

# Department of Pharmaceutical Sciences

## A. Richard Chamberlin, Department Chair

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<http://www.pharmsci.uci.edu>

## Overview

The Department of Pharmaceutical Sciences offers a curriculum focusing on the preparation of students for professional positions in the pharmaceutical production, control, and development sectors of the pharmaceutical and biotechnology industry or for graduate studies in pharmaceuticals, medicinal chemistry, pharmacology, analytical chemistry, medicine, and pharmacy. Collaborative interdisciplinary research will be supported by joint faculty appointments shared with other UCI departments.

## Degrees

Pharmaceutical Sciences	B.S.
Pharmacological Sciences*	M.S., Ph.D.

\* Offered in conjunction with the Department of Pharmacology.

## Undergraduate Program

The B.S. program in Pharmaceutical Sciences trains students in a multidisciplinary approach so that they can contribute to the advancement of new pharmaceutical technologies such as accelerated chemical synthesis, molecular-based assays using cloned enzymes and cloned metabolizing enzymes, combinatorial chemistry, *in vitro* biopharmaceutical techniques, and gene therapies. Pharmaceutical scientists are rapidly changing the field of drug discovery and development. The graduates of this program may seek employment in public and private sectors or choose to pursue graduate degrees such as a Ph.D., M.D., or Pharm.D.

**Undergraduate Honors.** Honors at graduation, e.g., *cum laude*, *magna cum laude*, *summa cum laude*, are awarded to approximately the top 16 percent of the graduating seniors. To be eligible for honors, a general criterion is that students must have completed at least 72 units in residence at a University of California campus. Other important factors are considered visit at Honors Recognition (<http://catalogue.uci.edu/informationforadmittedstudents/academicadvisingandhonors/#honorsopportunities>).

## Admission to the Major

Students may be admitted to the Pharmaceutical Sciences major upon entering the University as freshmen, via change of major, or as transfer students from other colleges and universities.

Information about change-of-major policies is available in the Department of Pharmaceutical Sciences office and at the UCI Change of Major Criteria website (<http://www.changeofmajor.uci.edu>).

**Transfer Students:** All applicants must have completed the following required courses with a grade of B- or better in all courses: one year of general chemistry courses with laboratory courses equivalent to UCI's CHEM 1A-CHEM 1B-CHEM 1C and CHEM 1LC-CHEM 1LD **and** one year of biology courses equivalent to UCI's BIO SCI 93 and BIO SCI 94. In addition, all applicants must have a cumulative GPA of 3.0 or better. Additional courses that are recommended, but not required: one year of calculus, one year of calculus-based physics with laboratory, one year of organic chemistry with laboratory, and additional articulated lower-division biology requirements.

Note: To complete the B.S. requirements in two years, transfer students also need to complete one year of general chemistry with laboratory equivalent to UCI's CHEM 1A-CHEM 1B-CHEM 1C and CHEM 1LC-CHEM 1LD **AND** one year of organic chemistry with laboratory equivalent to UCI's CHEM 51A-CHEM 51B-CHEM 51C and CHEM 51LB-CHEM 51LC. Transfer students must also complete one to two years of biology courses equivalent to UCI's BIO SCI 93, BIO SCI 94, BIO SCI 97, BIO SCI 98, and BIO SCI 99 with a grade of "B" or better in each course; and have a cumulative GPA of 3.0 or higher.

## Requirements for the B.S. in Pharmaceutical Sciences

**All students must meet the University Requirements** (<http://catalogue.uci.edu/informationforadmittedstudents/requirementsforabachelorsdegree>).

