upon completion of all proposed research, the student's findings will be reported in the form of a dissertation to be prepared in accordance with Department and Graduate School guidelines. While the dissertation must be defended to the graduate faculty of the College, acceptability only requires the affirmative vote of a majority of the student's committee members.

Doctor of Philosophy in Pharmaceutical Sciences (Biopharmaceutical Analysis, Drug Delivery, Medicinal Chemistry, or Pharmacology Emphasis)

Other Admission Requirements

Official report of Graduate Record Examination scores. Applicants should achieve at least a 50th percentile on one of the three aptitude sections (Verbal, Quantitative, Analytical). Achievement of two or more scores at the 50th percentile is highly preferred. Applicants may be accepted as Classified (w/PR) students with lower GRE scores.

International students must have a demonstrated proficiency in the English language. Students from countries where English is not the first language must demonstrate proficiency in the English language. International students should refer to the "Admission of International Students" section of the Graduate Catalog.

Three letters of recommendation and a personal statement of interest must accompany the application. The personal statement of interest should clearly identify which area of emphasis in the graduate program the applicant intends to follow (e.g., pharmacology, medicinal chemistry, etc.), and members of the department faculty with whom the applicant would prefer to complete his/her degree. Applications without a personal statement following these guidelines will be rejected.

Applications for the graduate program in Pharmaceutical Sciences (Emphasis in Biopharmaceutical Analysis, Drug Delivery, Medicinal Chemistry, or Pharmacology) are reviewed twice yearly near the end of the fall and spring semesters. Deadline for the receipt of applications is April 1 for admission in the fall semester, and October 1 for admission in the spring semester. Incomplete applications and applications received after these deadlines will not be considered.

Candidates must complete the following courses:

PSCI 601	Graduate Seminar in Pharmaceutical Sciences	4 cr
PSCI 602	Research Design and Analysis for the Pharmaceutical Sciences	3 cr
PSCI 603	Scientific Writing	3 cr
PSCI 606	Selected Techniques in the Laboratory	2 cr
PSCI 607	Research Foundations in the Pharmaceutical Sciences	3 cr
PSCI 698	Dissertation Research	18 cr* min.
PSCI 699	Dissertation	1-2 cr* min.
Electives in Pharmaceutical Sciences		9 cr

**Candidates must complete a minimum of 20 credits in combination of PSCI 698 and PSCI 699 toward completion of degree requirements after admission to candidacy.*

A minimum of 72 credits including a minimum of 20 credit hours in dissertation research (PSCI 698) and dissertation (PSCI 699) are required. For all degree candidates, at least one half of total graduate credit hours required by the student's Graduate Program Committee must be 600 level. Minimum graduate credit requirements usually do not fulfill Departmental degree requirements. Specific details are provided in the Department of Pharmaceutical Sciences Graduate Guidelines.

All students in the graduate program, whether seeking the Doctor of Philosophy or the Master of Science, are expected to demonstrate proficiency in written and spoken English. Students may be required to successfully complete classes in speech and in technical writing at the request of the graduate program director and the graduate faculty of the Department of Biomedical and Pharmaceutical Sciences.

Joint Pharm.D.-M.S. in Pharmaceutical Sciences or Pharm.D.-Ph.D. in Pharmaceutical Sciences (Biopharmaceutical Analysis, Drug Delivery, Medicinal Chemistry, or Pharmacology Emphasis)

Admission Requirements

Professional students currently enrolled in the College of Pharmacy may be granted early admission to a graduate program administered by the College. In order that a student be eligible for early admission to a graduate program in the College, the following criteria must be met:

1. Completion of at least 136 academic credits or a B.S. degree must be certified to the Graduate Dean by the Registrar. Such certification must include all University general education requirements, and meet all graduate student admission requirements.
2. Formal application for admission to the College graduate program, with acceptance as a Classified (w/PR) student by the appropriate department faculty.
3. A non-B.S. degree-holding student may be admitted to the Graduate School as Classified (w/PR). Following the award of the Pharm.D. degree, the student may petition to change to classified status. Students should consult the Graduate Catalog for course requirements for the graduate degrees offered by the College.
4. Students must meet all the requirements of the Pharm.D. program; see Undergraduate Catalog.
5. Students must meet all the department requirements for the M.S. or Ph.D. degree described in the M.S. or Ph.D. section.
6. A joint-degree student cannot take more than 19 credits/semester while in the Pharm.D. program, of which no more than 3 credits can be graduate credits. After completing the Pharm.D. requirements, the joint-degree student reverts to the Graduate School requirements, not to exceed 16 credits/semester.

