
USC School of Pharmacy



Pharmacy students Hovik Mekhjian and Parth Parikh founded Project India, an outreach program that educates the subcontinent's pharmacy students about their role in battling the growing diabetes epidemic. "This project exemplifies a major component of our global initiatives here at the school," said Michael Wincor, the school's associate dean of globalization.

Founded in 1905, the USC School of Pharmacy is the oldest and foremost pharmacy school in Southern California. The school is a national leader known for its progressive curriculum and research excellence. Approximately 50 percent of the practicing pharmacists in Southern California are graduates of USC. The school has an average student body of 730 full-time students in the Pharm.D. program, 190 students in the Master of Science, Doctor of Philosophy and Doctor of Regulatory Science programs, a full-time faculty of 76 and more than 400 part-time and volunteer faculty.

The school occupies state-of-the-art facilities on the USC Health Sciences campus in metropolitan Los Angeles, adjacent to the Los Angeles County+USC Medical Center (one of the largest teaching hospitals in the country), the USC/Norris Comprehensive Cancer Center, the Doheny Eye Institute and the USC University Hospital. USC pharmacy students receive clinical training at these facilities and many other affiliated hospitals, health care clinics, skilled nursing facilities, home health care agencies and pharmacies in the Southern California region. The school also owns and operates two campus pharmacies. Recognized as one of the most innovative schools of pharmacy in the nation, the USC School of Pharmacy serves as a model for other progressive schools. In 1950, USC was the first to establish a Doctor of Pharmacy program. Additional national "firsts" that distinguish the school include: first clinical pharmacy program and first M.S. in radiopharmacy (both in 1968); first Pharm.D./M.B.A. dual degree program (1988); first M.S. and Ph.D. programs in pharmaceutical economics and policy (1994) and first professional doctorate in regulatory science (2008). The Pharm.D. program is complemented by additional dual/joint degree options, including the Pharm.D./J.D., Pharm.D./Ph.D., Pharm.D./M.S. in regulatory science, Pharm.D./M.P.H. and Pharm.D./M.S. in gerontology. The school also offers Ph.D. and M.S. degrees in pharmaceutical sciences, molecular pharmacology and toxicology, and pharmaceutical economics and policy.

Consistently the top-ranked private school of pharmacy, the school is second in the nation in funding from the National Institutes of Health. As a member of the American Association of Colleges of Pharmacy, the school must maintain certain minimum requirements for entrance and graduation. The School of Pharmacy Pharm.D. program is accredited by the Accreditation Council for Pharmacy Education.

Health Sciences Campus
John Stauffer Pharmaceutical Sciences
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 (323) 442-1369
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 Office of Admission and Student Affairs
 (323) 442-1466
 Email: pharmadm@usc.edu
 Email: pharmfa@usc.edu
www.usc.edu/schools/pharmacy

Administration

R. Pete Vanderveen, Ph.D., R.Ph., *Dean*

Fred G. Weissman, Pharm.D., J.D., *Associate Dean, Academic and Clinical Affairs*

Cynthia C. White, B.A., *Associate Dean, Administrative Affairs*

Ronald L. Alkana, Pharm.D., Ph.D., *Associate Dean, Graduate Affairs and Curricular Development*

Sarah F. Hamm-Alvarez, Ph.D., *Associate Dean, Research Affairs, and Chair, Department of Pharmacology and Pharmaceutical Sciences*

Michael Z. Wincor, Pharm.D., *Associate Dean, Global Initiatives and Continuing Professional Development*

Kathleen A. Johnson, Pharm.D., M.P.H., Ph.D., *Chair, Titus Family Department of Clinical Pharmacy and Pharmaceutical Economics & Policy*

Faculty

John Stauffer Dean's Chair in Pharmaceutical Sciences: R. Pete Vanderveen, Ph.D., R.Ph.

University Professor and Boyd P. and Elsie D. Welin Professor of Pharmaceutical Sciences: Jean Chen Shih, Ph.D.

Distinguished Professor: Walter Wolf, Ph.D.

William A. Heeres and Josephine A. Heeres Endowed Chair in Community Pharmacy: Kathleen A. Johnson, Pharm.D., M.P.H., Ph.D.

R. Pete Vanderveen Endowed Chair in Therapeutic Discovery and Development: Roberta Diaz Brinton, Ph.D.

John A. Biles Professor of Pharmaceutical Sciences: Wei-Chiang Shen, Ph.D.

Timothy M. Chan Professor of Complementary Therapeutics: Rajindar S. Sohal, Ph.D.

Gavin S. Herbert Professor of Pharmaceutical Sciences: Sarah F. Hamm-Alvarez, Ph.D.

Charles Krown/Pharmacy Alumni Professor of Pharmaceutical Sciences: Enrique Cadenas, M.D., Ph.D.

Provost's Professor of Cell and Neurobiology, Pharmacology and Pharmaceutical Sciences, and Psychology: Pat Levitt, Ph.D.

Provost's Professor of Medicine and Pharmacy: Michael Kahn, Ph.D.

Professors: Ronald L. Alkana, Pharm.D., Ph.D.; Enrique Cadenas, M.D., Ph.D.; Timothy M. Chan, Ph.D.; Roberta Diaz-Brinton, Ph.D.; Dana Goldman, Ph.D.; Sarah F. Hamm-Alvarez, Ph.D.; Michael B. Nichol, Ph.D.; Wei-Chiang Shen, Ph.D.; Jean C. Shih, Ph.D.; Rajindar Sohal, Ph.D.; R. Pete Vanderveen, Ph.D.; Walter W. Wolf, Ph.D.

Associate Professors: James D. Adams, Jr., Ph.D.; Julio A. Camarero, Ph.D.; Jason N. Doctor, Ph.D.; Roger F. Duncan, Ph.D.; Ian S. Haworth, Ph.D.; Geoffrey Joyce, Ph.D.; Jeffrey S. McCombs, Ph.D.; Nouri Neamati, Ph.D.; Curtis T. Okamoto, Ph.D.; Neeraj Sood, Ph.D.; Clay C.C. Wang, Ph.D.

Assistant Professors: J. Andrew MacKay, Ph.D.; Bogdan Z. Olenjuk, Ph.D.; Bangyan Stiles, Ph.D.

Lecturer: Rebecca Romero, Ph.D.

Research Professor: Ian Hutchinson, Ph.D., D.Sc.

Research Associate Professors: Kevin J.Y.H. Shin Chen, Ph.D.; Julie Zissimopoulos, Ph.D.

Research Assistant Professors: Marco Bortolato, Ph.D.; Julianna Hwang, Pharm.D.; Ph.D.; Jennica Krankel, Ph.D.; Igor Rebrin, Ph.D.; Liquin Zhao, Ph.D.

Professors of Pharmacy: Kathleen A. Johnson, Pharm.D., M.P.H., Ph.D.; Frances Richmond, Ph.D.; Glen L. Stimmel, Pharm.D.; Bradley R. Williams, Pharm.D.

Associate Professors of Pharmacy: Melvin F. Baron, Pharm.D., M.P.A.; Paul M. Beringer, Pharm.D.; Kathleen H. Besinque, Pharm.D., M.S.Ed.; Steven Chen, Pharm.D.; Alfred Chin, Pharm.D.; Daryl L. Davies, Ph.D.; Julie A. Dopheide, Pharm.D.; Kevin L. Forrester, Pharm.D.; Jeffery Goad, Pharm.D., M.P.H.; William C. Gong, Pharm.D.; Jack W. Kern, Pharm.D.; Cynthia L.L. Lieu, Pharm.D.; Stanley G. Louie, Pharm.D.; Gladys H. Mitani, Pharm.D.; Tien Ng, Pharm.D.; Irving Steinberg, Pharm.D.; Gregory A. Thompson, Pharm.D.; Fred G. Weissman, Pharm.D., J.D.; Michael Z. Wincor, Pharm.D.; Annie Wong-Beringer, Pharm.D.; Frances S. Wong, Pharm.D.

Assistant Professors of Pharmacy: Betty Chan, Pharm.D.; Marc Cosep, Pharm.D.; Jennifer H. Cupo-Abbott, Pharm.D.; Shetal Desai, Pharm.D.; Melissa Durham, Pharm.D.; Emily Han, Pharm.D.; Kevin Kaneko, Pharm.D.; Jiwon Kim, Pharm.D.; Kum Ja K. Lee, Pharm.D.; May C. Mak, Pharm.D.; Edith Mirzaian, Pharm.D.; Tien Ng, Pharm.D.; Susie Park, Pharm.D.; Paula Phongsamron, Pharm.D.; Veena Venugopalan; Florence H. Wong-Yu, Pharm.D.

Distinguished Emeritus Professor: John A. Biles, Ph.D.

Emeritus Professor: Eric J. Lien, Ph.D.

Programs

The School of Pharmacy offers curricula leading to the Doctor of Pharmacy (Pharm.D.) and Doctor of Regulatory Science (D.R.Sc.) degrees. Through the Graduate School, graduate degrees offered are: Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in pharmaceutical sciences, Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in molecular pharmacology and toxicology, Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in pharmaceutical economics and policy, Doctor of Philosophy (Ph.D.) in clinical and experimental therapeutics and Master of Science (M.S.) in regulatory science. Five dual degree programs, one joint program and numerous certificate programs are also offered: Pharm.D./J.D., Pharm.D./M.B.A., Pharm.D./M.P.H., Pharm.D./M.S. in regulatory science, Pharm.D./M.S. in gerontology, Pharm.D./Ph.D., Pharm.D./graduate certificate in gerontology, certificate in clinical research design and management, certificate in food safety, certificate in preclinical drug development, and certificate in patient and product safety.

The USC School of Pharmacy Doctor of Pharmacy is accredited by the Accreditation Council for Pharmacy Education, 20 North Clark Street, Suite 2500, Chicago, IL 60602, Phone: (312) 664-3575, FAX (312) 664-4652.

Tuition and Fees (Estimated)

Tuition for School of Pharmacy degree programs (Pharm.D.; M.S. and Ph.D. in pharmaceutical sciences; M.S. and Ph.D. in molecular pharmacology and toxicology; M.S. and Ph.D. in pharmaceutical economics and policy) is charged at the following rate (which differs from standard USC tuition): per semester (15-18 units) \$21,663; for less than 15 units and each unit above 18 units, \$1,444 per unit. See the Tuition and Fees section, page 41, for fee information. These fees are based upon current information available at the time of publication and are subject to possible later change.

Doctor of Pharmacy students must pay a \$500 non-refundable acceptance deposit that is applicable toward tuition. For deposit information in other degree programs in the School of Pharmacy, please consult appropriate offices.

Honor Societies

Rho Chi

Theta chapter of Rho Chi, national honorary pharmaceutical society, was established at USC in 1925. Charters for chapters of this organization are granted only to student groups in those colleges that are members in good standing of the American Association of Colleges of Pharmacy. Eligibility for membership is based on high attainment in scholarship, character, personality and leadership. All candidates selected for membership must have completed two years of college work, and they must be approved by the Dean of the School of Pharmacy.

Phi Lambda Sigma

The Phi Lambda Sigma chapter was established at USC in 1988. This national pharmacy leadership society is devoted to identifying, supporting and recognizing the contribution of pharmacy students to their colleges, their classmates, their campuses, their communities and to their chosen profession.

Student Housing and Service Facility, Health Sciences Campus

There are limited university-managed accommodations on the Health Sciences campus. Students may wish to live in student housing on the University Park campus, located about eight miles from the Health Sciences campus.

The Blanche and Frank R. Seaver Student Residence, adjacent to the John Stauffer Pharmaceutical Sciences Center, provides dining facilities and a book store. For residence information, phone (323) 442-1576; for bookstore information call (323) 442-2674.

Student Health Services, Health Sciences Campus

Services of the Student Health Center, covered by the mandatory student health fee, include the usual ambulatory care health services given by the faculty of the USC Department of Family Medicine and the Student Health Center nursing staff. Hours are from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding USC holidays. The Student Health Center is located in the USC Health Care Consultation Center, 1500 San Pablo Street, Suite 104, adjacent to the USC University Hospital, one block northeast of the School of Pharmacy. The telephone number is (323) 442-5980. In addition to the student health fee, all Pharm.D. students must have major medical insurance coverage from the USC Health Plan. A student may request a waiver of the USC Health Plan if covered by a personal medical plan acceptable to the Health Insurance Office.

Professional Degrees

Doctor of Pharmacy

A four-year curriculum, following appropriate college prerequisite work, leading to the Doctor of Pharmacy (Pharm.D.) is offered to students admitted to the School of Pharmacy. A sample outline of the curriculum is listed in the following pages. The degree will be conferred when the student has successfully completed all Doctor of Pharmacy degree requirements.

Application Procedure

The School of Pharmacy uses the Pharmacy College Application Service (PharmCAS) and a supplemental application for its admission process. Applications are available at www.usc.edu/schools/pharmacy. The PharmCAS and supplemental application deadline is November 1.

Applications are due November 1. Priority interview consideration is given when the PharmCAS and supplemental application are submitted and all necessary criteria have been met. Follow the instructions carefully for the PharmCAS application and the supplemental application for the USC School of Pharmacy. Both applications must be received by the Office of Admission and Student Affairs before the evaluation process can begin.

All documents mailed directly to the School of Pharmacy and received from PharmCAS by the Office of Admission become the property of the university and cannot be returned or duplicated for other than university purposes.

Admission Guidelines

The Admission Committee considers several factors in making admissions decisions: strong academics; competitive performance in the interview; recommendation forms; and written comments specified in the application. The committee also considers a candidate's motivation to pursue pharmacy, strong interpersonal skills, excellent oral and written communication skills, and leadership abilities. While the School of Pharmacy gives equal consideration to every qualified applicant, the school cannot accommodate all qualified candidates who apply for admission.

Admission of International Students

International students may be admitted on a space available basis. All requirements described in this section are also applicable to the admission of international students.

In addition, special application and admission procedures are required of international students. Refer to the section on Admission of International Students in this catalogue.

Entrance Requirements

Admission to the School of Pharmacy requires completion of a baccalaureate degree, completion of the prerequisite college courses, a minimum 3.0 (A = 4.0) cumulative grade point average and a minimum 3.0 grade point average in the prepharmacy prerequisites.

Prepharmacy Requirements

To be eligible for admission to the School of Pharmacy, students must take the required prerequisite college courses, including general chemistry, organic chemistry, general biology, physics, biochemistry, molecular biology or cell biology, microbiology, mammalian physiology, calculus, statistics, a social sciences course related to human behavior, and a course in microeconomics. These science requirements should be completed at an accredited four-year university. All other requirements may be completed at a two-year college.

Grades of pass/no pass or credit/no credit will not be accepted (unless a course is only offered on a pass/no pass basis).

Mathematics and Physical Sciences

Courses must include calculus, statistics, general chemistry, organic chemistry and physics. Only courses for science majors are acceptable. It is highly recommended that math and science courses be completed during the regular academic year and not during a summer term.