### Major Requirements

#### A. Lower-Division Requirements:

1. Select one of the following sequences:

CHEM 1A- 1B- 1C

General Chemistry  
and General Chemistry  
and General Chemistry

CHEM H2A- H2B- H2C	Honors General Chemistry and Honors General Chemistry and Honors General Chemistry
and select one of the following lab sequences:	
CHEM 1LC- 1LD	General Chemistry Laboratory and General Chemistry Laboratory
CHEM H2LA- H2LB- H2LC	Honors General Chemistry Laboratory and Honors General Chemistry Laboratory and Honors General Chemistry Laboratory
CHEM M2LA- M2LB- M3LC	Majors General Chemistry Laboratory and Majors General Chemistry Laboratory and Majors Quantitative Analytical Chemistry Laboratory
Select one of the following organic chemistry sequences and accompanying labs:	
CHEM 51A- 51B- 51C	Organic Chemistry and Organic Chemistry and Organic Chemistry
CHEM 51LB- 51LC- 51LD	Organic Chemistry Laboratory and Organic Chemistry Laboratory and Organic Chemistry Laboratory
or	
CHEM H52A- H52B- H52C	Honors Organic Chemistry and Honors Organic Chemistry and Honors Organic Chemistry
CHEM H52LA- H52LB- H52LC	Honors Organic Chemistry Laboratory and Honors Organic Chemistry Laboratory and Honors Organic Chemistry Laboratory
2. Complete:	
MATH 2A- 2B	Single-Variable Calculus and Single-Variable Calculus
and select one of the following:	
MATH 2D	Multivariable Calculus
MATH 3A	Introduction to Linear Algebra
STATS 7	Basic Statistics
STATS 8	Introduction to Biological Statistics
3. Select one of the following physics sequences:	
PHYSICS 3A- 3B- 3C	Basic Physics I and Basic Physics II and Basic Physics III
or	
PHYSICS 7C- 7D- 7E	Classical Physics and Classical Physics and Classical Physics
4. Complete:	
BIO SCI 93	From DNA to Organisms
BIO SCI 94	From Organisms to Ecosystems
BIO SCI 97	Genetics
BIO SCI 98	Biochemistry
BIO SCI 99	Molecular Biology
5. Complete:	
PHRMSCI 1	New Student Seminar
PHRMSCI 42	Life 101
PHRMSCI 76	Ethical Conduct of Research
<b>B. Upper-Division Requirements:</b>	
Complete:	
BIO SCI 100	Scientific Writing

BIO SCI 194S	Safety and Ethics for Research
PHRMSCI 120- 120L	Human Physiology and Human Physiology Lab
PHRMSCI 170A- 170B	Molecular Pharmacology I and Molecular Pharmacology II
PHRMSCI 171	Physical Biochemistry
PHRMSCI 172	Topics in Pharmaceutical Sciences
PHRMSCI 173	Pharmacotherapy
PHRMSCI 174- 174L	Biopharmaceutics and Nanomedicine and Biopharmaceutics and Nanomedicine Lab
PHRMSCI 177- 177L	Medicinal Chemistry and Medicinal Chemistry Laboratory

**C. Upper-Division Electives (8 units):**

The upper-division electives may be selected from the following: <sup>1</sup>

BIO SCI D103	Cell Biology
BIO SCI D104	Developmental Biology
BIO SCI D111L	Developmental and Cell Biology Laboratory
BIO SCI D136	Human Anatomy
BIO SCI D137	Eukaryotic and Human Genetics
BIO SCI D140	How to Read a Science Paper
BIO SCI D145	Genomics, Development, and Medicine
BIO SCI D148	Development and Disease
BIO SCI D153	Molecular and Cellular Basis of Disease
BIO SCI D170	Applied Human Anatomy
BIO SCI E136	The Physiology of Human Nutrition
BIO SCI E142W	Writing/Philosophy of Biology
BIO SCI E189	Environmental Ethics
BIO SCI M114	Advanced Biochemistry
BIO SCI M114L	Biochemistry Laboratory
BIO SCI M116L	Molecular Biology Laboratory
BIO SCI M118L	Experimental Microbiology Laboratory
BIO SCI M120	Signal Transduction in Mammalian Cells
BIO SCI M121	Immunology with Hematology
BIO SCI M122	General Microbiology
BIO SCI M123	Introduction to Computational Biology
BIO SCI M124A	Virology
BIO SCI M124B	Viral Pathogenesis and Immunity
BIO SCI M125	Molecular Biology of Cancer
BIO SCI M137	Microbial Genetics
BIO SCI M143	Human Parasitology
BIO SCI M144	Cell Organelles and Membranes
BIO SCI N110	Neurobiology and Behavior
BIO SCI N113L	Neurobiology Laboratory
BIO SCI N153	Neuropharmacology
BIO SCI N154	Molecular Neurobiology
CHEM 107	Inorganic Chemistry
CHEM 107L	Inorganic Chemistry Laboratory
CHEM 125	Advanced Organic Chemistry
CHEM 128	Introduction to Chemical Biology
CHEM 128L	Introduction to Chemical Biology Laboratory Techniques
CHEM 138	Introduction to Computational Organic Chemistry
CHEM 156	Advanced Laboratory in Chemistry and Synthesis of Materials
CHEM 160	Organic Synthesis Laboratory

CHEM 170	Radioisotope Techniques
PUBHLTH 121	Introduction to Complementary and Alternative Medicine

<sup>1</sup> Course may not be used to satisfy more than one requirement.

