



College of Pharmacy

Barbara G. Wells, Pharm.D., Dean
Virginia J. Galizia, Ph.D., Associate
Dean

Department of Pharmacy Practice and Administrative Sciences

Chair and Associate Professor Culbertson
Professors Adamcik, Hurley, Mason,
Sharp
Associate Professors Cady, Erramouspe,
Gould, Lott, Rhodes
Assistant Professors Beckwith, R. Force,
Hefflinger, Hitt, Larson, Liday,
Madaras-Kelly, Reitz
Clinical Professor Jue
Clinical Assistant Professor Heyneman

Department of Pharmaceutical Sciences

Chair and Associate Professor Daniels
Professors Diedrich, Lai
Associate Professors Das, Jarvi, LaHann,
Nelson, Ratka
Assistant Professors Bhushan, Devaud,
Wilson
Professor Emeriti Cole, Fontenelle,
Goettsch, Isaacson

Degree Programs

The College of Pharmacy offers two graduate degrees: the Master of Science (M.S.) in Pharmacy 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 University Bulletin.

Master of Science in Pharmacy

The M.S. program offers the student a choice of five majors:

1. Major in Pharmaceutical Chemistry leading to the degree of M.S. in Pharmacy (Pharmaceutical Chemistry)
2. Major in Pharmacognosy leading to the degree of M.S. in Pharmacy (Pharmacognosy)
3. Major in Pharmacology leading to the degree of M.S. in Pharmacy (Pharmacology)
4. Major in Pharmaceutics leading to the degree of M.S. in Pharmacy (Pharmaceutics)
5. Major in Pharmacy Administration leading to the degree of M.S. in Pharmacy (Pharmacy Administration)

Admission Requirements

To qualify for admission, a student must possess a professional degree in pharmacy (B.S. or Pharm.D.), or a baccalaureate degree in chemistry, biology, or a related field from an accredited institution, and have a grade point average of 3.0 or better over the last two years of undergraduate study. Students with a grade point average between 2.75 and 3.0 will receive consideration for admission on a conditional 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 candidates are required to demonstrate a reading knowledge of a foreign language or proficiency with a research tool (such as computer programming and/or statistics).

Individual requirements for each student must be approved by the student's major professor within the emphasis area.

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: For admission to the M.S. program, attainment of scores on the GRE at the 35th percentile or better in either the verbal or quantitative portion of the test. For admission to the Ph.D. program, attainment of scores on the GRE at the 50th percentile
3. Formal application for admission to the College graduate program, with acceptance as a conditional student by the appropriate department faculty.

After meeting the above three criteria, a student may be admitted to the Graduate School on a conditional basis. 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 Pharmacy (Pharmaceutical Chemistry, Pharmaceutics, or Pharmacology Emphasis)

Candidates must complete the following courses:

PSCI 601	Graduate Seminar	2 cr
PSCI 603	Scientific Writing	2 cr
PSCI 605	Principles of Instrumental Techniques	3 cr
PSCI 606	Selected Techniques in the Laboratory	2 cr
PSCI 607	Research Foundations in the Pharmaceutical Sciences	2 cr total
PSCI 650	Thesis Research	6 cr min.

Graduate School requirement is a minimum of 30 credits including at least 6 credit hours in thesis research (PSCI 650). 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.

Master of Science in Pharmacy (Pharmacy Administration 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			
BIOS 605	Biometry OR		4 cr
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

		NON-THESIS	THESIS
PADM 634	Advanced Pharmacy Administration I OR	3 cr	3 cr
PADM 635	Advanced Pharmacy Administration II	3 cr	3 cr
	Major area elective courses	15 cr	12 cr
	Total	12 cr	
RESEARCH ACTIVITY			
PADM 650	Thesis Research		6 cr
PADM 651	Master's Paper	3 cr	
	Total	33 cr	33 cr

Joint Pharm.D.-Graduate Degree Program (Pharmacy Administration 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 cr. of PADM 650 Thesis Research.