Calculus: one semester or two quarters of calculus are required. The course should include differential and integral calculus for science majors. The recommended course at USC is MATH 125.

Statistics: One course in statistics (not business statistics) is required.

General chemistry: a one-year course for science majors, including laboratory, is required. The course should include inorganic chemistry and qualitative analysis. The recommended courses at USC are CHEM 105a**LbL**.

Organic chemistry: a one-year course for science majors, including laboratory, is required. If the school offers less than a one-year course, the student must complete the second semester at another institution. The recommended courses at USC are CHEM 322**abL**.

Physics: a one-semester (two quarters) course in physics for science majors with laboratory is required (inclusion of thermodynamics and electromagnetism is recommended). The recommended courses at USC are PHYS 135**abL** or PHYS 151**L** and PHYS 152**L**.

Biological Sciences

General biology: a one-year course (two semesters, three quarters) for science majors is required in general biology with laboratory (excluding courses in human anatomy, human physiology, botany and microbiology). If the school offers less than a one-year course, the student must complete the second semester at another institution. The recommended courses at USC are BISC 120**Lx** and BISC 220**L**.

Microbiology: one course in fundamental microbiology for science majors is required. The recommended course at USC is BISC 300**L**. Lab is recommended.

Molecular or cell biology: one upper division course in molecular or cell biology for science majors is required. The recommended course at USC is BISC 320**L** or BISC 411.

Biochemistry: one upper division course in biochemistry for science majors is required. The recommended course at USC is BISC 330**L**.

Mammalian physiology: one course in mammalian physiology for science majors is required (human physiology is preferred; courses in plant physiology, cell physiology and marine physiology cannot be used to meet this requirement). The recommended course at USC is BISC 307**L**.

Social and Behavioral Sciences

One course in human behavior (psychology, sociology, cultural anthropology or related courses is required).

Economics: one course in microeconomics is required. If a one-year course is offered, both semesters may be taken and excess units may be applied to either the remainder of the unit requirements for the subject area or as elective units. The equivalent course at USC is ECON 203.

Students who have earned a baccalaureate degree and meet the prerequisites described above (including general psychology or introduction to sociology and microeconomics or macroeconomics) at the time of admission will have fulfilled the requirement for social and behavioral sciences.

Advanced Placement and International Baccalaureate Examinations

Applicants can use AP and IB courses to meet USC School of Pharmacy prerequisites with the following provisos. AP results are acceptable with scores of 4 or 5. IB results are acceptable with a score of 5. Science courses must include respective laboratory courses taken at the college/university level. AP/IB courses used to meet prerequisites will be for course credit only (i.e., they will not count toward the GPA). The Admission Committee recommends that applicants enroll in all of the required pre-pharmacy courses. Please contact the School of Pharmacy Office of Admission for specific information.

Entrance Examination

An in-person interview is required for admission. The PCAT is not required.

Special Admissions Program for Entering Freshmen and USC Undergraduates

The Trojan Admission Prepharmacy (TAP) program provides guaranteed admission to the USC School of Pharmacy for USC undergraduates who meet preset performance standards. The TAP program is designed to attract highly qualified, mature high school seniors applying to USC. Admission requirements for high school applicants to the TAP program include prior admission to any USC undergraduate program. Currently enrolled

USC undergraduates may apply to the TAP program with a 3.2 GPA at USC. Transfer students are eligible for the TAP program provided they study at USC for a minimum of two years. A bachelor's degree from USC is required for all TAP students beginning fall 2009.

Students accepted into the TAP program must meet all Pharm.D. entrance requirements, prerequisites, take a full course load each semester, complete their prepharmacy requirements with at least a 3.2 cumulative GPA and have a minimum 3.0 cumulative GPA. All prepharmacy courses must be taken for letter grades. Pass/no pass, credit/no credit grades and grades lower than C are not acceptable.

TAP program participants who fulfill the requirements listed above will be guaranteed admission to the Doctor of Pharmacy program at USC. TAP program students receive ongoing individual advisement, access to the School of Pharmacy's student services and the privilege of joining the student-run prepharmacy club, the USC Pre-Pharmacy Society. A specific listing of USC courses and a recommended program for TAP participants can be obtained from the School of Pharmacy Office of Admission or online at www.usc.edu/schools/pharmacy/pharmd/programs/tap.html.

General Education Requirements (TAP Students Only)

TAP students must meet the university's general education requirements; see pages 63 and 245 for details.

Pharm.D. Curriculum Requirements

The completion of a four-year professional curriculum is required to earn the Doctor of Pharmacy degree. The curriculum, except for the fourth year, is a "block" program. All students must enroll in 18 units each semester in courses designated for the fall or spring. Students do not have choices of courses to take nor are they permitted to drop any one course or courses during the semester. (Year III and IV students have elective course choices). Progress is permitted only when the prior semester is completed in full. Students should view the curriculum outlined here as advisory only and subject to modification. Aggregate hours must equal a minimum of 144 units to meet graduation requirements.

The pharmacist of tomorrow will provide preventive and therapeutic pharmaceutical care, provide drugs to patients, communicate in health care matters, meet the ethical and legal requirements of the practice of pharmacy and maintain professional expertise.

The curriculum committee of the School of Pharmacy has developed guidelines and patient care competencies consistent with interpretations of this new role. An appropriate and dynamic educational program is needed to develop these competencies, and curriculum changes are necessary and desirable in order to meet scientific advances, population profile changes, increasing health expectations, technological advances, the increasing role of the government in health services and other influences.

Program of Courses

| YEAR I, FALL (18 UNITS) | | UNITS |
|----------------------------|---|-------|
| PHRD 501 | Pharmaceutics I | 4 |
| PHRD 503 | Biological Systems I | 4 |
| PHRD 507 | Health Care Delivery Systems | 2 |
| PHRD 509 | Pharmacy Practice and Experience I | 4 |
| PHRD 555 | Biochemical and Molecular Sites of Drug Action | 4 |
| YEAR I, SPRING (18 UNITS) | | UNITS |
| PHRD 502 | Pharmaceutics II | 3 |
| PHRD 504 | Biological Systems II | 6 |
| PHRD 505 | Molecular Genetics and Therapy | 3 |
| PHRD 510 | Pharmacy Practice and Experience II | 4 |
| PHRD 554 | Public Health and Epidemiology | 2 |
| YEAR II, FALL (18 UNITS) | | UNITS |
| PHRD 506 | Self Care and Non-Prescription Therapies | 5 |
| PHRD 508 | Pharmacy Literature Analysis and Drug Information, or | |
| PHRD 561 | Parenteral Therapy Externship | 3 |
| PHRD 551 | Immunology | 3 |
| PHRD 557 | Therapeutics I | 5 |
| PHRD 559 | Therapeutics II | 2 |
| YEAR II, SPRING (18 UNITS) | | UNITS |
| PHRD 552 | Pharmaceutics III | 3 |
| PHRD 553 | Management within Health Care Organizations | 2 |
| PHRD 560 | Therapeutics III | 6 |
| PHRD 561 | Parenteral Therapy Externship, or | |
| PHRD 508 | Pharmacy Literature Analysis and Drug Information | 3 |
| PHRD 562 | Therapeutics IV | 4 |
| YEAR III, FALL (18 UNITS) | | UNITS |
| PHRD 601 | Therapeutics V | 6 |
| PHRD 603 | Therapeutics VI | 3 |
| PHRD 605 | Therapeutics VII | 4 |
| PHRD 607 | Nutrition | 2 |
| Elective | | 3 |

| YEAR III, SPRING (18 UNITS) | | UNITS |
|-----------------------------|--|-------|
| PHRD 606 | Therapeutics VIII | 2 |
| PHRD 608 | Therapeutics IX | 2 |
| PHRD 610 | Therapeutics X | 3 |
| PHRD 612 | Therapeutics XI | 2 |
| PHRD 614 | Pharmaceutical Economics and Outcome Studies | 3 |
| PHRD 616 | Pharmacy Law and Ethics | 3 |
| Elective | | 3 |

Year III students must choose their electives from the following (3 units each):

| | |
|-----------|--|
| PHRD 651 | Community Pharmacy I |
| PHRD 652 | Community Pharmacy II |
| PHRD 653 | Health Systems Pharmacy I |
| PHRD 654 | Health Systems Pharmacy II |
| PHRD 655 | Geriatric Pharmacy I |
| PHRD 656 | Geriatric Pharmacy II |
| PHRD 657L | Basic Research Design |
| PHRD 658 | Sleep and the Pharmacologic Management of Its Disorders |
| PHRD 659 | Molecular Therapeutics: Signal Transduction |
| PHRD 660 | Disease State Management I |
| PHRD 661 | Pharmacy Practice in Women's Health |
| PHRD 662 | Psychiatric Pharmacy Practice |
| PHRD 663 | Pharmaceutical Development |
| PHRD 664 | Clinical Problem Solving |
| PHRD 665 | Complementary/Alternative Therapeutics |
| PHRD 666 | Therapeutic Drug Monitoring |
| PHRD 667 | Drugs of Abuse |
| PHRD 668 | Computing Application |
| PHRD 669 | Health Care Needs of Special Populations |
| PHRD 670 | Marketing and Development in the Pharmaceutical Industry |
| PHRD 675 | Travel Medicine |
| PHRD 677 | Risk Assessment and Management in Pharmacy Practice |

YEAR IV, FALL (18 UNITS)

Required Clerkships
Elective Clerkships

YEAR IV, SPRING (18 UNITS)

Required Clerkships
Elective Clerkships

Required Clerkships (6 units each) — four rotations:

| | |
|----------|--|
| PHRD 701 | Acute Care Clinical Practice Clerkship |
| PHRD 705 | Community Pharmacy Clerkship |
| PHRD 704 | Primary Care Clerkship, or |
| PHRD 718 | Hospital Pharmacy Practice Clerkship |

An inpatient practice elective must be satisfied by PHRD 702 if the student selects PHRD 707 Outpatient Psychiatric Pharmacy Clerkship. If the student selects PHRD 702, the student may take elective clerkships marked * to satisfy the requirement.

Elective Clerkships — two rotations (limit of one course that does not involve direct patient care):

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|-----------|---|
| PHRD 702* | Inpatient Psychiatric Pharmacy Clerkship |
| PHRD 703 | Long Term Care Clerkship |
| PHRD 706 | Geriatrics Clerkship |
| PHRD 707 | Outpatient Psychiatric Clerkship |
| PHRD 708* | Inpatient Clinical Practice Clerkship |
| PHRD 709* | Pediatric Drug Therapy Clerkship |
| PHRD 710* | Surgery Clerkship |
| PHRD 711* | Cardiovascular Drug Therapy Clerkship |
| PHRD 712* | Applied Clinical Pharmacokinetics Clerkship |
| PHRD 713* | Drug Information Clerkship |
| PHRD 714* | Radiopharmacy Clerkship |
| PHRD 715* | Oncology Clerkship |
| PHRD 716* | Ob-Gyn Clerkship |
| PHRD 717 | Dermatology Clerkship |
| PHRD 719 | Pain Management Clerkship |
| PHRD 720* | Critical Care Clerkship |
| PHRD 721* | Drug Utilization and Evaluation Clerkship |
| PHRD 722 | Home Health Care Clerkship |
| PHRD 723* | Nutritional Support Clerkship |
| PHRD 724 | Advanced Community Pharmacy Clerkship |
| PHRD 725* | International Pharmacy Clerkship |
| PHRD 726* | Directed Clinical Project Clerkship I |
| PHRD 727 | Directed Clinical Project Clerkship II |
| PHRD 728 | Directed Clinical Project Clerkship III |
| PHRD 729 | Directed Clinical Project Clerkship IV |
| PHRD 730 | Acute Care Geriatrics Clerkship |
| PHRD 731 | Advanced Geriatrics Clerkship |
| PHRD 732* | Pharmacy Administration Clerkship |
| PHRD 733* | Anticoagulation Therapy Clerkship |
| PHRD 734* | Antimicrobial Therapy Clerkship |
| PHRD 735* | Clinical Pharmacy Research Clerkship |
| PHRD 736* | Chemical Dependency Clerkship |
| PHRD 737* | Clinical Transplantation Clerkship |
| PHRD 738* | Pharmaceutical Industry Clerkship |

| | |
|-----------|--|
| PHRD 739 | AIDS/Immune Disorders Clerkship |
| PHRD 740* | Health Care Systems Administration Clerkship |
| PHRD 741 | Advanced Ambulatory Care Clerkship |

*Indicates course does not involve direct patient care.

Total for Pharm.D. degree: 144 semester units.

Degree Requirements

All students in the Doctor of Pharmacy degree program must meet course requirements, grade point average requirements and program residency requirements. All course

requirements must be completed with a grade of "C" or better. The degree will not be conferred until the student has successfully completed all Doctor of Pharmacy degree requirements. Students are subject to the degree requirements in the *USC Catalogue* current for the semester of their admission into the Doctor of Pharmacy program. Students must have a cumulative grade point average of 3.0 in the Pharm.D. curriculum to meet graduation requirements.

Registration

Details of the School of Pharmacy registration procedure will be included in the orientation program prior to the first week of classes.

Cancellation of Registration

During the first three years of the Doctor of Pharmacy program (Years I, II and III), a student will only be permitted to withdraw from all courses enrolled in a semester and may not selectively withdraw from a single course or group of courses. During the fourth year, students must contact the School of Pharmacy Office of Admission and Student Affairs for withdrawal guidelines. Procedures for readmission into the program or make-up of incomplete courses and clerkships are included in the school's brochure on academic policies and procedures.

Graduate Degrees

The School of Pharmacy, through the Graduate School, offers curricula leading to the M.S. and Ph.D. degrees in pharmaceutical sciences and in molecular pharmacology and toxicology as well as a Ph.D. in clinical and experimental therapeutics. The school also offers an interdisciplinary M.S. in regulatory science. The Ph.D. degree in pharmaceutical economics and policy is offered jointly with the Department of Economics. The M.S. degree in pharmaceutical economics and policy is offered jointly with the School of Policy, Planning, and Development and the Department of Economics. In addition, the school offers dual degrees with the schools of law, business and gerontology as well as other programs. Instructions given in the Admission section of this catalogue are to be followed, but the application and the supplemental information requested should first be submitted to: Graduate Programs Office, USC School of Pharmacy, 1985 Zonal Avenue, Los Angeles, CA 90033. Additional information may be obtained by calling (323) 442-1474 or sending email to pharmgrd@usc.edu.

Admission Requirements for the Master of Science and Doctor of Philosophy in Pharmaceutical Sciences

Applicants should possess a bachelor's degree or equivalent from an accredited college or university. A minimum grade point average of 3.0 and qualifying scores on the GRE in the verbal and quantitative tests are required.