**Upper-Division Writing Requirement:** Pharmaceutical Sciences majors satisfy the upper-division writing requirement by completing BIO SCI 100 with a grade of C or better, followed by the completion of PHRMSCI 174L and PHRMSCI 177L. Students must earn a grade of C or better in each of these laboratory courses.

NOTE: Double majors with Pharmaceutical Sciences, Public Health Sciences, Nursing Science, Biomedical Engineering: Premedical, or with any of the School of Biological Sciences majors are not permitted.

## Sample Program — Pharmaceutical Sciences

Freshman		
Fall	Winter	Spring
BIO SCI 93	BIO SCI 94	CHEM 1C- 1LC
CHEM 1A	CHEM 1B	MATH 2A
WRITING 39B or HUMAN 1A	WRITING 39C or HUMAN 1B	HUMAN 1C (or General Education)
PHRMSCI 1	General Education	General Education
General Education		
Sophomore		
Fall	Winter	Spring
BIO SCI 97	BIO SCI 98	BIO SCI 99
CHEM 51A- 1LD	CHEM 51B- 51LB	CHEM 51C- 51LC
MATH 2B	STATS 7, 8, MATH 2D, or MATH 3A	General Education
BIO SCI 194S	PHRMSCI 42	
	General Education	
Junior		
Fall	Winter	Spring
PHRMSCI 120- 120L	PHRMSCI 170A	PHRMSCI 170B
BIO SCI 100	General Education	Elective
PHYSICS 3A, 7C, or 7LD	PHYSICS 3B, 7D, or 7LD	PHYSICS 3C or 7E
	Elective	
Senior		
Fall	Winter	Spring
PHRMSCI 171	PHRMSCI 177- 177L	General Education
PHRMSCI 174- 174L	General Education	Elective
General Education	Elective	PHRMSCI 173
PHRMSCI 172		PHRMSCI 76

## Graduate Programs

David Mobley, Graduate Program Advisor

Graduate Student Affairs: 949-824-1991

<http://www.pharmacology.uci.edu> and <http://www.pharmsci.uci.edu>

The Departments of Pharmacology and Pharmaceutical Sciences join forces to offer an interdisciplinary program leading to the Ph.D. in Pharmacological Sciences with a concentration in Pharmacology, Pharmaceutical Sciences, or Medicinal Chemistry. For complete program information, see the Interdisciplinary Studies (<http://catalogue.uci.edu/interdisciplinarystudies/pharmacologyandtoxicology>) section of the *Catalogue*, or the Department of Pharmaceutical Sciences website (<http://www.pharmsci.uci.edu/graduate>).

## Faculty

Claudia Benavente, Ph.D. University of Arizona, *Assistant Professor of Pharmaceutical Sciences; Developmental and Cell Biology* (genetics, epigenetics, cancer, pediatric cancer, retinoblastoma, osteosarcoma)

Bruce Blumberg, Ph.D. University of California, Los Angeles, *Professor of Developmental and Cell Biology; Biomedical Engineering; Environmental Health Sciences; Pharmaceutical Sciences* (gene regulation by nuclear hormone receptors in vertebrate development physiology, endocrine disruption)

A. Richard Chamberlin, Ph.D. University of California, San Diego, *Department Chair and Professor of Pharmaceutical Sciences; Chemistry* (chemical biology, organic and synthetic)

John Charles Chaput, Ph.D. University of California, Riverside, *Professor of Pharmaceutical Sciences; Molecular Biology and Biochemistry* (chemical and synthetic biology)

Olivier Civelli, Ph.D. Swiss Federal Institute of Technology in Zurich, *Department Chair and Eric L. and Lila D. Nelson Chair in Neuropharmacology and Professor of Pharmacology; Developmental and Cell Biology; Pharmaceutical Sciences* (novel neuroactive molecules)

Melanie Cocco, Ph.D. Pennsylvania State University, *Associate Professor of Molecular Biology and Biochemistry; Pharmaceutical Sciences*

John P. Fruehauf, M.D. Rush University, *Professor of Medicine; Biomedical Engineering; Pharmaceutical Sciences* (in-vitro cancer models using 3-D tissue systems to predict drug response)