Third Professional Year Course Substitutions:

BIOS 605	Biometry OR	4 cr
MBA 602	Survey of Business Statistical Techniques	3 cr
PADM 605	Research Methods in Pharmacy Administration OR	3 cr
MBA 630	Business Research Pharmacy Administration Major Area Graduate Course	3 cr 3 cr

Fourth Professional Year Elective Clerkship:

PPRA 569	Clinical Research Clerkship	4 cr
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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

Doctor of Philosophy

Programs of study leading to the Doctor of Philosophy (Ph.D.) degree are offered through the Department of Pharmaceutical Sciences (emphasis areas of Pharmacology, Pharmacokinetics, Biopharmaceutics, and Biopharmaceutical Analysis) 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

1. Professional degree in pharmacy or a baccalaureate degree in a related field with a GPA of not less than 3.0 for the final two years;
2. Achieve at least the 50th percentile in two of the Graduate Record Examination aptitude section scores (Verbal, Quantitative or Analytical). Requirements may differ within the College of Pharmacy's two Departments; check with the Department for specific requirements; and
3. Three letters of recommendation.

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 program.

Each beginning graduate student will have a graduate advisor/program committee assigned from the graduate faculty upon entry into the program. The student's advisor/graduate program committee 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 third 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/graduate program committee and with the approval of the Head of the Graduate Program, a student may be required to with-

draw 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 which 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 (Pharmacology, Pharmacokinetics, Biopharmaceutics, and Biopharmaceutical Analysis Emphasis)

Candidate must complete the following courses:

PSCI 601	Graduate Seminar in Pharmaceutical Sciences	4 cr
PSCI 603	Scientific Writing	2 cr
PSCI 605	Principles of Instrumental Techniques	3 cr
PSCI 606	Selected Techniques in the Laboratory	2 cr
PSCI 607	Research Foundations in the Pharmaceutical Sciences	4 cr
PSCI 698	Dissertation Research	18 cr* min.
PSCI 699	Dissertation	1-2 cr* min.

*Candidates may only count PSCI 698 and 699 credits earned after admission to candidacy toward completion of degree requirements. A minimum of 20 units in combination must be completed.

A minimum of 72 credits including a minimum of 20 credit hours in dissertation research (PSCI 698) and dissertation (PSCI 699) completed following admission to candidacy 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.

Doctor of Philosophy in Pharmaceutical Sciences (Pharmacy Administration Emphasis)

Candidates must complete the following courses:

Statistics and Research Methods (14 credits)

BIOS 605	Biometry	4 cr
	Multivariate Analysis	4 cr
PADM 605	Research Methods	3 cr
	One additional methods course (e.g. 3 cr MBA 630, 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
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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 a 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 a 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 a M.S. thesis, s/he may petition the Advisory

Committee to accept it as fulfillment of this requirement.

Pharmaceutical Sciences Graduate Courses

PSCI g423 Pharmaceutics I 3 credits. Fundamental knowledge for pharmaceutical evaluation: terminology, physical and chemical properties of drugs, and pharmacokinetic principles. Students become familiar with physician orders, patients' charts, current literature, and will evaluate patient profiles.

PSCI g424 Pharmaceutics II 4 credits. Pharmaceutical principles based on different routes of administration: biopharmaceutics, stability, packaging and formulation of various dosage forms; pharmacokinetic processes and dose modelling. Three hours lecture and three hours laboratory each week. PREREQ: PSCI g423.

PSCI g425 Pharmaceutics III 4 credits. Parenterals, radiopharmaceuticals, chemotherapeutic products, biological derived products and manufacturing techniques. Three hours of lecture and three hours of laboratory each week. PREREQ: PSCI g424.

PSCI g455 Medicinal Chemistry I 3 credits. A study of the general chemistry, chemical properties and relationships between chemical structures and pharmacological activities of organic and inorganic medicinal agents. PREREQ: PSCI g465, BIOS g477.

PSCI g456 Medicinal Chemistry II 3 credits. A study of the general chemistry, chemical properties and relationships between chemical structures and pharmacological activities of organic and inorganic medicinal agents. PREREQ: PSCI g455.

PSCI g465 Pharmacology I 4 credits. Study of drug action, receptors and metabolism; principles of pharmacology of the major classes of drugs. PREREQ: BIOS 445, BIOS 449.

PSCI g466 Pharmacology II 4 credits. Study of drug action, receptors and metabolism; principles of pharmacology of the major classes of drugs. PREREQ: PSCI 465, BIOS 447, BIOS 456.

PSCI g467 Pharmacology III 3 credits. Principles of pharmacology of the major classes of drugs; the actions, receptor sites, and metabolism of these agents. PREREQ: PSCI g466, PSCI g455.

***PSCI g510 Pharmaceutical Analysis 3 credits.** Principles and techniques of pharmaceutical analysis used for the evaluation of drugs and their dosage forms. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI g511 Vitamins and Enzymes 3 credits. Study of the biochemical role of vitamins and enzymes. PREREQ: BIOS 645, BIOS 477.