In addition to excellent communication skills, applicants should possess knowledge and competence equivalent to one year of acceptable course work in at least three of the following disciplines: mathematics, organic chemistry, physical chemistry, biochemistry, physiology and pharmacology. In addition to the application for admission, three letters of recommendation from faculty members who can evaluate the promise of the applicant for graduate study and a personal statement summarizing career objectives and research interests must be submitted.

Applicants who do not meet all the specific requirements indicated above, but who show unique potential, may be considered for admission with conditions which may be fulfilled during the first semester of enrollment. See the Graduate School section of this catalogue, page 97.

Admission Requirements for the Master of Science and Doctor of Philosophy in Molecular Pharmacology and Toxicology

Applicants should possess a bachelor's degree or equivalent from an accredited college or university. A minimum grade point average of 3.0 and qualifying scores on the GRE in verbal and quantitative tests are required. In addition to excellent communication skills, applicants should possess knowledge and competence equivalent to one year of work in at least three of the following disciplines: mathematics, organic chemistry, physical chemistry, biochemistry, molecular biology, cell biology, physiology, pharmacology, economics, statistics and computer sciences. In addition to the application for admission, the candidate must submit three letters of

recommendation from faculty members who can evaluate the promise of the applicant for graduate study and a personal statement summarizing the candidate's career objectives and research interests. Students will be selected for admission on the basis of their academic and scientific record, and, whenever possible, interviews (in person or by phone) with one or more members of the faculty.

Admission Requirements for the Master of Science in Pharmaceutical Economics and Policy

Applicants for admission must have achieved a minimum 3.0 GPA in undergraduate or professional school and adequate scores on the GRE. In addition, applicants will be required to have completed upper division courses in statistical methods, calculus and microeconomics.

Admission Requirements for the Doctor of Philosophy in Clinical and Experimental Therapeutics

Applicants should possess a bachelor's degree in quantitative/biological sciences (or health profession) or an advanced health professional degree (i.e., Pharm.D., M.D., D.D.S.) from an accredited college or university. A minimum grade point average of 3.0 and qualifying scores on the GRE in the verbal and quantitative tests are required. A student currently enrolled in the Pharm.D. program may pursue a Pharm.D./Ph.D. dual degree following the admission procedure in the Catalogue.

In addition to the application for admission, three letters of recommendation from faculty members who can evaluate the promise of the applicant for graduate study and a personal statement summarizing career objectives and research interests must be submitted.

Applicants who do not meet all the specific requirements indicated above, but who show unique potential, may be considered for admission with conditions, which may be fulfilled during the first semester of enrollment. See the Graduate School section, page 97, of this catalogue for further information.

Admission Requirements for the Doctor of Philosophy in Pharmaceutical Economics and Policy

Candidates with a bachelor's, master's or Pharm.D. degree are invited to apply. Applicants must have demonstrated proficiency in verbal and written English and aptitude in economics, mathematics, statistics and computer science. Deficiencies in economics and statistical background can be addressed through preliminary course work after admission to the program.

Degree Requirements

These degrees are under the jurisdiction of the Graduate School. Students should also refer to the Requirements for Graduation section, page 86 and the Graduate School section of this catalogue for general regulations, page 97. All courses applied toward the degrees must be courses accepted by the Graduate School.

Master of Science in Pharmaceutical Sciences

A Master of Science in the pharmaceutical sciences will be granted on the basis of completion of at least 24 units of formal course work and presentation of an acceptable thesis (PSCI 594ab, 4 units) based on the results of an original investigation.

Master of Science in Molecular Pharmacology and Toxicology

A Master of Science in molecular pharmacology and toxicology will be granted on the basis of completion of 32 units: 24 units of formal course work, MPTX 594ab (4 units over two semesters), MPTX 700 (4 units over four semesters) and a presentation of an acceptable thesis based on the results of an original investigation.

A minimum grade point average of at least 3.0 (A = 4.0) is required. Special attention is given to the grades achieved in economics, statistics and mathematics courses relevant to the program. A qualifying score on the GRE in verbal and quantitative areas is required. Students with GRE scores of 1200 or better will be given priority for financial aid support.

Admission Requirements for the Master of Science in Regulatory Science

Applicants should possess a bachelor's degree or equivalent from an accredited college or university. Applicants with graduate or professional degrees are encouraged to apply. A minimum grade point average of 3.0 or qualifying scores on the GRE or equivalent examination are required. The program encourages the participation of part-time students with work experience.

Acceptance criteria for those individuals will be assessed on a case-by-case basis. English proficiency is essential. Students will be selected for admission, whenever possible, after interviews with one or more members of faculty.

Admission of International Students to Graduate Degree Programs

All requirements described in this section are also applicable to the admission of international students. In addition, special application and admission procedures are required of international students. Refer to the section on Admission of International Students in this catalogue.

Master of Science in Pharmaceutical Economics and Policy

The Department of Pharmaceutical Economics and Policy (School of Pharmacy) offers a program of study leading to the M.S. degree. Applicants must apply to the Graduate School and meet the admissions requirements of the program. This program requires students to demonstrate skills in the analysis of pharmaceutical and health technology innovations, as well as an understanding of contemporary health policy issues. A minimum of 36 units of graduate level courses is required.

Grade Point Average

A grade point average of at least 3.0 (A = 4.0) must be achieved on graduate course work at USC.

Course Requirements

The student is required to complete the following 36 units of graduate level course work: ECON 414 (4 units), ECON 500 (4 units) or PPD 501 (4 units), PM 511aL (4 units), PM 512 (4 units) or approved elective, PMEP 509 (4 units), PMEP 519 (4 units), PMEP 529 (4 units), PMEP 538 (4 units) and PMEP 539 (4 units).

Students must complete all requirements for the degree within five years of entry into the program.

Additional Degree Requirements

The student must satisfactorily complete the specified courses in economics, preventive medicine and public administration prior to enrolling in PMEP 538 or PMEP 539. The student is also required to complete an empirical research project on a topic relevant to pharmaceutical economics and policy.

Master of Science in Regulatory Science

Regulatory science relates the regulatory and legal requirements of biomedical product development to the scientific study needed to establish product safety and efficacy. A Master of Science degree in regulatory science will be granted upon completion of at least 30 units of formal course work and 6 units of research project work in an internship setting (MPTX 630). Students with experience in industry or government can substitute an equivalent amount of formal course work for the research project with the permission of the admissions committee. Course requirements normally include a minimum of three courses concerned with regulatory aspects of medical product development and a minimum of one course each in quality assurance, clinical research, business, statistics and law. Recommended course work includes some courses available in other departments of the university. Students should develop a specific plan of study in consultation with the graduate advisors before beginning the program.

Doctor of Regulatory Science

The Doctor of Regulatory Science program cultivates research, leadership and inquiry skills for advanced students in the emerging profession of global regulatory science. It is designed to produce graduates with expertise in strategic management, policy development and research assessment who can play leadership roles in the public sector, academia and the medical products industry. Participants in this program will take a set of interdependent courses that extend from a strong core of basic regulatory science course work and additionally focus on three main areas — global product strategy, product lifecycle strategy, and project and personnel management. After students have completed foundational course work, they will participate as a cohort that typically has a two-year cycle of classes and an additional year of dissertation research. The program has been designed to meet the needs of individuals who are already working full-time outside of the university. The doctoral degree will be administered by the School of Pharmacy.

Admission

The program is designed for individuals with strong professional experience and demonstrated intellectual and leadership capabilities. Applicants are expected to have a GPA of 3.0 on university-level course work and five or more years of professional experience. Admission requirements include university transcripts, a resume, at least three letters of reference, and a one-page personal statement that outlines the background and goals of the applicant. Students are encouraged even at this early stage to identify areas in which they are interested in conducting research. Additional requirements for international students are outlined by university regulations under Admission of International Students, page 81. Students are not required to provide GRE scores unless indicated by the program director.

Students with an appropriate graduate or professional degree may use some previous graduate courses as transfer units toward the overall credit requirements of the Doctor of Regulatory Science program with the approval of the program director and under the normal rules of the university. Students who have graduated from the M.S. program in Regulatory Science can apply all of the previously taken course work toward the doctoral degree. Students with graduate degrees from outside of the regulatory science program are required to take a minimum of 32 units of course work and 4 units of dissertation research to complete the requirements for graduation. The course work requirements will be determined on an individual basis in consultation with the program director and participant's advisors.

Curriculum Requirements

The Doctor of Regulatory Science is administered by the School of Pharmacy. It requires participants to complete 64 units that include the following elements:

| REQUIREMENTS | UNITS |
|------------------------------|-------|
| Foundation courses | 15 |
| Product lifecycle strategy | 8 |
| Global strategy | 8 |
| Project/personnel management | 8 |
| Research methods | 4 |
| Dissertation | 4 |

Additional elective course work will be selected in consultation with the program advisors according to the areas of intended specialization of the participant in order to meet the credit requirements of the program. Typically foundational courses and some electives will be taken in the first two years of the program. Advanced courses in product lifecycle strategy, global strategy and project/personnel management will normally be taken by the doctoral cohort of students during the third and fourth years of the program. Dissertation planning and research will typically commence in the third year of the program, and extend until the successful completion of the dissertation.

Foundation Courses

Fifteen or more units of foundation courses may be taken as part of the master's program in regulatory science, or with prior approval, from another graduate program with similar objectives. Required foundational courses normally include: MPTX 511 Introduction to Medical Product Regulation; two from MPTX 512 Regulation of Pharmaceutical and Biological Products, MPTX 513 Regulation of Medical Devices and Diagnostics, MPTX 514 Regulation of Food and Dietary Supplements; MPTX 515 Quality Systems and Standards; MPTX 516 Medical Products and the Law; MPTX 517 Structure and Management of Clinical Trials. Other courses may be substituted after the participant's background preparation has been considered.

Product Lifecycle Strategy

Eight or more units of course work related to product lifecycle management, from discovery to commercialization, will be drawn from a broad list of courses offered in regulatory science or through the Titus Family Department of Clinical Pharmacy and Pharmaceutical Economics and Policy. Included in this list are: PMEP 538 Pharmaceutical Economics; PMEP 539 Economic Assessment of Medical Care; RSCI 601 Biomedical Commerce. Other courses may also be considered in consultation with the supervisors and program director. Students are also encouraged to take courses outside the School of Pharmacy when more specialized courses fit their professional research or development plans.

Global Regulatory Strategy and Policy

Eight or more units of course work related to global regulatory strategy could include some of the following courses: MPTX 519 Global Regulation of Medical Products; PPD 571 International Public Policy and Management Seminar; RSCI 604 Regulatory Strategy in Asia; RSCI 608 Regulatory Strategy in Europe and the Americas.

Project and Personnel Management

Eight or more units of relevant course work should typically include: MPTX 602 Science, Research and Ethics; RSCI 603 Managing Complex Projects; RSCI 605 Managing Organizations and Human Resources. Graduate courses in other university departments or schools can be substituted with the approval of the program director.

Research Methods

Participants will typically take PMEP 509 Research Design or MPTX 522 Introduction to Clinical Design and Statistics.

Student Progress and Assessments

In the third year, students are expected to identify a pair of advisors including one USC faculty member and one advisor from industry or the private sector. Students are typically placed in study groups of three or four whose dissertation interests are most similar and whose collective supervisors will oversee their academic and research progress. This committee will form the dissertation committee.

At the completion of the foundational course work, students will undergo a competency review that will include considerations of academic progress. Students are expected to maintain a GPA of 3.0 and will be required to pass a written examination designed to assure the professional competence of the student prior to advancing further in the program. Students who do not pass this preliminary review, administered prior to entering the dissertation and advanced course work phase of the program, will be notified of dismissal from the program in writing by the associate dean for graduate studies in the School of Pharmacy.

Doctoral Dissertation

Students must enroll in RSCI 794 Doctoral Dissertation for at least two terms, during which time they will develop a dissertation proposal and conduct the necessary research and analysis in collaboration with the supervisory team. The dissertation committee will approve the thesis plan and monitor its progress. Each student will be required to produce and defend an independent dissertation as a requirement for graduation. A maximum of 6 dissertation units can be applied to

satisfy the degree requirement, but students should register for the dissertation units in each term subsequent to the completion of their course work requirements. Institutional Review Board approval is required for all human studies.

Doctor of Philosophy in Clinical and Experimental Therapeutics

The goal of the Ph.D. program in Clinical and Experimental Therapeutics is to develop a scientist who is engaged in team science through interdisciplinary education; competent in conducting research across clinical and basic science disciplines; and integrates basic investigations and clinical observations in applied research to better understand disease process, advance drug development and evaluate efficacy and toxicity of therapeutic regimens with the goal of improving the safe, effective and economical use of therapeutic modalities by patients.

The program applies an interdisciplinary approach that focuses the graduate studies directly toward translational, rather than basic science, aiming to educate students with the perspective and skill set to identify important connections between fundamental biomedical research and human disease. This program emphasizes cross-training between clinical and basic sciences focusing on the investigation of disease processes, drug development and the efficacy and toxicity of therapeutic regimens. Course requirements and research opportunities for graduate students enrolled in the program provide both experimental (basic) and disease-focused experiences that complement the graduate's research focus.

Course Requirements

A minimum of 60 units is required. At least 26 of the 60 units are to be formal graduate course work at the 500-level or above, exclusive of seminars and directed research. Students must complete 14 units of course work before they are eligible for the screening procedure. Additional course work relevant to the research interests of the student may be required by the student's advisors or the student's guidance committee, with an emphasis on cross-training and taking into account the amount and level of previous scientific preparation and the nature of the research dissertation that will be the major endpoint of the program. Specifically, course work requirements differ between students who have an advanced professional degree (Track I) and those who do not (Track II). A maximum of 12 units may be transferred from graduate studies elsewhere.

In the first year, all students (Tracks I and II) are required to take 14 units of course work in translational medicine (RSCI 530, 2 units), research design (PMEP 509, 4 units), biostatistics (PM 510L, 4 units), and clinical trial design (MPTX 517, 4 units). In the second year, Track I students will take the remaining 12 units of course work as electives based on the background of the student and the proposed research focus of the student. Track II students who do not have an advanced professional degree will need to select from the following courses as part of their electives: systems physiology and disease (INTD 572 and INTD 573, 4 units each) or pathology (INTD 550 and INTD 551, 4 units each). Other electives that can be chosen are INTD 531, INTD 561, PATH 580, PM 533, PM 538, PM 570, PSCI 661L and PSCI 665.

The remaining 34 of the 60 units required for the Ph.D. degree may be fulfilled with other courses including ethics, interdisciplinary seminar, directed research and dissertation. Note that to become eligible to take the qualifying exam, Track II students must fulfill the prescribed clinical experiences that match the disease-related topic of the student's thesis work as approved by the student's advisors and advisory committee. Students with a bachelor's degree in a health care subject area (e.g., nursing, pharmacy, medicine) will be evaluated on a case basis and may be required to meet the therapeutic course work or clinical experience component described above, as determined by their background and previous experiences.