Doctor of Philosophy in Pharmaceutical Sciences (Social and Administrative Sciences Emphasis)

Candidates must complete the following courses:

Statistics and Research Methods (14 credits)

BIOL 605	Biometry	4 cr
Multivariate Analysis		4 cr
PADM 605	Research Methods	3 cr
One additional methods course (e.g., 3 cr SOC 508, PSYC 632)		3 cr

Pharmacy Administration Major Courses (28 credits)

PADM 601	Graduate Seminar in Pharmacy Administration	4 cr
PADM 610	Social and Behavior Aspects of Pharmacy Practice	3 cr
PADM 632	Medical Economics	3 cr
PADM 634	Advanced Pharmacy Administration I	3 cr
PADM 635	Advanced Pharmacy Administration II	3 cr
Major area elective courses		12 cr

Minor Area Courses (12 credits)*

Minor area elective courses	12 cr

Research Activities (19 credits minimum)**

PADM 650	Thesis Research**	3 cr
PSCI 698	Dissertation Research	18 cr
PSCI 699	Dissertation Preparation	1 cr
	Total	73-76 cr

**A student entering the Ph.D. program with an M.S. degree in a related area may petition the Advisory Committee to waive the elective 12 credits required in a minor area of study.*

***All students must have research experience prior to beginning the dissertation. If a student has not completed an M.S. thesis, then s/he must complete a minimum of 3 credits of graduate research (PADM 650) and complete a research project resulting in a paper of publishable quality. If a student has completed an M.S. thesis, s/he may petition the Advisory Committee to accept it as fulfillment of this requirement.*

Master of Science in Pharmaceutical Sciences

The M.S. program offers the student a choice of four emphases:

1. Emphasis in Medicinal Chemistry leading to the degree of M.S. in Pharmaceutical Sciences (Medicinal Chemistry).
2. Emphasis in Pharmacology leading to the degree of M.S. in Pharmaceutical Sciences (Pharmacology).
3. Emphasis in Drug Delivery leading to the degree of M.S. in Pharmaceutical Sciences (Drug Delivery).
4. Emphasis in Social and Administrative Sciences leading to the degree of M.S. in Pharmaceutical Sciences (Social and Administrative Sciences).

Admission Requirements

The student must apply to, and meet all criteria for, admission to the Graduate School. In addition, a student must possess a baccalaureate degree in biology, chemistry, psychology, other scientific field, or a professional degree in pharmacy (B.S. or Pharm. D.) from an accredited institution, and have a grade point average of 3.0 or better on all upper-division courses. Students with a grade point average between 2.75 and 3.0 will receive consideration for admission on a Classified (w/PR) basis.

Other Requirements

All applicants are required to provide three letters of recommendation from professors from whom they have taken courses or under whose direction they have worked. It is highly recommended that the Graduate Record Examination be taken prior to the start of the semester in which a student begins graduate study. The GRE must be taken during the first semester in residence if it has not been taken previously.

All classified graduate students must register for the appropriate graduate seminar (601) each semester in which they are registered for graduate credit. A maximum of two credits in graduate seminar (601) may be applied toward the degree.

Early Entry Into the Graduate Program For Pharmacy Students Only

Professional students currently enrolled in the College of Pharmacy may be granted early admission to a graduate program administered by the College following completion of the second professional (P2) year in the Pharm.D. curriculum.

In order that a student be eligible for early admission to a graduate program in the College, the following criteria must be met:

1. Completion of at least 136 academic credits must be certified to the Graduate Dean by the Registrar. Such certification must include all University general education requirements, and all College of Pharmacy pre-pharmacy, first (P1) and second (P2) professional year course requirements in the Pharm.D. curriculum.
2. Minimum Graduate Record Examination scores.
3. Formal application for admission to the College graduate program, with acceptance as a Classified (w/PR) student by the appropriate department faculty.

After meeting the above three criteria, a student may be admitted to the Graduate School as Classified (w/PR). Following the award of the Pharm.D. degree, the student may petition to change to classified status. Students should consult the Graduate School Bulletin for course requirements for the graduate degrees offered by the College.

Master of Science in Pharmaceutical Sciences (Medicinal Chemistry, Pharmacology, or Drug Delivery Emphasis)

Other Admission Requirements

The student must apply to, and meet all criteria for, admission to the Graduate School.