Daniel W. Gil, Ph.D. University of Pennsylvania, *Associate Adjunct Professor of Pharmaceutical Sciences*

Celia Goulding, Ph.D. King's College London, *Professor of Molecular Biology and Biochemistry; Pharmaceutical Sciences*

Stephen Hanessian, Ph.D. Ohio State University, *Director of Medicinal Chemistry and Pharmacology Graduate Program and Professor of Pharmaceutical Sciences; Chemistry; Pharmacology* (organic chemistry)

Mahtab F. Jafari, Pharm.D. University of California, San Francisco, *Vice Chair and Director of the Center for Healthspan Pharmacology and Professor of Pharmaceutical Sciences; Ecology and Evolutionary Biology; Pharmacology* (anti-aging pharmacology and preventive medicine)

Young Jik Kwon, Ph.D. University of Southern California, *Professor of Pharmaceutical Sciences; Biomedical Engineering; Chemical Engineering and Materials Science; Molecular Biology and Biochemistry* (gene therapy, drug delivery, cancer-targeted therapeutics, combined molecular imaging and therapy, cancer vaccine)

Anthony D. Long, Ph.D. McMaster University, *Professor of Ecology and Evolutionary Biology; Pharmaceutical Sciences*

Andrej Luptak, Ph.D. Yale University, *Associate Professor of Pharmaceutical Sciences; Chemistry; Molecular Biology and Biochemistry* (chemical biology)

David L. Mobley, Ph.D. University of California, Davis, *Vice Chair and Associate Professor of Pharmaceutical Sciences; Chemistry* (chemical biology, physical chemistry and chemical physics, theoretical and computational)

Lawrence Plon, Pharm.D. M.A. University of Southern California, *Assistant Adjunct Professor of Pharmaceutical Sciences*

Thomas L. Poulos, Ph.D. University of California, San Diego, *UCI Distinguished Professor of Molecular Biology and Biochemistry; Chemistry; Pharmaceutical Sciences; Physiology and Biophysics* (chemical biology)

Jennifer A. Prescher, Ph.D. University of California, Berkeley, *Associate Professor of Chemistry; Molecular Biology and Biochemistry; Pharmaceutical Sciences* (chemical biology, organic and synthetic)

Paolo Sassone-Corsi, Ph.D. University of Naples Federico II, *Donald Bren Professor and Professor of Biological Chemistry; Microbiology and Molecular Genetics; Pharmaceutical Sciences*

Samuel E. Schriener, Ph.D. University of Washington, *Lecturer with Potential Security of Employment of Pharmaceutical Sciences*

Robert Spitale, Ph.D. University of Rochester, *Assistant Professor of Pharmaceutical Sciences; Molecular Biology and Biochemistry* (chemistry, chemical biology, RNA biology)

Shiou-Chuan (Sheryl) Tsai, Ph.D. University of California, Berkeley, *Professor of Molecular Biology and Biochemistry; Chemistry; Pharmaceutical Sciences*

Weian Zhao, Ph.D. McMaster University, *Associate Professor of Pharmaceutical Sciences; Biomedical Engineering* (stem cell therapy, diagnostics, biosensors, nano- and microtechnology, aptamers)

## Courses

### PHRMSCI 1. New Student Seminar. 1 Unit.

Weekly meetings consisting of presentations by faculty, professional staff, and Peer Academic Advisors provide information about the Pharmaceutical Sciences major, campus resources, learning skills, and special programs and opportunities.

Grading Option: Pass/no pass only.

Restriction: Pharmaceutical Sciences Majors only. New students only.

**PHRMSCI 3. Professional Development and Careers in the Pharmaceutical Sciences. 1 Workload Unit.**

Designed to help Pharmaceutical Science majors select a career track and prepare for graduate program applications and careers in industry.

Grading Option: Workload Credit Letter Grade with P/NP.

Restriction: Juniors only. Pharmaceutical Sciences Majors only.

**PHRMSCI 42. Life 101 . 1 Unit.**

Covers the latest scientific work on the impact of nutrition, exercise, and lifestyle choices on mental and physical health. The course will motivate students to make positive changes by fostering personal growth.

**PHRMSCI 76. Ethical Conduct of Research. 2 Units.**

Covers the ethical responsibilities of biomedical scientists. Topics include, as discussions and case studies, the high standards of science, the responsible conduct of research, animal experimentation, and clinical trials as they relate to the pharmaceutical sciences.