Foreign Language Requirement

There is no formal language requirement. However, an individual guidance committee can require competency in a foreign language or a computer language if it is relevant for the student's area of research.

Guidance Committee

Upon admission, the student will be assigned to a member of the graduate faculty who will serve as his or her temporary advisor until a permanent advisor has been identified. The student's program of study will be under the direction of the guidance committee composed of at least five members, one of whom must be from outside the department. Because of the centrality of research in the Ph.D. program, the student is encouraged to get acquainted with the participating faculty mentors from the day they enter the program, and have selected a research direction, paired graduate advisors (clinical and basic scientists), and guidance committee no later than the third semester of study. The graduate affairs committee will serve as the guidance committee until one is selected.

Screening Procedure

The performance of each student will be evaluated no later than the end of the second semester of enrollment in the graduate program. This screening procedure is conducted by the student's guidance committee or, if a student has not yet selected a guidance committee, by the graduate affairs committee. The committee reviews the student's progress to date in various areas including course work, research interests, and laboratory performance on his or her research project or laboratory rotations. If a performance deficiency is determined, specific goals will be established that the student must fulfill to continue in the program. Passing this screening procedure is prerequisite to continuation in the Ph.D. program.

Qualifying Examination

Students will be required to pass a comprehensive written and oral examination on the chosen disease-focused area of research emphasis. The examination will encompass basic scientific concepts relevant to the disease under study and the laboratory techniques in that discipline, fundamental principles of clinical research and design, biostatistics, and therapeutics in the chosen disease-focused area of research. The examination is administered by the guidance committee and consists of two parts: a written examination administered to all students at the end of their second year of study and a detailed written proposal and its oral presentation and defense by the student to the guidance committee. The examination process is conducted by the student's advisory committee with oversight by the graduate affairs committee. All course and qualifying examination requirements for the Doctor of Philosophy must be completed within two-and-a-half years after admission. After passing these examinations, the student is admitted to candidacy for the Ph.D. degree.

Dissertation

A dissertation based on original investigation in a relevant scientific area is required for the Ph.D. The dissertation research must represent a significant contribution to science and should demonstrate the candidate's scholarly advancement and competence to undertake independent research. An oral defense of the dissertation will be held after the candidate submits the final draft of the dissertation to the dissertation committee. (See Theses and Dissertations in the Graduate School section, page 100.)

Student Teaching

Teaching experience is considered an integral part of the training of graduate students. As part of the general requirements for the Ph.D. degree, each student is required to participate in the teaching program of the School of Pharmacy.

Doctor of Philosophy in Pharmaceutical Sciences

This program emphasizes basic as well as applied research in drug delivery and targeting, utilizing medicinal chemistry, computational chemistry, pharmaceuticals, pharmacodynamics, molecular pharmacology, immunology and cell biology.

A minimum of 60 units is required for the Doctor of Philosophy degree. At least 24 units of course work are required at the 500-level or above, exclusive of seminar and directed research. The guidance committee may require more than 24 units of course work. A minimum of 12 units is to be taken in courses in the Department of Pharmaceutical Sciences and a minimum of 8 units must be taken in various related disciplines outside the department. The remaining 36 units may be fulfilled with other courses, directed research and dissertation.

Foreign Language Requirement

There is no formal foreign language requirement. However, an individual guidance committee can require competency in a foreign language or some other research tool such as computer language, if this is relevant for the student's area of research.

Guidance Committee

Upon admission, the student will be assigned to a member of the graduate faculty who will serve as his or her temporary advisor until a permanent advisor has been identified. The student's program of study will be under the direction of a guidance committee composed of at least five members, one of whom must be from outside the department granting the degree. The student should select a graduate advisor and guidance committee no later than the third semester in residence.

Screening Procedure

The performance of each student will be evaluated no later than the end of the second semester of enrollment in the graduate program. This screening procedure is conducted by the student's guidance committee or, if a student has not selected his or her research advisor at that time, by the Graduate Review Committee of the department. The committee reviews thoroughly the student's progress up to that point in various areas including course work, research interests and laboratory performance on his or her research project or laboratory rotations. If a performance deficiency is detected at that point by the committee, the student will be recommended to either take additional course work or transfer to the Master of Science program. Passing this screening procedure is prerequisite to continuation in the Ph.D. program.

Qualifying Examination

Students will be required to pass a comprehensive qualifying examination in major areas of the pharmaceutical sciences. The examination is administered by the guidance committee and consists of two parts: a written examination and a written proposition outlining a research project, followed by an oral examination based on the proposition and questions dealing with the written examination.

All course and qualifying examination requirements for the Doctor of Philosophy must be completed within two and one half years after admission.

Dissertation

A dissertation based on original investigation is required. The research should make a contribution to science and should demonstrate the candidate's scholarly advancement and competence to undertake independent research. An oral defense of the dissertation will be held after the candidate submits the final draft of the dissertation to the dissertation committee (see Theses and Dissertations, page 100).

Student Teaching

Teaching experience is considered an integral part of the training of graduate students. Thus, as part of the general requirements for the Ph.D., each student is required to participate in the teaching program of the School of Pharmacy.

Doctor of Philosophy in Molecular Pharmacology and Toxicology

This program emphasizes basic as well as applied research in various aspects of drug discovery and molecular and behavioral mechanisms of action. Research opportunities span investigations of fundamental molecular and cellular physiological mechanisms, including receptor activity, intracellular signaling and the regulation of gene expression, to the molecular bases of disease and aging, including avenues of pharmacological intervention.

A minimum of 60 units is required. At least 24 units of course work are required at the 500-level or above, exclusive of seminars and directed research. The guidance committee may require more than 24 units of course work in some cases. The specific requirements will depend on the student's background and research area and will be determined by the student's advisor and advisory committee. A minimum of 12 units is to be taken in appropriate courses offered by the School of Pharmacy. The remaining 36 units may be fulfilled with other courses, directed research and dissertation. A maximum of 12 units can be transferred from graduate studies elsewhere.

Foreign Language Requirement

There is no formal language requirement. However, an individual guidance committee can require competency in a foreign language or a computer language if it is relevant for the student's area of research.

Guidance Committee

Upon admission, the student will be assigned to a member of the graduate faculty who will serve as his or her temporary advisor until a permanent advisor has been identified. The student's program of study will be under the direction of a guidance committee composed of at least five members, one of whom must be from outside the department. The student should select a graduate advisor and guidance committee no later than the third semester in residence. The graduate affairs committee will serve as the guidance committee until one is selected.

Screening Procedure

The performance of each student will be evaluated no later than the end of the second semester of enrollment in the graduate program. This screening procedure is conducted by the student's guidance committee or, if a student has not yet selected a guidance committee, by the graduate affairs committee. The committee reviews the student's progress to date in various areas including course work, research interests and laboratory performance on his or her research project or laboratory rotations. If a performance deficiency is determined, specific goals will be established that the student must fulfill to continue in the program. Passing this screening procedure is prerequisite to continuation in the Ph.D. program.

Qualifying Examination

Students will be required to pass a comprehensive qualifying examination in major areas of molecular pharmacology, including fundamental principals of molecular and cellular biology. The examination is administered by the guidance committee and consists of two parts: a written examination administered to all students at the end of their second year of study and a written proposal outlining the dissertation goals, and its oral presentation and defense by the student to the guidance committee. The examination process is conducted by the student's advisory committee with oversight by the graduate affairs committee. The qualifying examination must be completed within three years after admission, unless an extension is obtained from the guidance committee.

Annual Research Appraisal (ARA)

Beginning in the third year, each graduate student will meet with the guidance committee and present a progress report on his or her research. Prior to the meeting the student will present a short written document describing significant experiments during the past year, problems and projected studies. This document is distributed to the committee members and is included in the student's file. The oral ARA meeting is intended to be a working session between the student and the guidance committee. Experimental results and problems are discussed in this context, as well as a research plan for the next year of work. A satisfactory ARA is required for each year in the graduate program.

Dissertation

A dissertation based on original investigation in a relevant scientific area is required for the Ph.D. The dissertation research should demonstrate the student's ability to undertake independent research through planning, conducting and evaluating experiments. The dissertation research must represent a significant contribution to knowledge. A public oral defense of the dissertation will be held after the candidate submits the final draft of the dissertation to the dissertation committee, and it is approved by the graduate advisor and dissertation committee. For additional details, see *Theses and Dissertations*, page 100.

Student Teaching

Teaching experience is considered an integral part of the training of graduate students. As part of the general requirements for the Ph.D. degree, each student is required to participate in the teaching program of the School of Pharmacy.

Doctor of Philosophy in Pharmaceutical Economics and Policy

The Department of Pharmaceutical Economics and Policy (School of Pharmacy) offers a program of study leading to the Ph.D. degree. This program focuses on economic assessment of pharmaceuticals and medical technology and research into the finance and delivery of pharmaceuticals and pharmacy services. A minimum of 64 units of graduate level courses numbered 500 or higher (excluding 794) and a minimum of four units of 794 is required.

Foreign Language Requirement

There is no formal foreign language requirement. However, competence in the use of one computer programming language is required for the graduate degrees. Such competence can be demonstrated either by course work or examination.

Grade Point Average

A grade point average of at least 3.0 (A = 4.0) must have been achieved on graduate course work at USC. ECON 615 or a higher level course in econometrics must be completed with a grade of B or higher.

Unit Requirements and Recommended Courses

Students are required to complete a minimum of 64 units of graduate level course work. The following courses are recommended towards fulfilling the 64-unit requirement: ECON 401, ECON 500, ECON 511, ECON 513, ECON 514, ECON 615, PM 511*a*, PMEP 509, PMEP 519, PMEP 529, PMEP 538, PMEP 539, PMEP 549 and PMEP 698. Students may transfer and substitute up to 24 units of graduate course work from other universities to fulfill the required 64 units of graduate credit subject to the approval of the department.

Guidance Committee

The student will be assigned to a member of the graduate faculty who will serve as his or her temporary advisor until the formation of a guidance committee. The student should consult the pharmaceutical economics and policy director of graduate studies on the appointment of a Ph.D. guidance committee after taking the written qualifying examination. The chairman of the student's Ph.D. guidance committee advises the student on matters of curriculum and graduate opportunities. The guidance committee comprises three to five members, at least one of whom must be from outside the department; at least two members must specialize in the student's area of emphasis; and at least three of the members must be suitable for service on the student's dissertation committee. The composition of all Ph.D. guidance committees must be approved by the pharmaceutical economics and policy director of graduate studies. The student must form his or her guidance committee within one month after passing the departmental screening procedure.

Screening Procedure

The student's progress will be reviewed after each semester and before registration for any additional course work to determine if progress has been satisfactory.

Seminar Requirements

Every student is required to take and satisfactorily complete 8 units of research seminars chosen from PMEP 698 or the equivalent. At least one of these seminars must be related to the student's major field and the same seminar may be taken more than once. Before completing the dissertation, the student must present at least one original research paper in a seminar of his or her choice. This paper should typically consist of original results contained in the student's dissertation. It becomes part of the student's permanent file.

Dissertation Proposal Preparation

The student is required to register for two units of PMEP 790 and write a research paper on a topic suitable for a dissertation. Typically, the chair of the student's guidance committee directs this work. The resulting essay becomes part of the student's written dissertation proposal which is presented and critiqued during the oral portion of the qualifying examination.

Qualifying Examination

Upon successful completion of the first two years of course and grade requirements, the student takes a general written and oral examination on the chosen area of research emphasis after presenting a detailed written dissertation proposal. After passing these examinations, the student is admitted to candidacy for the Ph.D. degree.

Dissertation

After admission to candidacy, the student forms a dissertation committee comprising three faculty members, one of whom must be from an outside department. The chair of this committee is the dissertation supervisor. The student must register for PMEP 794 each semester, excluding summer sessions, until the dissertation and all other degree requirements are completed.

The student is expected to complete a dissertation based on original investigation. The dissertation must represent a significant contribution to knowledge and must be defended in an oral examination administered by the dissertation committee (see the section on *Theses and Dissertations*, page 100).

Student Teaching

Teaching experience is considered an integral part of the training of graduate students. As part of the general requirements for the Ph.D., all students are required to undergo training as an educator. This will include participating in seminars on educational techniques and hands-on teaching experiences through participation in didactic and small group teaching in the School of Pharmacy.

Pharm.D./Juris Doctor*Admission Requirements*

Admission to the dual Pharm.D./J.D. program is competitive, and involves meeting admission requirements and gaining acceptance to both the School of Pharmacy and the USC Gould School of Law. Students will not be given special consideration for admission to either program because they are applying for the dual degree. Students who have a baccalaureate degree may apply to the dual Pharm.D./J.D. degree program in two ways.

First, they may apply at the time they submit their Pharm.D. application by concurrently submitting applications to both schools. Students who elect this approach must identify themselves on their Pharm.D. applications as potential dual Pharm.D./J.D. degree students. Students who are admitted to both schools will be offered admission to the dual degree contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 GPA. Students pursuing the dual Pharm.D./J.D. degree must notify the law school in a timely fashion that they will be enrolling in the dual Pharm.D./J.D. degree program and will not matriculate at the law school until the following year. Students who are accepted by only one school may choose to attend that school but will not be eligible for the dual degree. Second, students can apply to the dual degree by submitting an application to the Gould School of Law during their first year of enrollment in the Pharm.D. program prior to the law school's published application deadline. Students who elect this approach must apply through the School of Pharmacy. Students who are admitted to the law school using this approach would be offered admission to the dual degree contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 GPA. See the admissions section of the School of Pharmacy and the Gould School of Law for specific requirements.

Degree Requirements

The professions of pharmacy and law are distinctly different, yet pharmacists are often involved in legal issues and lawyers frequently deal with pharmacy, drug, health care, product development and toxin-related matters. This dual degree program provides qualified students with an efficient mechanism for obtaining the expertise and professional credentials that will enable them to develop professional practices that bring together expertise in both areas.

Overall Requirements

A student is required to complete all work for both degrees within six years of the date of matriculation at the School of Pharmacy (Pharm.D.) and five years of matriculation at the Gould School of Law (J.D.). The entire dual degree program will take six years to complete. Dual degree students will be allowed to use 12 units of approved J.D. course work (elective or required) to meet 12 units of Pharm.D. electives and 12 units of approved Pharm.D. course work (elective or required) to meet J.D. electives. A faculty guidance committee will determine the exact program for each student, including the appropriateness of courses in one program used to meet elective requirements for the other program. A total of 208 units are required for the dual degree.