International students must have a demonstrated proficiency in the English language. Students from countries where English is not the first language must demonstrate proficiency in the English language. International students should refer to the "Admission of International Students" section of the Graduate Catalog.

Three letters of recommendation and a personal statement of interests must accompany the application. The personal statement of interest should clearly identify which area of emphasis in the graduate program the applicant intends to follow (e.g., pharmacology, medicinal chemistry, drug delivery), and members of the departmental faculty with whom the applicant would prefer to complete their degree. Applications without a personal statement following these guidelines will be rejected.

Applicants for the graduate program in Pharmaceutical Sciences (Emphasis in Medicinal Chemistry, Pharmacology, or Drug Delivery) are reviewed twice yearly near the end of the fall and spring semesters. Deadlines for the receipt of applications is April 1 for admission in the fall semester, and October 1 for

admission in the spring semester. Incomplete applications and applications received after these deadlines will not be considered.

Applicants should select either the thesis or non-thesis option. The thesis option is intended for students seeking to enter a research career, and requires completion of an original research project. The non-thesis option is intended for students seeking careers in pharmaceutical sciences that do not require extensive laboratory experience. Applicants are strongly encouraged to contact the Department of Biomedical and Pharmacetuical Sciences for advice on choosing which option best meets their career goals.

Thesis Option:

Candidates must complete the following courses:

PSCI 601	Graduate Seminar	2 cr
PSCI 602	Research Design and Analysis for the Pharmaceutical Sciences	3 cr
PSCI 603	Scientific Writing	3 cr
PSCI 607	Research Foundations	3 cr
PSCI 650	Thesis Research	6 cr min.
Electives in Pharmaceutical Sciences		6 cr

A minimum of 30 credits, including at least 6 credit hours in thesis research (PSCI 650), is required by the Graduate School. For all degree candidates, at least one half of total graduate credit hours required by the student's Graduate Program Committee must be at the 600-level. Minimum Graduate School credit requirements may not fulfill Departmental degree requirements.

Non-Thesis Option:

Candidates must complete the following courses:

PSCI 601	Graduate Seminar	2 cr
PSCI 602	Research Design and Analysis for the Pharmaceutical Sciences	3 cr
PSCI 603	Scientific Writing	3 cr
PSCI 604	Research Practicum	3 cr
PSCI 607	Research Foundations	3 cr
PSCI 648	Master's Paper	3 cr
Electives in Pharmaceutical Sciences		9 cr

A minimum of 36 credits is required. For all degree candidates, at least one half of total graduate credit hours required by the student's Graduate Program Committee must be at the 600-level. Minimum Graduate School credit requirements may not fulfill Departmental degree requirements.

All students in the graduate program, whether seeking the Doctor of Philosophy or the Master of Science, are expected to demonstrate proficiency in written and spoken English. Students may be required to successfully complete classes in speech and in technical writing at the request of the graduate program director and the graduate faculty of the Department of Pharmaceutical Sciences.

Master of Science in Pharmaceutical Sciences (Social and Administrative Sciences Emphasis)

Candidates may elect either a thesis or non-thesis option and must complete the following courses:

M.S. Degree Option:

		NON-THESIS	THESIS
STATISTICS AND RESEARCH METHODS			
BIOL 605	Biometry		4 cr
	OR		
PPRA 518	Clinical Research Design and Analysis		4 cr
PADM 605	Research Methods	3 cr	3 cr
PHARMACY ADMINISTRATION MAJOR COURSES			
PADM 601	Graduate Seminar in Pharmacy Administration	2 cr	2 cr
PADM 610	Social and Behavioral Aspects of Pharmacy Practice	3 cr	3 cr
	OR		
PADM 632	Medical Economics	3 cr	3 cr
PADM 634	Advanced Pharmacy Administration I	3 cr	3 cr
	OR		
PADM 635	Advanced Pharmacy Administration II	3 cr	3 cr
Major area elective courses		15 cr	12 cr
RESEARCH ACTIVITY			
PADM 650	Thesis Research		6 cr
PADM 651	Master's Paper	3 cr	
	TOTAL	33 cr	34 cr

Joint Pharm.D.-Graduate Degree Program (Social and Administrative Sciences Emphasis)

Candidates must complete the following courses while enrolled in the P3 and P4 years of the Pharm.D. curriculum. (The courses listed below substitute for PSCI 532 Clinical Research Design and Analysis, and 6 credits of professional electives required in the Pharm.D. curriculum). In addition, the following courses taken in the P3 year will constitute a minor area in Clinical Pharmacy as required in the graduate program: PPRA 534 and PPRA 535 Therapeutics I and II, PSCI 529 Clinical Pharmacokinetics, and PSCI 568 Toxicology; PPRA 569 will substitute for 3 credits of PADM 650 Thesis Research.