**PHRMSCI 90. Speaking about Science. 4 Units.**

Students learn to effectively prepare and present public speeches and slide presentations. Included are storytelling, informative, commemorative, and persuasive speeches, and scientific presentation. Evaluating speeches and strategies to reduce speaker apprehension is also covered.

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment.

**PHRMSCI 120. Human Physiology. 4 Units.**

Covers the function of the human body. All major organ systems are discussed. Designed to prepare students for healthcare careers, such as medicine, pharmacy, dentistry, and for research careers which require basic knowledge of how the human body functions.

Corequisite: PHRMSCI 120L

Prerequisite: BIO SCI 99

Overlaps with BIO SCI E109.

**PHRMSCI 120L. Human Physiology Lab. 3 Units.**

Designed to complement PHRMSCI 120. Computer-based lab simulations will be used to study the function of the human body. Class will physically meet for review sessions and exams.

Corequisite: PHRMSCI 120

Prerequisite: BIO SCI E109

Overlaps with BIO SCI E112L.

**PHRMSCI 163. Pharmacogenomics and Epigenetics. 4 Units.**

Survey of the genetic and epigenetic basis of inter-subject variability in response to drugs. Covers drug efficacy, safety, and need for their optimization in pharmacotherapy. Emphasizes genetic mechanisms of polymorphisms in the pharmacokinetics and pharmacodynamics of representative therapeutic drugs.

Prerequisite: BIO SCI 99

Concurrent with PHRMSCI 263.

**PHRMSCI 170A. Molecular Pharmacology I. 4 Units.**

Molecular basis of drug-receptor action at the molecular and cellular levels. Structure-function of drug targets emphasizing enzymes, ion channels, and membrane transport proteins. Understanding how the drugs' mechanisms of action contribute to the development of more efficacious and safer drugs.

Prerequisite or corequisite: (CHEM 51C or CHEM H52C) and (PHRMSCI 120 or BIO SCI E109)

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment.

**PHRMSCI 170B. Molecular Pharmacology II. 4 Units.**

Introductory survey covering the molecular mechanisms of drugs that target the nervous system, such as anxiolytics, antidepressants, antipsychotics, hypnotics, muscle relaxants, and recreational drugs; drugs related to the immune system, including antibiotics, antihistamines, and immunosuppressants; drugs used to treat cancer.

Prerequisite: PHRMSCI 170A

**PHRMSCI 171. Physical Biochemistry. 4 Units.**

Thermodynamics and kinetic fundamentals as applied to problems relevant to pharmaceutical sciences such as receptor/enzyme-ligand interactions. Fundamentals of biophysical methods used in the pharmaceutical sciences including structure determination and biomolecular spectroscopy.

Prerequisite: MATH 2B and PHYSICS 3C and (CHEM 1C or CHEM H2C) and BIO SCI 99

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment.

**PHRMSCI 172. Topics in Pharmaceutical Sciences. 2 Units.**

Presents information about various fields of research, study, careers, and graduate school opportunities in pharmaceutical sciences. Taught by guest lecturers from various disciplines including 199 research course faculty. Helps Pharmaceutical Sciences students select electives appropriate to their future goals.

Prerequisite or corequisite: BIO SCI 99 and (CHEM 51C or CHEM H52C)

Grading Option: Pass/no pass only.

**PHRMSCI 173. Pharmacotherapy. 4 Units.**

An exploration of the clinical application of medications to selected disease states. Focus is on an understanding of underlying principles of pharmacology and how this knowledge can be applied to treatment of diseases.

Prerequisite or corequisite: PHRMSCI 170B

**PHRMSCI 174. Biopharmaceutics and Nanomedicine. 4 Units.**

Introduces theories and tools of new drug formulations. Particularly new novel therapeutics based on biological materials, pathological characteristics utilized to achieve the maximum efficacy and specificity, and drug delivery systems based on emerging nanotechnology are extensively discussed.

Prerequisite: PHRMSCI 170B

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment.

**PHRMSCI 174L. Biopharmaceutics and Nanomedicine Lab. 3 Units.**

Introduction to cancer drug screening using cellular models, and confirmation of comprehensive therapeutic efficacy using a live animal model. Includes basic cell culture, cytotoxicity assays, cell analysis, drug circulation test, and tumor eradication and imaging experiments. Materials fee.