Pharm.D. Requirements

Dual degree students must successfully complete 144 units of Pharm.D. and acceptable J.D. units to receive the Pharm.D. degree. The 144 units must include 132 units of required and elective pharmacy course work plus 12 units of J.D. course work deemed acceptable to meet Pharm.D. elective requirements. Dual degree students should graduate with their Pharm.D. degrees at the completion of the first semester of the sixth academic year of the dual degree program. Students will be eligible to sit for the Pharmacy Board Exams after completion of the Pharm.D. degree requirements. However, dual degree students will not actually be awarded their Pharm.D. degrees until they complete requirements for both degrees.

Juris Doctor Requirements

Dual degree students must successfully complete 88 units of J.D. and acceptable Pharm.D. course work during the second to sixth years of the dual degree program to receive the J.D. degree. The 88 units must be composed of 76 units of J.D. course work, including satisfaction of the upper-division writing requirement and any other substantive requirements, plus 12 units of Pharm.D. course work deemed acceptable to meet J.D. elective requirements. No J.D. credit will be awarded for Pharm.D. course work completed prior to matriculation in the law school. Students cannot receive the J.D. degree under requirements for the dual degree program without prior or simultaneous completion of the Pharm.D. degree.

Both professions require passing a state board or bar exam to practice the respective professions. Neither of these professional doctoral degrees requires a thesis or comprehensive final exam.

Recommended Program

Pharm.D./J.D. dual degree students will begin with the first year of the Pharm.D. curriculum (36 units). During the second year, students will take the first year law core (33 units), plus 3-5 Pharm.D. units. Due to the rigor of the law school core, pharmacy courses during the first year of law school are limited to non-science courses. The third through fifth years of the program focus on Pharm.D. courses with sufficient law courses to maintain students' educational momentum in law. Students should complete their Pharm.D. requirements during the fall of their sixth year of the program and their law course work also during the sixth year. Students must complete both degree requirements by the end of the sixth year of the program.

Pharm.D./M.B.A. Dual Degree Program

Responding to the growing demand on pharmacists to be knowledgeable in both science and business administration, the USC School of Pharmacy in 1988 helped pioneer an innovation in pharmaceutical education by offering this unique five-year dual degree program.

The Pharm.D./M.B.A. dual degree program is offered cooperatively by the School of Pharmacy and the USC Marshall School of Business. Students must complete concurrently all requirements established by both schools for their respective degrees.

The program involves completion of the first year in the School of Pharmacy, the second in the Marshall School of Business, and then completion of the balance of both degrees during the third through fifth years. A total of 48 units must be completed in the Marshall School of Business.

First Year: Required Pharmacy School courses.

Second Year: Required M.B.A. courses and graduate business electives.

Third to Fifth Years: 108 units of Pharmacy courses and graduate business electives sufficient to bring the total units completed in the Marshall School of Business to at least 48. Dual degree students may not count courses taken outside the Marshall School of Business toward the 48 units.

The Pharm.D. and the M.B.A. are awarded simultaneously upon completion of the School of Pharmacy and the Marshall School of Business requirements.

Admission Requirements

Applicants to this program must have a baccalaureate degree from an accredited college or university and should apply during their first year of pharmacy studies. Only students who have successfully completed one year in the School of Pharmacy will be considered for admission to the Marshall School of Business. See the Marshall School of Business, page 155, for admission requirements.

Pharm.D./M.S., Gerontology

The emerging impact of the elderly on the health care system has created a need for health care providers who understand the unique health-related needs of the elderly. As drug therapy remains the primary therapeutic option for chronic disease, the demand for prescription drugs will continue to rise. There is a demand for pharmacists who are equipped to meet the pharmaceutical care needs of this population. Geriatric pharmacy is becoming increasingly recognized as a specialty.

Pharmacists with expertise in gerontology and geriatrics are in an excellent position to play a leading role in health policy and direct patient care. The Pharm.D./M.S., Gerontology program will provide extensive education and training in the unique health care needs of older adults. It will allow student pharmacists with a career interest in geriatrics or gerontology to work with health care planning or delivery organizations to develop and implement progressive pharmaceutical care programs for the elderly.

Application and Admission Requirements

Students who would like to pursue the dual Pharm.D./M.S. degree must be accepted by both programs. Students applying for the dual degree program must meet the respective admission requirements for each program. This includes having completed a baccalaureate degree from an accredited college or university with a minimum GPA of 3.0 and a minimum GRE score of 1000. Students will not be given special consideration for admission to either program because they are applying for the dual degree. Students may apply to the dual Pharm.D./M.S. degree program in two ways. First, they may apply at the time they submit their Pharm.D. application by concurrently submitting applications to both programs. Students who elect this approach must identify themselves on both applications as potential dual degree students. Students who are admitted to both programs will be offered admission to the Pharm.D. and will be offered admission to the dual degree program contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 GPA. Students who are accepted only by one program may choose to attend that program, but will not be eligible for the dual degree. Second, students can apply to the dual degree by submitting an application to the M.S. program during their first year of enrollment in the Pharm.D. prior to the M.S. published application deadline. Students who elect this approach must apply through the School of Pharmacy. Students admitted to the M.S. program using this approach will be offered admission to the dual degree contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 GPA. Students accepted to the dual degree program must maintain a minimum 3.0 GPA in their Gerontology and Pharm.D. courses.

Recommended Program

First year: Required Year I Pharm.D. course work

Second year: Required Gerontology course work

Third year: Required Year II Pharm.D. course work

Fourth year: Required Year III Pharm.D. course work

Fifth year: Required Year IV Pharm.D. course work

Graduation Requirements

Students must complete all requirements for the Pharm.D. (see page 832) and M.S., Gerontology degrees as listed in the current catalogue with a minimum cumulative 3.0 GPA. The specific M.S. course requirements for the dual Pharm.D./M.S. degree are listed on page 694.

Pharm.D./Master of Public Health

The School of Pharmacy and the Master of Public Health program, in recognition of the rapidly changing health care environment, and in response to the growing demand for pharmacists who are knowledgeable in both pharmacy and population-based health care issues, have developed a dual degree program. The joint Pharm.D./M.P.H. degree will enable graduates to be more responsive to today's health care needs and will provide training for pharmacists who seek to be agents of change within the profession and to assume leadership roles in the pharmacy field and in public health at the local, state and national levels.

Students who are enrolled in the School of Pharmacy must apply to the Master of Public Health program no later than January of their first year. All requirements for admission to the regular M.P.H. program must also be fulfilled by dual degree applicants.

The Pharm.D./M.P.H. program spans five years (four years of pharmacy school courses and one year of public health courses). Students begin the core M.P.H. courses following the successful completion of the first year of pharmacy school. The last three years of the program are devoted to course work and the clinical rotations of the School of Pharmacy and to the completion of the elective courses and practicum (field experience) of the M.P.H. program.

All students in the Pharm.D./M.P.H. program must meet course requirements, grade point average requirements and program residency requirements of both programs. Students must have a cumulative GPA of 3.0 in the Pharm.D. curriculum and a 3.0 in the M.P.H. curriculum to meet graduation requirements.

The Pharm.D. and the M.P.H. degrees are awarded simultaneously upon completion of the School of Pharmacy and the Master of Public Health requirements.

Admission Requirements and Procedures

Students applying for the dual degree program must meet the respective admission requirements for each program. This includes having completed a baccalaureate degree from an accredited college or university with a minimum GPA of 3.0 and having acceptable GRE and TOEFL scores as applicable. Students will not be given special consideration for admission to either program because they are applying for the dual degree. Students may apply to the dual Pharm.D./M.P.H. degree program in two ways. First, they may apply at the time they submit their Pharm.D. application by concurrently submitting applications to both programs. Students who elect this approach must identify themselves on both applications as potential dual degree students. Students who are admitted to both programs will be offered admission to the Pharm.D. and will be offered admission to the dual degree program contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 GPA. Students who are accepted by only one program may choose to attend that program, but will not be eligible for the dual degree. Second, students can apply to the dual degree by submitting an application to the M.P.H. program during their first year of enrollment in the Pharm.D. prior to the M.P.H. published application deadline. Students who elect this approach must apply through the School of Pharmacy. Students admitted to the M.P.H. program using this approach will be offered admission to the dual degree contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 GPA.

Pharm.D./M.S., Regulatory Science

Regulatory science is that branch of knowledge which relates the regulatory and legal requirements of biomedical product development to the scientific testing and oversight needed to ensure product safety and efficacy. The program provides an opportunity for advanced preparation in the fields of regulatory affairs, quality assurance and clinical research. Students must complete concurrently all of the requirements established for the respective degrees. The program alternates the courses required for the Pharm.D. program during the fall and spring terms with courses required in summer terms for the M.S. program. Students will typically take courses in the summers of years two-four. Up to 12 appropriate units of course work from the Pharm.D. program can be applied toward the M.S. degree. The Pharm.D. and the M.S., Regulatory Science degrees will be awarded simultaneously upon completion of requirements for the two programs.

Admission Requirements and Procedures

Students applying for the dual degree program must meet the respective admission requirements for each program and must have a baccalaureate degree. Students will not be given special consideration for admission to either program because they are applying for the dual degree. Students may apply to the dual Pharm.D./M.S., Regulatory Science degree program in two ways. First, they may apply at the time they submit their Pharm.D. application by concurrently submitting applications to both programs. Students who elect this approach must identify themselves on both applications as potential dual degree students. Students who are admitted to both programs will be offered admission to the Pharm.D. and will be offered admission to the dual degree program contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 GPA. Students who are accepted by only one program may choose to attend that program but will not be eligible for the dual degree. Second, students can apply to the dual degree by submitting an application to the M.S. in Regulatory Science program during their first or second year of enrollment in the Pharm.D. prior to the M.S. in Regulatory Science published application deadline. Students who elect this approach must apply through the School of Pharmacy. Students admitted to the M.S. in Regulatory Science using this approach will be offered admission to the dual degree contingent on passing all courses in their Pharm.D. studies with a minimum 3.0 GPA.

Pharm.D./Doctor of Philosophy

The Doctor of Pharmacy/Doctor of Philosophy (Pharm.D./Ph.D.) program is designed to permit qualified Pharm.D. students with a bachelor of science or equivalent degree to pursue research training in the pharmaceutical sciences and toxicology. A student accepted into the joint program must meet all requirements for the Pharm.D., as well as the requirements for the Ph.D. in the pharmaceutical sciences or toxicology sections listed in this catalogue. A maximum

of 20 units from the Pharm.D. program may be credited toward the Ph.D. Up to 12 units of these Pharm.D. courses may, at the discretion of the student's Ph.D. advisor, be counted toward the required 24 units of core course work.

Admission Procedure

Students applying for the dual degree program must meet the respective admission requirements for each program. This includes having completed a baccalaureate degree from an accredited college or university with a minimum GPA of 3.0 and a minimum GRE score of 1000. Students will not be given special consideration for admission to either program because they are applying for the dual degree. Students may apply to the dual Pharm.D./Ph.D. degree program in two ways. First, they may apply at the time they submit their Pharm.D. application by concurrently submitting applications to both programs. Students who elect this approach must identify themselves on both applications as potential dual degree students. Students who are admitted to both programs will be offered admission to the Pharm.D. and will be offered admission to the dual degree program contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 GPA. Students who are accepted by only one program may choose to attend that program but will not be eligible for the dual degree. Second, students can apply to the dual degree by submitting an application to one of the Ph.D. programs in the School of Pharmacy during their first two years of enrollment in the Pharm.D. prior to the respective published application deadlines for the Ph.D. programs. Students who elect this approach must apply through the Pharm.D. program. Students admitted to the Ph.D. program using this approach will be offered admission to the dual degree contingent on their having maintained a minimum 3.0 GPA in the Pharm.D. program.

Post-Pharm.D. Graduate Studies

Qualified students who wish to continue graduate studies within the School of Pharmacy upon completion of the Pharm.D. may, with permission of the dean, substitute certain Pharm.D. courses with courses necessary for the graduate degree so that the graduate program will not be delayed. These units cannot, however, be substituted for the 24 units of core course work.

Pharm.D./Graduate Certificate in Gerontology

This integrated program in pharmacy and gerontology prepares students with an interest in geriatric pharmacy to assume leadership roles at academic, administrative or policy levels within the profession. The program involves the completion of 16 units of core area courses in physiology, psychology, sociology and social policy aspects of aging offered by the USC Davis School of Gerontology. In addition, students are required to complete 8 units of approved elective courses in gerontology or geriatric pharmacy to be credited toward the requirements for the Pharm.D. and the Graduate Certificate in Gerontology. It is expected that the program can be successfully completed by candidates taking electives in geriatric pharmacy or gerontology during the regular semester and completing one core course in gerontology during each summer in the four year Pharm.D. program.

See the Davis School of Gerontology, page 693, for complete requirements.

Admission Requirements

Students who have a baccalaureate degree from an accredited college or university must submit separate applications to the School of Pharmacy and the Davis School of Gerontology. All requirements for admission to the regular Pharm.D. program must be fulfilled by the candidate. GRE scores are not required for admission to the certificate program.