PSCI 515 Pharmacological Basis of Cancer Chemotherapy 3 credits. An in-depth study of the pharmacology of the antineoplastics and the rational basis for chemotherapy. Advances in the

design and evaluation of newer combined treatments are included. PREREQ: PSCI 465, PSCI 466, PSCI 467.

PSCI 582 Independent Problems in Pharmaceutical Sciences 1-2 credits. Advanced students are assigned special laboratory studies on the basis of interest and previous preparation. PREREQ: PERMISSION OF INSTRUCTOR.

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

PSCI 603 Scientific Writing 2 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 605 Principles of Instrumental Techniques 3 credits. Discussion and practical experience in the use of instruments in Pharmaceutical Sciences research.

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 2 credits. A discussion of the nature and critical analysis of experimentation, literature in the Pharmaceutical Sciences and styles of technical presentation. May be repeated.

PSCI 609 Advanced Pharmaceutics 3 credits. A study of the application of physicochemical principles to the design and formulation of pharmaceutical dosage forms. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 612 Advanced Medicinal Chemistry 3 credits. Advanced study of the chemical and biochemical nature of action of specific pharmacological agents. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 613 Advanced Physical Pharmacy 3 credits. Physical-chemical principles involved in the formulation and evaluation of pharmaceutical systems, including degradation, stabilization, and complexation. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 614 Structure Activity Relationships 3 credits. Examination of current theories of the relationship between chemical structure and biological activity. PREREQ: PCHM 612.

PSCI 616 Dispersed Systems 3 credits. The theoretical considerations of pharmaceutical dispersion systems including colloidal dispersions, interfacial phenomena, and electrokinetic and rheological properties. 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 elimi-

nation 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 632 Surgical and Experimental Methods in Pharmacology Research 2 credits. Advanced laboratory experience in surgical techniques used in pharmacology research. PREREQ: PCOL 352 AND/OR PERMISSION OF INSTRUCTOR.

PSCI 649 Research in Pharmaceutical Sciences 1-2 credits per semester. Research problems ancillary to the thesis project. May be repeated. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 650 Thesis Research 1-10 credits.

PSCI 651 Pharmacokinetic Theory 2 credits. A rigorous treatment of mathematical techniques involved in the derivation of equations describing the time-courses of drugs and metabolites in biological systems. PREREQ: GRADUATE STANDING AND PSCI 427, MATH 360.

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 Biopharmaceutical Analysis 4 credits. A treatment of modern methods for the quantitative measurement of drugs and metabolites in biological materials. PREREQ: GRADUATE STANDING.

PSCI 654 Applied Pharmacokinetics 3 credits. Applications of pharmacokinetic concepts in the design of dosing regimens for specific drugs in individual subjects. PREREQ: PSCI 427.

PSCI 655 Biopharmaceutical Analysis II 2 credits. A continuation of 653, this course covers the nonchromatographic methods of analysis such as spectroscopy, immunoassays, radiochemical methods, fluorimetry, enzymatic assays, microbiological techniques, electroanalytical techniques, and electrophoresis.

PSCI 660 Mechanisms of Drug Action 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 467 AND PERMISSION OF INSTRUCTOR.

PSCI 661 Drug Metabolism and Toxicology 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 toxicity, and risk assessment. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 662 Advanced Neuropharmacology 3 credits. The molecular basis of drug action in the central nervous system including nerve excitation, molecular properties of ion channels, neuropharmacological methods, pharmacology of ethanol and the mechanisms in tolerance and physical dependence. PREREQ: PSCI 467 AND PERMISSION OF INSTRUCTOR.

PSCI 682 Independent Problems in Pharmaceutical Sciences 1-2 credits. Advanced students are assigned special laboratory studies on the basis of interest and previous preparation. PREREQ: PERMISSION OF INSTRUCTOR.

PSCI 691 Topical Seminar in Pharmaceutical Sciences 2-4 credits. In-depth study of a current topic in pharmacology. May be repeated.

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 g454 Pharmacy Management I 2 credits. Principles of organization, management and financial analysis as applied to the practice of pharmacy. PREREQ: PPRA 519.

PADM g456 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: MBA 602 OR EQUIVALENT 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 MBA 601, 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.

PADM 650 Thesis Research 1-10 credits.

PADM 651 Master's Paper 3 credits.

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 g491 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 Nurse Practitioners 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.