Third Professional Year Course Substitutions:

BIOL 605	Biometry	4 cr
PADM 605	Research Methods in Pharmacy Administration	3 cr
Pharmacy Administration		3 cr
Major Area Graduate Course		

Fourth Professional Year Elective Clerkship:

PPRA 569	Research Specialty Clerkship	4 cr

Additional Graduate Program Requirements:

M.S. (thesis option):

PADM 601	Graduate Seminar	2 cr
Major Area Courses		12 cr
PADM 650	Thesis Research	3 cr
		Total 17 cr

Ph.D.:

PADM 601	Graduate Seminar	4 cr
Multivariate Analysis		4 cr
Research Methods Elective		3 cr
Major Area Courses		21 cr
PSCI 698	Dissertation Research	18 cr
PSCI 699	Dissertation Prep	1 cr
		Total 51 cr

Pharmaceutical Sciences Graduate Courses

PSCI g541 Diabetes for Health Sciences 2 credits. A discussion of Diabetes: types, development, complications, treatment, monitoring, and patient-related issues. Topics include basic science and the patient elements. Discussions will be based on student interest and back ground. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 601 Graduate Seminar 1 credit. Discussion of current research and theories in Pharmaceutical Sciences. May be repeated.

PSCI 602 Research Design and Analysis for Pharmaceutical Sciences 3 credits. Principles of research design and statistical analysis applicable to the pharmaceutical or biomedical sciences. Emphasis on evaluation of biomedical literature and on development of research plans. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 603 Scientific Writing 3 credits. Basic techniques in scientific writing including: philosophy of science and logic in writing; how to write scientific papers, thesis/dissertation, grant proposals, and reviews; use of computers and software.

PSCI 604 Research Practicum 3 credits. The student will receive practical laboratory training in pharmaceutical sciences under the guidance of faculty. May be repeated. PREREQ: ENROLLMENT IN THE NON-THESIS OPTION, AND PERMISSION OF THE INSTRUCTOR. Graded S/U.

PSCI 606 Selected Techniques in the Laboratory 2 credits. Practical experience in the use of instrumentation and techniques in the student's area of specialization. Each student shall select three faculty laboratories in the Pharmaceutical Sciences for specific technical training. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 607 Research Foundations 3 credits. A discussion of the nature and critical analysis of experimentation, principles of the scientific method, and literature in the Pharmaceutical Sciences.

PSCI 609 Advanced Drug Delivery 3 credits. Critical assessment of novel drug carrier systems regarding biological, drug-related, and carrier-related factors. Study of targeted drug delivery and controlled release devices with emphasis on bioerodible polymers, matrix and reservoir systems.

PSCI 610 Analytical Techniques in Pharmaceutics and Drug Delivery 3 credits. Theory and practice of analytical techniques in pharmaceutics and drug delivery research. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 611 Current Topics in Pharmaceutics and Drug Delivery 1 credit. Discussion of current research topics in pharmaceutics and drug delivery. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 620 Drug Discovery 2 credits. An overview of the process of drug discovery and the regulatory process of drug development, infrastructure of FDA and the process of clinical trials for approval of drugs, biologics, and medical devices. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 621 Biological Actions of Chemicals 3 credits. Introduction to basic principles of pharmacology, including the molecular basis for drug action; entry, distribution, metabolism and elimination of chemicals, genetic influences in chemical actions, and tolerance. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 622 Principles of Toxicology 3 credits. Introduction to basic concepts of toxicology, including mutagenesis, carcinogenesis, teratology, risk assessment, regulatory toxicology, toxicology of solvents, pesticides, metals and radioactive materials and design of toxicological studies. PREREQ: PSCI 621 OR PERMISSION OF INSTRUCTOR.