Certificate Programs

Regulatory Science Program
USC School of Pharmacy
1540 Alcazar St., CHP G32
Los Angeles, CA 90089
(323) 442-3102
Email: regsci@usc.edu
regulatory.usc.edu

Certificate in Clinical Research Design and Management

The graduate certificate in clinical research design and management is designed to strengthen the statistical, research and project management skills of clinical researchers and their associated clinical team members. Students must complete at least 12 units of

course work including at least two courses in clinical design and trial management, one course in ethics and one course in a specialized aspect of design, management or statistics, subject to the approval of the program director. The program will include course work delivered in nontraditional formats such as intensive weekend sessions and will use distance learning tools, Webcast lectures and

study materials. Courses can be taken on site, by distance or as a blended combination. Students should confirm their specific course work plan in consultation with the graduate advisors before beginning the program. Students who have bachelor's degrees from accredited colleges or universities must submit an application for graduate study through the regulatory science program of the School of Pharmacy. GRE scores are not required for admission to the certificate program. Students are expected to enroll each semester until the program is completed.

| REQUIREMENTS | UNITS |
|--|-------|
| <i>Introduction to Clinical Trials</i> | |
| MPTX 517 Structure and Management of Clinical Trials | 4 |
| <i>Clinical Design/Statistics (choose one)</i> | |
| PM 510L Principles of Biostatistics | 4 |
| MPTX 522 Introduction to Clinical Trial Design and Statistics | 3 |
| <i>Biomedical Ethics</i> | |
| MPTX 602 Science, Research and Ethics | 2 |
| Additional options in specialized aspect of design or management (choose one): | |
| MPTX 511 Introduction to Medical Product Regulation | 3 |
| MPTX 520 Risk Management for Health Care Products | 3 |
| PM 510L Principles of Biostatistics | 4 |
| PM 511a Data Analysis | 4 |
| PM 512 Principles of Epidemiology | 4 |
| PM 523 Design of Clinical Studies | 3 |
| RSCI 527 Medical Product Safety | 3 |
| RSCI 528 Safety in the Health Care Environment | 3 |

Certificate in Food Safety

The graduate certificate in food safety is a 12-unit program of course work designed to strengthen the knowledge base and functional "toolkit" of individuals who deal with the production and management of food in industry and government. Students are required to take an entry level course that focuses on regulatory requirements for foods and dietary supplements and two additional courses that focus on food science and food/drug toxicology respectively. Final course work will be selected from a small grouping of electives that deal with quality systems or risk management. The program will include course work delivered in nontraditional formats, such as intensive weekend sessions, and will use distance learning tools, Webcast lectures and study materials. Courses can be

taken on site, by distance or as a blended combination. Students should confirm their specific course work plan in consultation with the graduate advisors before beginning the program. Students who have bachelor's degrees from accredited colleges or universities must submit an application for graduate study through the regulatory science program of the School of Pharmacy. GRE scores are not required for admission to the certificate program. Students are expected to enroll each semester until the program is completed.

| REQUIREMENTS | UNITS |
|---|-------|
| MPTX 514 Regulation of Food and Dietary Supplements | 3 |
| MPTX 524 Introduction to Food Science and Technology | 3 |
| RSCI 525 Introduction to Drug and Food Toxicology | 3 |
| <i>Quality/Risk Management Option:</i> | |
| MPTX 515 Quality Systems and Standards | 3 |
| MPTX 526 Chemistry Manufacturing and Controls | 3 |
| RSCI 520 Introduction to Risk Management for Health Care Products | 2 |
| RSCI 529 Application of Risk Management Tools and Techniques | 2 |

Certificate in Patient and Product Safety

The graduate certificate in patient and product safety is a 12-unit program that educates students in the emerging field of safety and risk management in the health care environment. It is designed to produce graduates who have a particular expertise in the evaluation and mitigation of medical errors and health-care product problems. Course work is typically delivered in nontraditional formats such as intensive weekend sessions and will use distance learning tools, Webcast lectures and study materials. Courses can be taken on site, by distance or as a blended combination. Students should confirm their specific course work plan in consultation with the graduate advisors before beginning the program. Students who have bachelor's degrees from accredited colleges or universities must submit an application for graduate study through the regulatory science program of the School of Pharmacy. GRE scores are not required for admission to the certificate program. Students are expected to enroll each semester until the program is completed.

Students must complete 12 units of specified course work, that normally will include an introductory course in the basic principles of risk management, a second course in the use of risk management tools, and two additional courses in patient and product safety respectively as listed below. In addition, a course in medical ethics is recommended. Most students will take the courses that are listed in the sample student program below, but if students have already strong previous experience in risk management or safety, other statistical or quality courses taught in graduate programs at USC may be substituted with the permission of the program director. The certificate can be completed on a part-time basis but must be finished within five years.

| REQUIREMENTS | UNITS |
|---|-------|
| MPTX 602 Science, Research and Ethics | 2 |
| RSCI 520 Introduction to Risk Management for Health Care Products | 2 |
| RSCI 527 Medical Product Safety | 3 |
| RSCI 528 Safety in the Health Care Environment | 3 |
| RSCI 529 Application of Risk Management Tools and Techniques | 2 |

Certificate in Preclinical Drug Development

The graduate certificate in preclinical drug development provides advanced foundational training in preclinical aspects of drug development, translational research and regulatory control. Students must complete at least 12 units of course work including at least three courses in preclinical design and development (typically, RSCI 530 Translational Medicine: An Overview; RSCI 531 Drug Discovery; RSCI 532 Early Stage Drug Development) and one course in a related aspect of research design, regulation or ethics, subject to the approval of the program director. The program will include course work delivered in nontraditional formats such as intensive weekend sessions and will use distance capabilities, Webcast lectures and study materials. Courses can be taken on site, by distance or as a blended combination. Students should confirm their specific course work plan in consultation with graduate advisors before beginning the program. Students who have baccalaureate degrees from accredited colleges or universities must submit an application for graduate study through the regulatory science program of the School of Pharmacy. GRE scores are not required for admission to the certificate program. Students are expected to enroll each semester until the program is completed.

Certificate in Regulatory and Clinical Affairs

The graduate certificate in regulatory and clinical affairs is designed to provide specialized education for individuals interested in developing a systematic understanding of the U.S. regulatory system for medical products. Students must complete at least 12 units of course work including an introductory course in regulatory affairs:

| REQUIREMENTS | UNITS |
|--|-------|
| <i>One introductory course in regulatory affairs</i> | |
| MPTX 511 Introduction to Medical Product Regulation | 3 |
| RSCI 530 Translational Medicine: An Overview | 2 |
| RSCI 532 Early Stage Drug Development | 3 |

At least one specialized course in regulatory management of a particular product type

| | |
|---|---|
| MPTX 512 Regulation of Pharmaceutical and Biological Products | 3 |
| MPTX 513 Regulation of Medical Devices and Diagnostics | 3 |
| MPTX 514 Regulation of Food and Dietary Supplements | 3 |

at least one course in clinical design

| | |
|---|---|
| MPTX 517 Structure and Management of Clinical Trials, or | 4 |
| MPTX 522 Introduction to Clinical Trial Design and Statistics | 4 |

one course in quality systems or risk management

| | |
|---|---|
| MPTX 515 Quality Systems and Standards | 3 |
| MPTX 526 Chemistry Manufacturing and Controls | 3 |
| MPTX 520 Risk Management for Health Care Products | 3 |
| RSCI 525 Introduction to Drug and Food Toxicology | 3 |

Other courses may be substituted with the approval of the program director. The program will include course work delivered in nontraditional formats such as intensive weekend sessions and will use distance capabilities to capture and Webcast lectures and study materials. Courses can be taken on site, by distance or as a blended combination. Students should confirm their specific course work plan in consultation with the graduate advisors before beginning the program. Students who have a baccalaureate degree from an accredited college or university must submit an application for graduate study through the regulatory science program of the School of Pharmacy. This program is particularly directed at Ph.D. students who wish to take the certificate during their USC studies. GRE scores are not required for admission to the certificate program. Students are expected to enroll each semester until the program is completed.

Non-Degree Programs

Office of Continuing Professional Development

1985 Zonal Avenue
Los Angeles, CA 90089-9121
(323) 442-2403
FAX: (323) 442-3600
Email: pharmce@usc.edu
www.usc.edu/schools/pharmacy/continuing_education

Continuing Education

The School of Pharmacy, Office of Continuing Professional Development, is a recognized provider of continuing pharmacy education and certificate programs accredited by the Accreditation Council for Pharmacy Education (ACPE) and recognized by the California State Board of Pharmacy and throughout the United States.

The school serves as a primary educational resource for pharmacists in California and as a supplementary resource for other health professionals and pharmacists, nationally and internationally.

Programs are designed to educate pharmacists about current issues in pharmaceutical care, practice management, therapeutics and other topics of professional interest. Continuing education programs are held at the School of Pharmacy, other campus locations, and annually in Las Vegas and Hawaii.

For information concerning continuing education programs contact: Office of Continuing Professional Development.

Courses of Instruction

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

CLINICAL AND EXPERIMENTAL THERAPEUTICS (CXPT)

CXPT 609 Preclinical Experimental Therapeutic Development (4, FaSpSm) Evolution of a chemical entity as it is transformed into a drug candidate. Open only to students in clinical and experimental therapeutics.

CXPT 664 Clinical Problem Solving (3, Sp) (Enroll in PHRD 664)

MOLECULAR PHARMACOLOGY AND TOXICOLOGY (MPTX)

MPTX 500 Molecular Pharmacology and Toxicology I (4, Fa) This is the first part of a two-semester introductory and survey course for the molecular pharmacology and toxicology degree program. *Prerequisite:* knowledge of biochemistry.

MPTX 501 Molecular Pharmacology and Toxicology II (4, Sp) The second part of the two-semester course covers the general aspects of molecular pharmacology and toxicology on the basis of biochemical, molecular, biological and environmental approaches. *Prerequisite:* MPTX 500.

MPTX 502 Pharmacology (4, Fa) Fundamentals of pharmacology in the context of the rapidly developing knowledge of related disciplines.

MPTX 511 Introduction to Medical Product Regulation (3, Sm) Introduction to regulatory environments surrounding medical product development, manufacturing and marketing; operation of federal, state and international regulatory bodies. *Recommended preparation:* undergraduate degree in pharmacy, medicine or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

MPTX 512 Regulation of Pharmaceutical and Biological Products (3, Sm) Ensuring safety and effectiveness of new drugs and biologics; marketing and monitoring approved pharmaceutical/biological products; management of genetically engineered products. *Recommended preparation:* undergraduate degree in pharmacy, medicine or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

MPTX 513 Regulation of Medical Devices and Diagnostics (3, Sm) Development and testing of new medical products according to U.S. and international regulatory requirements. *Recommended preparation:* undergraduate degree in pharmacy, medicine or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

MPTX 514 Regulation of Food and Dietary Supplements (3, Sm) Regulation and testing of foods, food additives and dietary supplements in the U.S. and abroad. *Recommended preparation:* undergraduate degree in pharmacy, medicine or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

MPTX 515 Quality Systems and Standards (3, Sm) Principles of quality assurance and quality control for medical-product development and manufacture. *Recommended preparation:* undergraduate degree in pharmacy, medicine or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

MPTX 516 Medical Products and the Law (3, Fa) Legal issues affecting intellectual property, medical product development, marketing and safety, taught through case studies and lectures. *Recommended preparation:* undergraduate degree in pharmacy, medicine or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

MPTX 517 Structure and Management of Clinical Trials (4, FaSpSm) Development and execution of clinical trials: bioethical principles, good clinical practices, project management and documentation.

MPTX 518 Writing Regulatory Drug Submissions (3, Sp) Developing form and content for investigational drug applications, new drug applications, biologic licensing applications to FDA; common technical documents; considerations of writing style.

MPTX 519 Global Regulation of Medical Products (3, Fa) Regulatory requirements governing medical products in European Union, Asia and other global markets.

MPTX 520 Risk Management for Health Care Products (3, Sp) Risk assessment and management techniques, including FMEA, HACCP, HAZAP, human factors analysis; policies, regulations, requirements and standards; loss control and liability prevention.

MPTX 522 Introduction to Clinical Trial Design and Statistics (3) Clinical designs and statistics commonly used to test medical products in general populations and special patient groups.

MPTX 524 Introduction to Food Science and Technology (3, Sm) Discusses the basic and applied concepts of food science and food safety, and demonstrates the principles of food chemistry, sensory evaluation, and product development. *Recommended preparation:* undergraduate degree in biological sciences or related disciplines.

MPTX 526 Chemistry Manufacturing and Controls (3, Fa) Provides a firm foundation in the domestic and international CMC process, from concept to commercialization of new active pharmaceutical ingredients and products. *Recommended preparation:* undergraduate degree in pharmacy, medicine or independent health science, engineering or equivalent.

MPTX 531 Cell Biology (4) (Enroll in INTD 531)

MPTX 561 Molecular Genetics (4, Sp) (Enroll in INTD 561)

MPTX 571 Biochemistry (4, Sp) (Enroll in INTD 571)

MPTX 572 Systems Physiology and Disease I (4, Fa) (Enroll in INTD 572)

MPTX 573 Systems Physiology and Disease II (4, Sp) (Enroll in INTD 573)

MPTX 590 Directed Research (1-12, FaSpSm) Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

MPTX 594abz Master's Thesis (2-2-0, FaSpSm) Credit on acceptance of thesis. Graded IP/CR/NC.

MPTX 599 Special Topics (2-4, max 8) Special topics in Molecular Pharmacology and Toxicology.

MPTX 602 Science, Research and Ethics (2, Fa) A discussion of the unique technological and philosophical issues that challenge modern scientists and a discernment of ethical responses to those challenges.

MPTX 603 Molecular Mechanisms for Biological Signals (4, Fa) Biological mechanisms of hormone, neuro-transmitter, growth factor and xenobiotic actions from ligand-receptor interactions, signal transductions, modification processes to regulation of gene expression and cellular growth. *Prerequisite:* knowledge of physiology and biochemistry.

MPTX 630 Directed Field-Research Project (6, FaSpSm) Research/policy analysis conducted under preceptor supervision in an industrial or governmental setting. Open to students who have completed the majority of course credits in the Regulatory Science program. Graded CR/NC.

MPTX 700 Seminar in Molecular Pharmacology and Toxicology (1, max 8, FaSp) Contemporary advances in molecular pharmacology and toxicology research. Registration required during each year of residency.

MPTX 790 Research (1-12, FaSpSm) Research leading to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

MPTX 794abcdz Doctoral Dissertation (2-2-2-2-0, FaSpSm) Credit on acceptance of dissertation. Graded IP/CR/NC.

PHARMACY (PHRD)

PHRD 501 Pharmaceutics I (4, Fa) Introduction to physiochemical principles of dosage forms; properties of molecules in dosage forms, stability of pharmaceuticals and their interactions in body tissue, including computational approaches. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 303.)

PHRD 502 Pharmaceutics II (3, Sp) Principles involved in molecules movement across biological barriers. Properties, characteristics, application of homogeneous and heterogeneous dosage forms, liquid, semi-solid and solid. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 306L.)

PHRD 503 Biological Systems I (4, Fa) Integrated teaching of anatomy, histology, physiology and pathophysiology using an organ-based approach. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 309, PHAR 313, PHAR 314 and PHAR 419.)

PHRD 504 Biological Systems II (6, Sp) Continued integrated teaching of anatomy, histology, physiology and pathophysiology, using an organ-based approach. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 310 and PHAR 419.)

PHRD 505 Molecular Genetics and Therapy (3, Fa) Principles of gene expression, and recombinant DNA methods and applications. Focus on human genetics and influence of genetic background on the utilization and effectiveness of drugs. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 316.)

PHRD 506 Self Care and Non-Prescription Therapies (5, Fa) Facilitate patient selection of self-care health care products: OTC drugs, dosages, pharmacology, efficacy, cost, side effects, adverse reactions, contraindications, and interactions with other medications. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 331 and PHAR 332.)

PHRD 507 Health Care Delivery Systems (2, Fa) Introduction to understanding the structure of the health care system. Includes health care financing and the role of pharmacy and the pharmacist in health systems.

PHRD 508 Pharmacy Literature Analysis and Drug Information (3, FaSp) Literature evaluation and biostatistics of clinical and health services research, and drug information services. Emphasis on drug therapy, patient outcomes, and formulary development. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 319 and PHAR 366.)

PHRD 509 Pharmacy Practice and Experience I (4, Fa) Introduction of principles and the application of pharmaceutical care in community or hospital pharmacy setting. Includes communications, basic practice skills, career pathways and leadership. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 361, PHAR 363, PHAR 365 and PHAR 450.)

PHRD 510 Pharmacy Practice and Experience II (4, Sp) Introduction of principles and the application of pharmaceutical care in community or hospital pharmacy setting. Includes calculations, drug information, and basic practice skills. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 362, PHAR 368 and PHAR 450.)