Prerequisite: PHRMSCI 170B and BIO SCI 100

(Ib)

**PHRMSCI 175. Drug Discovery Computing Techniques. 4 Units.**

Techniques used in computer-aided drug discovery, including theory behind these techniques and practical applications. Topics include scientific computing; python; classical force fields and simulations; visualization and movie-making; quantum mechanics in drug discovery; molecular dynamics; solvation models; and several others.

Prerequisite: CSE 41 or I&C SCI 31. CSE 42 or I&C SCI 32 is recommended.

Concurrent with PHRMSCI 275.

**PHRMSCI 177. Medicinal Chemistry. 4 Units.**

An introduction of the basics of drug activity and mechanisms. Strategies used to identify lead compounds such as natural product chemistry, combinatorial chemistry, molecular modeling, and high-through put screening. Relationship of molecular structure to pharmacological activity.

Prerequisite: CHEM 51A and CHEM 51B and CHEM 51C and (BIO SCI 98 or CHEM 128)

Same as CHEM 177.

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment.



**PHRMSCI 177L. Medicinal Chemistry Laboratory. 3 Units.**

An introduction of the basics of drug activity and mechanisms. Strategies used to identify lead compounds such as natural product chemistry, combinatorial chemistry, molecular modeling, and high-throughput screening. Relationship of molecular structure to pharmacological activity. Materials fee.

Corequisite: PHRMSCI 177 or CHEM 177.

Prerequisite: CHEM 51A and CHEM 51B and CHEM 51C and BIO SCI 100 and (BIO SCI 98 or CHEM 128)

Same as CHEM 177L.

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment.

**(Ib)****PHRMSCI 178. Stem Cell Therapy . 4 Units.**

Introduces new paradigms in regenerative medicine involving stem cells, and emerging molecular, nano- and micro-engineered tools for in vivo imaging that is critical for studying and monitoring regeneration. Selected topics include stem cell biology and in vivo imaging modalities.

Prerequisite: BIO SCI D103

Concurrent with PHRMSCI 278.

**PHRMSCI 179. Emerging Technologies in Pharmaceutical Sciences and Medicine. 4 Units.**

Introduces emerging, ground-breaking technologies in pharmaceutical sciences and medicine, including pharmacogenomics, genome editing, and stem cell and engineered T cell therapies. Explores these novel technologies with both their underlying theories and forward-thinking applications.

Concurrent with PHRMSCI 279.

**PHRMSCI 192. Tutoring in Pharmaceutical Sciences. 2 Workload Units.**

Tutoring program with Pharmaceutical Sciences student peers.

Grading Option: Workload Credit P/NP Only.

Repeatability: May be taken for credit 6 times.

Restriction: Pharmaceutical Sciences Peer Tutoring Program students only.

**PHRMSCI 197. Professional Internship. 4 Units.**

Provides students with opportunity to develop leadership and professional skills necessary for competitive placement in their chosen industry. Students gain new and field-specific skills outside the classroom environment while participating in a supervised internship for a total of 100 hours.

Grading Option: Pass/no pass only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Seniors only.

**PHRMSCI 198. Independent Study in Pharmaceutical Sciences. 1-4 Units.**

Students interested in independent study should arrange with a faculty member to sponsor and supervise such work. A time commitment of three hours per week per unit is expected. A written report is required at the end of each quarter.

Repeatability: May be taken for credit for 4 units.

**PHRMSCI 199. Undergraduate Research. 1-4 Units.**

Original research in the laboratory of Pharmaceutical Sciences faculty. Attendance at regular research group meetings is also generally expected, and a quarterly written report is required. Strongly recommended for students considering research careers and/or graduate degree programs.

Repeatability: May be repeated for credit unlimited times.

**PHRMSCI H199. Honors Research in Pharmaceutical Sciences. 1-4 Units.**

Undergraduate honors research in Pharmaceutical Sciences. A student time commitment of 10-15 hours per week is required.

Repeatability: May be repeated for credit unlimited times.

**PHRMSCI 223. Biological Macromolecules. 4 Units.**

Introduction to nucleic acid and protein structure, dynamics, and function. Topics include analytical methods, molecular evolution, folding, and catalysis.

Same as CHEM 223.



**PHRMSCI 250A. Current Topics in Pharmaceutical Sciences. 1 Unit.**

Intended to expose students to the primary literature and current research in the field of Pharmaceutical Sciences. Students analyze and present information for discussion. Guest speakers from academia and industry may participate throughout the quarter.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be taken for credit 3 times.