PSCI 623 Pharmacology of the Pulmonary and the Renal Systems 2 credits. Provides a detailed examination of the pharmacology of pulmonary and renal systems, focusing on mechanisms of action of major drug classes used in treatment of disorders via coordination with pharmacology sections of the professional pharmacotherapy module series. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 624 Pharmacology of the Cardiovscular System 3-4 credits. Provides a detailed examination of the pharmacology of the cardiovascular system, focuing on mechanisms of action of major drug classes used in treatment of cardiovascular disorders via coordination with pharmacology sections of the professional pharmacotherapy module series. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 625 Pharmacology of the Gastrointestinal and the Hepatic Systems 2 credits. Provides a detailed examination of the pharmacology of GI and hepatic systems, focusing on mechanisms of action of major drug classes used in treatment of disorders via coordination with phyrmacology sections of the professional pharmacotherapy module series. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 626 Pharmacology of the Immune System and Infectious Diseases 3 credits. Provides a detailed examination of the pharmacology of the immune system, focusing on mechanisms of action of major drug classes used in treatment of infectious diseases via coordination with pharmacology sections of the professional pharmacotherapy module series. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 627 Endocrine Pharmacology 2 credits. Provides a detailed examination of the pharmacology of endocrine systems, focusing on mechanisms of action of major drug classes used in treatment of disorders via coordination with pharmacology sections of the professional pharmacotherapy module series. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 630 Psychopharmacology 3 credits. This course will cover the mechanisms of action of psychoactive drugs, including drugs used in the treatment of psychopathological disorders and drugs of abuse. Also covered will be the learned basis of drug effects. Students will critique contemporary readings in the application of psychotherapeutic agents and processes of addiction. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 631 Cancer Biology 3 credits. Study of the difference between normal and cancerous cells growth control, cell cycle, carcinogenesis, growth factor and oncogenes, cellular signaling, angiogenesis, telomerases, tumor invasion and metastasis, vitamins, diet and tobacco. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 632 Anti-cancer Drugs 3 credits. Cell cycle drug design and development, mechanisms of antimetabolites, alkylating agents, topoisomerase inhibitors, natural compounds, hormones and novel agents. Relationship between receptors and response to chemotherapy, drug resistance, drug delivery. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 633 Experimental Oncology 2 credits. Cell culture, anticancer drug screening, protein, RNA and DNA analysis, methods in signal transduction and oncogene expression. Immunohistology, cell cycle analysis, receptor binding, receptor screening of tumors. Laboratory work included. Limit 5 students.

PSCI 634 Current Topics in Oncology 1 credit. Study of current topics in cancer research. Emphasis on novel approaches to understand and treat cancer. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 636 Concepts and Tools in Pharmacogenomics 2 credits. The role of genetic factors in the development and evaluation of drugs, basic principles of microarray analysis introduction to proteomics. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 635 Special Topics in Oncology 2 credits. An introduction to cancer biology and cancer terminology. An overview of fundamentals of pharmacology as applied to cancer therapy. Mechanisms of action and resistance to chemotherapeutic drugs will be emphasized. A discussion of the importance of early detection. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 640 Elements of Nanoscience and Nanotechnology 3 credits. An introduction to the properties of nanomaterials. Applications of nanomaterials in biomedical, pharmaceutical, environmental, and bioengineering systems and their impact on society. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 648 Master's Paper 3 credits. The student will be required to complete an original literature review of a topical area in the pharmaceutical sciences. PREREQ: ENROLLMENT IN THE NON-THESIS OPTION, AND PERMISSION OF THE INSTRUCTOR. Graded S/U.

PSCI 650 Thesis Research 1-10 credits. Graded S/ U

PSCI 652 Advanced Biopharmaceutics and Pharmacokinetics 3 credits. Physicochemical principles involved in the kinetics of drug absorption, distribution, biotransformation, elimination, and therapeutic response. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 653 Principles of Biopharmaceutical Analysis 3 credits. A treatment of the principles of modern methods for the qualitative and quantitative determination of drugs in biological materials.

PSCI 655 Advanced Biopharmaceutical Analysis 3 credits. A continuation of PSCI 653, this course covers the chromatographic techniques of analysis in detail including liquid chromatography, gas chromatography, thin layer capillary zone electrophoresis, and mass spectrometry, chromatography.

PSCI 660 Molecular Pharmacology 3 credits. Advanced study in the transduction of biological signals, molecular basis for the action of hormones, neurotransmitters and growth factors on neurotransmission, metabolism, gene regulation and cell growth. PREREQ: PSCI g567 AND PERMISSION OF INSTRUCTOR.