PHRD 551 Immunology (3, Fa) Basic principles of immunology and their application to the understanding and treatment of immunologically-mediated diseases. Provides the scientific basis of immunotherapy and immunodiagnosis. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 441.)

PHRD 552 Pharmaceutics III (3, Sp) Principles and applications of controlled, targeted, and self-regulating drug delivery. Methods to deliver therapeutic peptides, proteins and genetic materials. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 406.)

PHRD 553 Management within Health Care Organizations (2, Fa) Management of the professional practice of pharmacy in organized health care systems. Introduction to formulary development and outcome analysis. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 431 and PHAR 432.)

PHRD 554 Public Health and Epidemiology (2, Sp) Introduction to epidemiology, environmental health, health education, health care organizations and financing. Orientation to social and governmental controls on the health care system. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 437.)

PHRD 555 Biochemical and Molecular Sites of Drug Action (4, Fa) Basic principles of drug action and receptor actions. Includes their application to the understanding and treatment of disease. Provides the scientific basis of pharmaceutical action.

PHRD 557 Therapeutics I (5, Fa) Introduction to principles of pharmacology, pharmacokinetics, medicinal chemistry and therapeutics. Open to Doctor of Pharmacy students only.

PHRD 559 Therapeutics II (2, Fa) Integrated teaching of pharmacogenomics and biotechnology with emphasis on general principles, diagnostics, and future technology.

PHRD 560 Therapeutics III (6, Sp) Integrated teaching of biomedical chemistry, pharmacology, clinical pharmacokinetics, and therapeutics of drugs, with emphasis on pharmaceuticals treating diseases associated with the central nervous system. Open to Doctor of Pharmacy students only.

PHRD 561 Parenteral Therapy Externship (3, FaSpSm) Drug weight/volume concentrations, dilutions and additive volumes are calculated in compounding of parenteral products in various patient-care settings using aseptic technique. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 414, PHAR 460 and PHAR 545.)

PHRD 562 Therapeutics IV (4, Sp) Integrated teaching of biomedical chemistry, pharmacology, clinical pharmacokinetics, and therapeutics of drugs with an emphasis on treating diseases of the renal, GI and pulmonary systems. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 548 and PHAR 549.)

PHRD 601 Therapeutics V (6, Fa) Integrated teaching of biomedical chemistry, pharmacology, clinical pharmacokinetics, and therapeutics of drugs, with emphasis on pharmaceuticals affecting cardiovascular and circulatory diseases. CPR certification. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 546.)

PHRD 603 Therapeutics VI (3, Fa) Integrated teaching of biomedical chemistry, pharmacology, clinical pharmacokinetics and therapeutics of drugs with an emphasis on pharmaceuticals affecting the endocrine diseases, systems and women's health. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 548 and PHAR 549.)

PHRD 605 Therapeutics VII (4, Fa) Integrated teaching of the biomedical chemistry, pharmacology, clinical pharmacokinetics, and therapeutics of drugs; with emphasis on chemotherapy of infectious disease: bacterial, microbial, viral, parasitic, and fungal. (Duplicates credit in former PHAR 411L, PHAR 418.)

PHRD 606 Therapeutics VIII (2, Sp) Advanced topics and clinical therapeutics of drugs, with emphasis on the treatment of infectious disease: bacterial, microbial, viral, parasitic and fungal. (Duplicates credit in former PHAR 411L, PHAR 418.)

PHRD 607 Nutrition (2, Fa) Biomedical knowledge is correlated with assessments of clinical case-management problems to understand the interrelationship between nutrition and health in both hospitalized and healthy patients. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 422.)

PHRD 608 Therapeutics IX (2, Sp) Integrated teaching of biomedical chemistry, pharmacology, clinical pharmacokinetics and therapeutics of drugs, with emphasis on pharmaceuticals for managing oncological diseases. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 550 and PHAR 562.)

PHRD 610 Therapeutics X (3, Sp) Focuses on the pharmacology, pharmacokinetics, medicinal chemistry and clinical therapeutics that apply to pharmaceutical care of pediatric, geriatric and chronic pain patients.

PHRD 612 Therapeutics XI (2, Sp) Updates students on recent advances in clinical areas, prepares students for advanced practice experiences and assessment of clinical readiness via a final examination. Graded CR/NC.

PHRD 614 Pharmaceutical Economics and Outcome Studies (3, Sp) Economic analysis of the U.S. health care system, the pharmaceutical industry, and the profession; economic assessment of drug therapy costs and health care outcomes applying pharmacoeconomic research methodologies. Open to Doctor of Pharmacy students only. (Duplicates credit in PHAR 406 and PHAR 553.)

PHRD 616 Pharmacy, Law and Ethics (3, Sp) To provide students with an understanding of ethical issues that arise in pharmacy practice along with state and federal statutes, regulations, and pharmacy-related cases. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 552 and PHAR 554.)

PHRD 651 Community Pharmacy I (3, Fa) Development of specialized knowledge and skills in community pharmacy practice involving location analysis, pharmacy management principles, and introduction to business law concepts. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 541 and PHAR 555.)

PHRD 652 Community Pharmacy II (3, Sp) A continuation of pharmacy business law concepts encompassing contract principles and forms of ownership, including a review of pharmacy laws, compounding principles, and OTC agents. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 556.) *Prerequisite:* PHRD 651.

PHRD 653 Health Systems Pharmacy I (3, Fa) Understanding formal and informal organizations in institutions, managed care, disease management, health care policy and financing, patients' chart organization, and clinical monitoring parameters. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 541 and PHAR 557.)

PHRD 654 Health Systems Pharmacy II (3, Sp) Recognizing resources available for drug information, familiarity with institutional formularies, medication counseling, writing chart notes, and clinical activities at an off-campus health care institution. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 558.) *Prerequisite:* PHRD 557.

PHRD 655 Geriatric Pharmacy I (3, Fa) Specialized knowledge and skills in geriatric pharmacy, pharmacology of aging, and unique functions of health care team providing care to the elderly patient. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 559.)

PHRD 656 Geriatric Pharmacy II (3, Sp) Specialized knowledge and skills in gerontology and geriatric pharmacy including the pathophysiology of selected cardiovascular, endocrine, genitourinary gastrointestinal disorders, osteoarthritis, and osteoporosis. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 560.) *Prerequisite:* PHRD 559.

PHRD 657L Basic Research Design (3, max 6, FaSp) Research experience to integrate research into Doctor of Pharmacy program. Research focuses on industrial, academic, or governmental issues. Open to Doctor of Pharmacy students only.

PHRD 658 Sleep and the Pharmacologic Management of Its Disorders (3, FaSp) Overview of normal sleep manifestations, and treatment of common sleep disorders, and the pharmacist's role in assessment, treatment, and referral. Open to Level III Doctor of Pharmacy students only. (Duplicates credit in former PHAR 570.)

PHRD 659 Molecular Therapeutics: Signal Transduction (3, FaSp) Principles of molecular therapeutics against signaling pathways; emphasis on biological mechanisms underlying hormone, growth factor, and neurotransmitter-mediated gene regulation, proliferation, and cell death. Open to Level III Pharm.D. students only. (Duplicates credit in former PHAR 573.)

PHRD 660 Disease State Management I (3, FaSp) The processes required to develop disease state management protocols based on data drawn from the medical research literature. Open to Level III Doctor of Pharmacy students only. (Duplicates credit in former PHAR 571.)

PHRD 661 Pharmacy Practice in Women's Health (3, FaSp) The pharmaceutical care of women patients is emphasized. Therapeutic, psychosocial factors and current research in women's health. Open to Level III Pharm.D. students only. (Duplicates credit in former PHAR 577.)

PHRD 662 Psychiatric Pharmacy Practice (3, Sp) Specialized knowledge and skills in psychiatric pharmacy practice including child, adult, and geriatric psychopharmacology applied to inpatient and outpatient treatment. Open to Level III Pharm.D. students only. (Duplicates credit in former PHAR 578.)

PHRD 663 Pharmaceutical Development (3, FaSp) Examination of pharmaceutical product development process including discovery, preclinical/clinical studies, regulatory-legal issues, and marketing. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 566.)

PHRD 664 Clinical Problem Solving (3, Sp) Integration of physical assessment, laboratory tests, history-taking, and diagnosis to formulate decisions for optimal treatment plans in specific disease states. Open to graduate pharmacy students only.

PHRD 665 Complementary/Alternative Therapeutics (3, FaSp) Examines the therapeutic use of complementary/alternative medicines, such as herbal medicines, homeopathic drugs, vitamins and other nutritional supplements. Open to Level III Pharm.D. students only. (Duplicates credit in former PHAR 579.)

PHRD 666 Therapeutic Drug Monitoring (3, FaSp) Application of pharmacokinetic and pharmacodynamic principles to individualize patient drug regimens. Open to Level III Pharm.D. students only. (Duplicates credit in former PHAR 575.)

PHRD 667 Drugs of Abuse (3, FaSp) Specialized knowledge and skills in specific substance abuse-related areas. Each area will include addiction, wellness, and prevention components. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 568.)

PHRD 668 Computing Application (3, FaSp) Specialized knowledge and skills using computers in professional practice: telecommunication protocols, typical patient databases in hospital and community pharmacies, drug interactions, insurance billing, inventory control. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 568.)

PHRD 669 Health Care Needs of Special Populations (3, FaSp) Health care needs of the poor will be examined through participation in a multidisciplinary community clinic setting focusing on medication counseling and compliance. Open to Level III Pharm.D. students only. (Duplicates credit in former PHAR 576.)

PHRD 670 Marketing and Development in the Pharmaceutical Industry (3, FaSp) Basic and advanced strategies for marketing and development of new compounds or indication in the pharmaceutical industry. *Recommended preparation:* PHRD 663.

PHRD 671 Pharmacy Education Seminar (3, FaSp) A seminar course with a focus on educational methods and teaching skills providing career development for students interested in academia. Open to Doctor of Pharmacy students only.

PHRD 675 Travel Medicine (3, FaSp) An elective course for emphasizing the role of the pharmacist in preventing and treating travel related medical conditions. Open only to pharmacy majors.

PHRD 677 Risk Assessment and Management in Pharmacy Practice (3, FaSp) Specific risk management issues, legal and professional expectations of pharmacists, and assessing and avoiding risk. Open only to Doctor of Pharmacy students.

PHRD 701 Acute Care Clinical Practice Clerkship (6, FaSpSm) Application of pharmaceutical care principles to the adult patient population in an acute care environment. Pharmacology, pharmacokinetics, and disease state management will be emphasized. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 601.)

PHRD 702 Inpatient Psychiatric Pharmacy Clerkship (6, FaSpSm) Application of pharmaceutical care principles to the inpatient psychiatric patient. Understanding of the treatment of common psychiatric disorders, patient interviewing skills and health care teams. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 602.)

PHRD 703 Long Term Care Clerkship (6, FaSpSm) Application of pharmaceutical care to patients in long term care environments. Understanding of the therapeutic, legal and special needs of this patient population. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 603.)

PHRD 704 Primary Care Clerkship (6, FaSpSm) Disease state management and pharmaceutical care in ambulatory care. Modification and design of drug therapy regimens, participation in medical care team and direct patient care. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 604.)

PHRD 705 Community Pharmacy Clerkship (6, FaSpSm) Pharmaceutical care principles applied to the community pharmacy environment. Participating in the development, implementation and outcome evaluation of patient care services in the community. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 605.)

PHRD 706 Geriatrics Clerkship (6, FaSpSm) Drug therapy and management of geriatric patients with a focus on unique medical, economic, and psycho-social problems of this population. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 606.)

PHRD 707 Outpatient Psychiatric Pharmacy Clerkship (6, FaSpSm) Disease state management and pharmaceutical care in ambulatory mental health care. Modification and design of psychiatric therapy regimens, participation in multidisciplinary teams and patient care. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 604 and PHAR 607.)

PHRD 708 Inpatient Clinical Practice Clerkship (6, FaSpSm) Drug therapy in a variety of inpatient clinical settings. Emphasis: patient monitoring, evaluation of therapeutic response, and provision of drug information. (Duplicates credit in former PHAR 610.)

PHRD 709 Pediatric Drug Therapy Clerkship (4-6, FaSpSm) Clinical therapeutic and pharmacokinetic concepts applied to the pediatric patient. Unique aspects of pediatric clinical pharmacology emphasized in treating a variety of organ system diseases. (Duplicates credit in former PHAR 611.)

PHRD 710 Surgery Clerkship (6, FaSpSm) Drug therapy in clinical situations common to surgical patients. The use of drugs and monitoring for response to treatment in surgical settings. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 612.)

PHRD 711 Cardiovascular Drug Therapy Clerkship (6, FaSpSm) Pharmaceutical care applied to cardiac patients. The use of cardiac drugs with an emphasis on physiologic response, pharmacokinetic principles and desired treatment outcomes. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 613.)

PHRD 712 Applied Clinical Pharmacokinetics Clerkship (6, FaSpSm) Practical experience in applying pharmacokinetic principles to patients in the health care system. A variety of disease states and therapeutic agents will be reviewed. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 614.)

PHRD 713 Drug Information Clerkship

(6, FaSpSm) Practical experience and training in the use of information resources and technology to improve patient care. Experience in information retrieval, literature evaluation, problem solving skills and communication skills emphasized. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 615.)

PHRD 714 Radiopharmacy Clerkship

(6, FaSpSm) Provides practical and theoretical aspects of radiopharmacy services delivery. (Duplicates credit in former PHAR 616.)

PHRD 715 Oncology Clerkship (6, FaSpSm)

Directed experiences in the use and monitoring of oncological drugs. (Duplicates credit in former PHAR 617.)

PHRD 716 Ob-Gyn Clerkship (6, FaSpSm)

Provides experiences in disease states common to this area and the drug therapy management employed. (Duplicates credit in former PHAR 618.)

PHRD 717 Dermatology Clerkship (6, FaSpSm)

Provides experiences in disease states common to this area and the drug therapy management employed. (Duplicates credit in former PHAR 619.)

PHRD 718 Hospital Pharmacy Practice Clerkship (6, FaSpSm)

Practical experience and training in the practice of hospital pharmacy. Administrative, practice-based and therapeutic competencies emphasized. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 620.)

PHRD 719 Pain Management Clerkship

(6, FaSpSm) Pharmaceutical care principles applied to patients requiring treatment in pain management. Pharmacology, patient counseling and management emphasized. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 623.)

PHRD 720 Critical Care Clerkship (6, FaSpSm)

Drug therapy in a critical care setting. Emphasizes therapeutic management in critically ill patients, often with multisystem failure. (Duplicates credit in former PHAR 624.)