Restriction: Graduate students only. Math and Computational Biology Majors only.

**PHRMSCI 250B. Current Topics in Pharmaceutical Sciences. 1 Unit.**

Intended to expose students to the primary literature and current research in the field of Pharmaceutical Sciences. Students analyze and present information for discussion. Guest speakers from academia and industry may participate throughout the quarter.

Prerequisite: PHRMSCI 250A

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be taken for credit 3 times.

Restriction: Graduate students only. Math and Computational Biology Majors only.

**PHRMSCI 250C. Current Topics in Pharmaceutical Sciences. 1 Unit.**

Intended to expose students to the primary literature and current research in the field of Pharmaceutical Sciences. Students analyze and present information for discussion. Guest speakers from academia and industry may participate throughout the quarter.

Prerequisite: PHRMSCI 250B

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be taken for credit 3 times.

Restriction: Graduate students only. Math and Computational Biology Majors only.

**PHRMSCI 263. Pharmacogenomics and Epigenetics. 4 Units.**

Survey of the genetic and epigenetic basis of inter-subject variability in response to drugs. Covers drug efficacy, safety, and the need for their optimization in pharmacotherapy. Emphasizes genetic mechanisms of polymorphisms in the pharmacokinetics and pharmacodynamics of representative therapeutic drugs.

Restriction: Graduate students only.

Concurrent with PHRMSCI 163.

**PHRMSCI 264. The RNA World: From Discovery to Mechanism. 4 Units.**

Provides a comprehensive understanding of RNA in biology. Use of knowledge gained in organic chemistry, biochemistry, genomics, and molecular biology to understand how RNA is integrated into contemporary biology.

Restriction: Graduate students only.

**PHRMSCI 265. New Frontiers in Chemical and Synthetic Biology. 4 Units.**

Explores new developments in chemical and synthetic biology that span the areas of chemistry, molecular biology, genetics, bioengineering, systems biology, and computational genomics.

Restriction: Graduate students only.

**PHRMSCI 272. Special Topics in Pharmaceutical Sciences. 2-4 Units.**

Reserved for current topics of particular interest in areas of pharmaceutical sciences that are not covered by other courses. The subject will vary from year to year, highlighting, for example, significant emerging fields or highly specialized but vital research areas.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

**PHRMSCI 274. Nanomedicine . 4 Units.**

Students will learn the current challenges in administering drugs to treat highly challenging diseases, the background theories of drug and gene delivery systems, and apply their knowledge in designing innovative forms of therapeutics formulations.

Restriction: Graduate students only.

**PHRMSCI 275. Drug Discovery Computing Techniques. 4 Units.**

Techniques used in computer-aided drug discovery, including theory behind these techniques and practical applications. Topics include scientific computing; python; classical force fields and simulations; visualization and movie-making; quantum mechanics in drug discovery; molecular dynamics; solvation models; and several others.

Restriction: Graduate students only.

Concurrent with PHRMSCI 175.

**PHRMSCI 277. Medicinal Chemistry. 4 Units.**

Fundamentals of medicinal chemistry covering diverse aspects of drug design, discovery, synthesis, and development. Molecular basis of drug action with an emphasis on the structure-to-function continuum.

**PHRMSCI 278. Stem Cell Therapy . 4 Units.**

Introduces new paradigms in regenerative medicine particularly those that involve stem cells, and emerging molecular, nano- and micro-engineered tools for in vivo imaging that is critical for studying and monitoring regeneration.

Restriction: Graduate students only.

**PHRMSCI 279. Emerging Technologies in Pharmaceutical Sciences and Medicine. 4 Units.**

Introduces emerging, ground-breaking technologies in pharmaceutical sciences and medicine, including pharmacogenomics, genome editing, and stem cell and engineered T cell therapies. Explores these novel technologies with both their underlying theories and forward-thinking applications.

Concurrent with PHRMSCI 179.

**PHRMSCI 298. Research Seminar . 2 Units.**

Presentation and discussion of current problems and methods in teaching and research in pharmaceutical sciences.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

**PHRMSCI 299. Graduate Research. 1-12 Units.**

Supervised original research or investigation under the direction of an individual faculty member.

Repeatability: May be repeated for credit unlimited times.

**PHRMSCI 399. University Teaching. 1-4 Units.**

Limited to Teaching Assistants.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.