PSCI 661 Drug Metabolism 3 credits. Advanced study in drug metabolism, cytochrome P450 oxidative system, toxic actions of drugs, mutagenicity, carcinogenicity, and *in vitro* systems for the study of metabolism. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 662 Neuropharmacology 3 credits. The molecular basis of drug action in the central nervous system including nerve excitation, mo-

lecular properties of ion channels, neuropharmacological methods, pharmacology of ethanol and the mechanisms in tolerance and physical dependence. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 682 Independent Problems in Pharmaceutical Sciences 1-4 credits. Advanced students are assigned special studies in areas of pharmaceutical sciences on the basis of interest and previous preparation. May be repeated. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 698 Dissertation Research variable credit. Research toward completion of the dissertation in the pharmaceutical, social, behavioral or administrative pharmacy sciences. Graded S/U.

PSCI 699 Dissertation variable credit. Preparation of the written report of the dissertation research. Graded S/U.

Pharmacy Administration Graduate Courses

PADM g554 Pharmacy Management I 2 credits. Principles of organization, management and financial analysis as applied to the practice of pharmacy. PREREQ: PPRA 519.

PADM g556 Pharmacy Management II 2 credits. Problems of management, merchandising, and salesmanship, applied to community pharmacy. PREREQ: PHAR 454.

PADM 538 Independent Problems in Pharmacy Administration 1-4 credits. Independent study of various topics in pharmacy administration. May be repeated.

PADM 601 Graduate Seminar in Pharmacy Administration 1 credit. Discussion of current research and theories in pharmacy administration. May be repeated.

PADM 603 Advanced Pharmacy Law 3 credits. Requirements of federal laws influencing the practice of pharmacy, including selected recent cases. PREREQ: PPRA 519 OR PERMISSION OF INSTRUCTOR.

PADM 605 Research Methods in Pharmacy Administration 3 credits. Methods in research design and analysis utilized in pharmacy administration research. PREREQ: GRADUATE LEVEL STATISTICS COURSE.

PADM 610 Social and Behavioral Aspects of Pharmacy Practice 3 credits. Examination of sociological and psychological concepts and theories as applied to the practice of pharmacy. PREREQ: PERMISSION OF INSTRUCTOR.

PADM 612 Ethics for Health Professionals 3 credits. Examination of ethical issues that arise in the provision of health care. PREREQ: PERMISSION OF INSTRUCTOR.

PADM 624 Advanced Pharmacy Management I 3 credits. Principles of operation and management encountered in the drug distribution process. PREREQ: ONE YEAR OF ACCOUNTING OR PERMISSION OF INSTRUCTOR.

PADM 626 Advanced Pharmacy Management II 3 credits. Case studies of problems encountered in pharmacy management. PREREQ: PADM 624.

PADM 630 Advanced Drug Marketing 3 credits. Approaches and methods of marketing as applied to pharmacy and the drug distribution process.

PADM 632 Medical Economics 3 credits. Examination of the market forces encountered in the medical care system.

PADM 634 Advanced Pharmacy Administration I 3 credits. An integration of socio-behavioral and management principles into an advanced consideration of pharmacy administration.

PADM 635 Advanced Pharmacy Administration II 3 credits. A continuation of PADM 634, this course further explores issues in the discipline of pharmacy administration.

PADM 649 Research in Pharmacy Administration 1-2 credits. Research problems ancillary to the thesis project.PREREQ: GRADUATE STANDING AND PERMISSION OF INSTRUCTOR. Graded S/U.

PADM 650 Thesis Research 1-10 credits. Graded S/U.

PADM 651 Master's Paper 3 credits. Graded S/U.

PADM 691 Topical Seminar in Pharmacy Administration 2-4 credits. Examination of selected topics in pharmacy administration. May be repeated.

Pharmacy Practice Graduate Courses

PPRA g591 Topical Seminar in Pharmacy Practice 1-4 credits. Examination of selected topics in pharmacy practice and pharmacy administration. May be repeated. PREREQ: PERMISSION OF INSTRUCTOR.

PPRA g518 Clinical Research Design and Analysis 4 credits. The fundamentals of experimental design, implementation and data analysis pertinent to pharmaceutical clinical investigations.

PPRA 553 Professional Student Seminar 1 credit. Development of a relevant therapeutic topic including the review, analysis, and oral presentation of all appropriate medical and scientific literature. PREREQ: MUST BE FOURTH-YEAR PROFESSIONAL STUDENT.

PPRA 596 Clinical Pharmacy Residency 0 credits. Advance practical experience in clinical pharmacy practice. PREREQ: MUST HAVE A DOCTOR OF PHARMACY DEGREE.

Services Courses

PHAR 645 Pharmacotherapeutics for Advanced Practice Nurses 3 credits. A problem-based course emphasizing the fundamentals of drug action and the rational use of drugs to treat various organ system disease states. PREREQ: BIOL g563.