PHRD 721 Drug Utilization and Evaluation Clerkship (6, FaSpSm)

Practical experience and training in the design, implementation and evaluation instruments (DUE/MUE) to measure the appropriate use of therapeutic agents and the evaluation of desired therapeutic outcomes. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 625.)

PHRD 722 Home Health Care Clerkship

(6, FaSpSm) Practical experience in the provision of comprehensive home intravenous and nutritional support services, including fluid and electrolyte therapy, chemotherapy, antibiotics, pain control and nutrition support. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 626.)

PHRD 723 Nutritional Support Clerkship

(6, FaSpSm) Experiential training in the pharmacy specialty of nutritional support. Activities include: patient evaluation, developing treatment plans, formula composition and design, integration with nutritional support team and consult services. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 627.)

PHRD 724 Advanced Community Pharmacy Clerkship (6, FaSpSm)

Directed project in community pharmacy. (Duplicates credit in former PHAR 628.)

PHRD 725 International Pharmacy Clerkship (6, FaSpSm)

Practical experience and training in the practice of pharmacy in the international setting. Students will visit an international pharmacy practice setting and complete a project. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 629.)

PHRD 726 Directed Clinical Clerkship

Project I (6, FaSpSm) Directed educational opportunities not presently offered as electives, e.g., research projects or new and evolving clerkships. (Duplicates credit in former PHAR 630*a*.)

PHRD 727 Directed Clinical Clerkship

Project II (6, FaSpSm) Directed educational opportunities not presently offered as electives, e.g., research projects or new and evolving clerkships. (Duplicates credit in former PHAR 630*b*.)

PHRD 728 Directed Clinical Clerkship

Project III (6, FaSpSm) Directed educational opportunities not presently offered as electives, e.g., research projects or new and evolving clerkships. (Duplicates credit in former PHAR 630*c*.)

PHRD 729 Directed Clinical Clerkship

Project IV (6, FaSpSm) Directed educational opportunities not presently offered as electives, e.g., research projects or new and evolving clerkships. (Duplicates credit in former PHAR 630*d*.)

PHRD 730 Acute Care Geriatrics Clerkship

(6, FaSpSm) Pharmaceutical care principles applied to the acutely ill geriatric patient population. Emphasis on drug therapy problem solving, physiology, pharmacokinetics and compliance problems. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 631.)

PHRD 731 Advanced Geriatrics Clerkship

(6, FaSpSm) Directed projects and experiences in geriatric drug therapy. (Duplicates credit in former PHAR 632.)

PHRD 732 Pharmacy Administration Clerkship (6, FaSpSm)

Principles and practices of hospital pharmacy administration, management and departmental relationships. Practical experiences and projects emphasized. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 633.)

PHRD 733 Anticoagulation Therapy Clerkship (6, FaSpSm)

Management of patients requiring anticoagulation. Applied knowledge of disease pathophysiology, anticoagulant pharmacology, and laboratory methods toward safe and effective patient outcomes. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 634.)

PHRD 734 Antimicrobial Therapy Clerkship (6, FaSpSm)

Antimicrobial therapy, including antibiotic selection, dosage adjustment, and outcomes assessment of patients in the health care setting. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 635.)

PHRD 735 Clinical Pharmacy Research Clerkship (6, FaSpSm)

Drug research administration: research design; ethics; record-keeping; and institutional review. Practical experience and projects are emphasized. Open to Level IV Doctor of Pharmacy students only. (Duplicates credit in former PHAR 636.)

PHRD 736 Chemical Dependency Clerkship (6, FaSpSm)

The psychiatric, social, and pharmacological management of chemical dependency. Emphasizes the inpatient, day treatment, and outpatient components of detoxification and recovery. (Duplicates credit in former PHAR 637.)

PHRD 737 Clinical Transplantation Clerkship (6, FaSpSm)

Drug therapy to organ transplantation. Emphasizes pre- and post-transplantation therapy designed to minimize organ rejection, prevent infection, and improve survival. (Duplicates credit in former PHAR 638.)

PHRD 738 Pharmaceutical Industry Clerkship (6, FaSpSm) Train within a pharmaceutical company to develop an understanding of the drug development, research, marketing process. (Duplicates credit in former PHAR 639.)

PHRD 739 AIDS/Immune Disorders Clerkship (6, FaSpSm) A multidisciplinary approach to the management of AIDS and other immuno-compromised patients. Pharmacologic management is directed toward opportunistic infections, disease modifiers, and adjuvant therapy. (Duplicates credit in former PHAR 640.)

PHRD 740 Health Care Systems Administration Clerkship (6, FaSpSm) Practical experience and training in managed care settings and health care systems. Emphasis on administrative principles, management and health outcomes. Students will complete a project. Open to Doctor of Pharmacy students only. (Duplicates credit in former PHAR 642.)

PHRD 741 Advanced Primary Care Clerkship (6, FaSpSm) Advanced experience in disease state management in the primary care setting. Design drug therapy regimens using a team-based approach at an advanced level of practice. Open to Doctor of Pharmacy students only. *Prerequisite:* PHRD 704.

PHRD 790 Directed Research (1-12, max 12) Research leading to doctorate in Clinical and Experimental Therapeutics. Graded CR/NC.

PHRD 794abcdz Doctoral Dissertation (2-2-2-2-0) Dissertation research required for completion of Doctor of Philosophy in Clinical and Experimental Therapeutics.

PHARMACEUTICAL ECONOMICS AND POLICY (PMEP)

PMEP 509 Research Design (4, Fa) Introduction to the concept of research design and examples of the variant research methods utilized in the field. Both the conceptual and practical issues of research including development of the research question, selection of appropriate methods, data sources and analytic approaches to address the research question will be addressed.

PMEP 519 Survey Research and Quality of Life Assessment (4, Sp) Skills to develop and assess surveys which are integral in Pharmaceutical Economics and Policy research. *Prerequisite:* PMEP 509; *recommended preparation:* biostatistics, econometrics.

PMEP 529 Risk, Probabilities and Preferences (4, Sp) Analysis of economic and psychological constructs of risks, probabilities, and health related preferences and utilities.

PMEP 538 Pharmaceutical Economics (4, Sm) Introduction to pharmacoeconomics with special emphasis on the role of pharmaceuticals and the pharmaceutical industry, insurance, managed care, regulation and pricing. *Prerequisite:* ECON 500.

PMEP 539 Economic Assessment of Medical Care (4, Fa) Principles of cost-benefit analysis and medical cost-effectiveness analysis with applications in medical care and the pharmaceutical field. *Prerequisite:* ECON 500 and ECON 581.

PMEP 549 Applied Pharmacoeconometrics (4, Sp) Use of quantitative models to describe and analyze pharmaceutical and health care markets; experimental design/power calculations; survival models; multiple indicator models; qualitative and limited dependent variables models; estimation and application of such models to selected problems. *Prerequisite:* ECON 615.

PMEP 590 Directed Research (1-12, FaSpSm) Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

PMEP 594abz Master's Thesis (2-2-0, FaSp) Credit on acceptance of thesis. Graded IP/CR/NC. *Prerequisite:* completion of all required course work for the M.S. degree.

PMEP 698 Seminar in Pharmaceutical Economics and Policy (4, max 8, FaSp) Current research in pharmaceutical economics and policy presented by outside scholars, faculty and students. Graded CR/NC.

PMEP 790 Research (1-12) Research leading to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

PMEP 794abcdz Doctoral Dissertation (2-2-2-2-0) Credit on acceptance of dissertation. Graded IP/CR/NC.

PHARMACEUTICAL SCIENCES (PSCI)

PSCI 531 Cell Biology (4) (Enroll in INTD 531)

PSCI 561 Molecular Genetics (4, Sp) (Enroll in INTD 561)

PSCI 571 Biochemistry (4, Fa) (Enroll in INTD 571)

PSCI 590 Directed Research (1-12, FaSpSm) Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

PSCI 594abz Master's Thesis (2-2-0, FaSp) Credit on acceptance of thesis. Graded IP/CR/NC. *Prerequisite:* completion of all required course work for the M.S. degree.

PSCI 599 Special Topics (2-4, max 8, FaSp) Topics in advanced pharmaceutical sciences.

PSCI 601 Molecular Biology of Gene Regulation (2, max 8) (Enroll in BIOC 601)

PSCI 655 Immunopharmaceutics (2, 2 years, Fa) Lectures and discussion sessions on pharmaceuticals-related immunology, including drugs affecting the immune system, antibodies and cytokines as drugs, and new developments in immunobiotechnology.

PSCI 661L Advanced Pharmaceutical Analysis (4, 2 years, Fa) Theory and application of quantitative instrumental techniques to the pharmaceutical sciences. Includes principles of chromatography, spectrophotometry, fluorescence, mass spectrometry and immunologic assays. Lecture and laboratory.

PSCI 662 Advanced Pharmacokinetics (4, 2 years, Sp) Principles of pharmacokinetics including mathematical description of drug disposition processes. Emphasis on design and evaluation of pharmacokinetic studies and statistical analysis of parameter estimates.

PSCI 663 Advanced Drug Delivery Systems (2, Fa) Design and applications of polymers, liposomes, micro/nanoparticles, prodrugs, and macromolecules for parenteral, oral, transdermal, respiratory and CNS drug delivery. *Recommended preparation:* college level chemistry and biology; *prerequisite:* PSCI 665.

PSCI 664 Drug Discovery and Design (4, Fa) Principles of drug discovery, design and characterization. Mechanisms of action of major classes of drugs. *Recommended preparation:* college level chemistry and biology.

PSCI 665 Drug Transport and Delivery (4, Fa) Principles of cellular drug transport, in vivo drug transport, and modern drug delivery, including drug targeting. *Recommended preparation:* college level chemistry and biology.

PSCI 667 Intracellular Drug Delivery and Targeting (2, 2 years, Sp) Mechanisms of membrane trafficking and intracellular transport and the utilization of these mechanisms in drug delivery and targeting. *Recommended preparation:* college level chemistry and biology, INTD 531.

PSCI 756ab Seminar in Pharmaceutical Sciences (1-1, FaSpSm) Review of current pharmaceutical and related research topics.

PSCI 790 Research (1-12, FaSpSm) Research leading to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

PSCI 791L Research (2-12, no max) Directed research for the M.S. thesis or Ph.D. dissertation.

PSCI 794abcdz Doctoral Dissertation (2-2-2-2-0, FaSpSm) Credit on acceptance of dissertation. Graded IP/CR/NC.

REGULATORY SCIENCE (RSCI)

RSCI 520 Introduction to Risk Management for Health Care Products (2) Historical development, formal language and theoretical approaches to risk management in health care and medical product environment; policies, regulations, standards; liability prevention and loss control. (Duplicates credit in MPTX 520.) *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 521 Seminars in Regulatory Science (1, max 6, FaSpSm) Current problems in regulatory affairs, legal management, preclinical and clinical testing, scientific evaluation and quality assurance. (Duplicates credit in former MPTX 521.) Graded CR/NC. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post secondary training and industry experience; enrollment in M.S., Regulatory Science program.

RSCI 523 Advanced Concepts in Risk Management for Medical Products (3) Managing risk in demanding health-care and medical-product situations: clinical trials, emerging technologies, counterfeit prevention, hard-to-reach populations. *Recommended preparation:* undergraduate or professional degree in pharmacy, medicine or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience; enrollment in M.S. (Regulatory Science), Certificate in Patient and Product Safety, or permission of instructor.

RSCI 525 Introduction to Drug and Food Toxicology (3) Factors affecting toxic responses to foods and drugs: dose-response relationships, absorption, distribution, bio-transformation, elimination of toxicants; target organ toxicity, teratogenesis, mutagenesis, carcinogenesis, food allergies, risk assessment. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 527 Medical Product Safety (3) Management of medical product safety by manufacturers/suppliers including: safe manufacturing, labeling, packaging; pharmacovigilance, field observations, complaint handling; record-keeping, safety issues documentation; crisis management/recalls. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 528 Safety in the Health Care Environment (3) Regulatory expectations for health care facilities and services: JCAHO certification, environmental risk management, management of medical and medication errors, reduction of health hazards. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 529 Application of Risk Management Tools and Techniques (2) Use of risk management tools in the medical products arena: functional analysis, fault-tree analysis, failure modes and effects analysis, HACCP and six sigma methods. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 530 Translational Medicine: An Overview (2) An overview of principles and concepts underlying drug discovery and development, including terminology of translational science. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience; enrollment in M.S., Regulatory Science, Certificate in Preclinical Drug Development.

RSCI 531 Industrial Approaches to Drug Discovery (4) Examines the process of drug discovery from selection of disease and therapeutic target to characterization and validation of lead drug candidates. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience; enrollment in M.S., Regulatory Science, Certificate in Preclinical Drug Development.

RSCI 532 Early Stage Drug Development (3) Explores the activities involved in transforming an early drug or biological candidate to a drug approved for marketing by regulatory authorities. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience; enrollment in M.S., Regulatory Science, Certificate in Preclinical Drug Development.

RSCI 596 Internship for Curricular Practical Training in Regulatory Science (1, FaSpSm) Part-time or full-time practical work experience in Regulatory Science. The internship must be located at an off-campus facility. Students are individually supervised by faculty. Graded CR/NC. *Recommended preparation:* undergraduate or professional degree in pharmacy, medicine or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience; enrollment in M.S. (Regulatory Science).

RSCI 601 Biomedical Commerce (4) Introduction to business principles appropriate to medical products, including: supply and demand, product entry-exit strategies, financing, reimbursement, marketing and pricing in global marketplace. *Recommended preparation:* undergraduate degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience; enrollment in M.S., Regulatory Science.

RSCI 603 Managing Complex Projects (3) Theory and methods to manage complex projects in medical products sectors; timelines, intellectual property, security, contracts, budgets, review activities, reports, electronic tools, cross-cultural communication. *Recommended preparation:* undergraduate or professional degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 604 Regulatory Strategy in Asia (4)

Regulatory policy, standards and practices in different Asian markets: product licensing, import/export management, materials sourcing, quality systems compliance, reimbursement, prescribing practices. Travel may be required. *Prerequisite:* MPTX 519; *recommended preparation:* undergraduate or professional degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 605 Managing Organizations and Human Resources (3)

Theory and practice of personnel management, organizational structure and industrial relations in small, growing enterprises and large global companies typical of pharmaceutical and medical device sectors. *Recommended preparation:* undergraduate or professional degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 608 Regulatory Strategy in Europe and the Americas (4)

Regulatory strategy in EU, Canada, Mexico and South America; culture, health-care practices, reimbursement, product registration, quality systems, trade restrictions, import/export requirements. Travel may be required. *Recommended preparation:* undergraduate or professional degree in pharmacy, medical or independent health sciences, engineering or equivalent mix of post-secondary training and industry experience.

RSCI 794abcdz Doctoral Dissertation

(2-2-2-2-0) Dissertation research required for completion of doctoral degree in regulatory science. Graded IP/CR/NC.