Department of Pharmaceutical Sciences

A. Richard Chamberlin, Department Chair
209 Steinhaus Hall
949-824-1991
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 pharmaceutics, medicinal chemistry, pharmacology, analytical chemistry, medicine, and pharmacy. Collaborative interdisciplinary research will be supported by joint faculty appointments shared with other UCI departments.

Degrees
<table>
<thead>
<tr>
<th>Pharmaceutical Sciences</th>
<th>B.S.</th>
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<tbody>
<tr>
<td>Pharmacological Sciences*</td>
<td>M.S., Ph.D.</td>
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</table>

* Offered in conjunction with the Department of Pharmacology.

In addition, the Gateway Program in Medicinal Chemistry and Pharmacology (MCP), established through the joint efforts of the Departments of Chemistry, Pharmacology, Molecular Biology and Biochemistry, and Pharmaceutical Sciences, offers a graduate program of study.

On This Page:
- Admission to the Major
- Requirements for B.S. Degree in Pharmaceutical Sciences
- Sample Program - Pharmaceutical Sciences

Undergraduate Program
The B.S. degree 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 12 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.

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.

Requirements for the B.S. Degree in Pharmaceutical Sciences
All students must meet the University Requirements.

Major Requirements
A. Lower-Division Requirements:
1. Select one of the following sequences:
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1A- 1B- 1C</td>
<td>General Chemistry and General Chemistry</td>
<td>and General Chemistry</td>
</tr>
<tr>
<td>CHEM H2A- H2B- H2C</td>
<td>Honors General Chemistry and Honors General Chemistry</td>
<td>and Honors General Chemistry</td>
</tr>
</tbody>
</table>

Select one of the following lab sequences:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1LC- 1LD</td>
<td>General Chemistry Laboratory and General Chemistry</td>
<td>Laboratory</td>
</tr>
<tr>
<td>CHEM H2LA- H2LB- H2LC</td>
<td>Honors General Chemistry Laboratory and Honors General Chemistry Laboratory</td>
<td>and Honors General Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM M2LA- M2LB- M3LC</td>
<td>Majors General Chemistry Laboratory and Majors General Chemistry Laboratory</td>
<td>and Majors Quantitative Analytical Chemistry Laboratory</td>
</tr>
</tbody>
</table>

Select one of the following organic chemistry sequences and accompanying labs:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 51A- 51B- 51C</td>
<td>Organic Chemistry and Organic Chemistry</td>
<td>and Organic Chemistry</td>
</tr>
<tr>
<td>CHEM 51LB- 51LC</td>
<td>Organic Chemistry Laboratory and Organic Chemistry Laboratory</td>
<td></td>
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</tbody>
</table>

or

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM H52A- H52B- H52C</td>
<td>Honors Organic Chemistry and Honors Organic Chemistry</td>
<td>and Honors Organic Chemistry</td>
</tr>
<tr>
<td>CHEM H52LA- H52LB- H52LC</td>
<td>Honors Organic Chemistry Laboratory and Honors Organic Chemistry Laboratory</td>
<td>and Honors Organic Chemistry Laboratory</td>
</tr>
</tbody>
</table>

2. Complete:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>MATH 2A- 2B</td>
<td>Single-Variable Calculus and Single-Variable Calculus</td>
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</tbody>
</table>

and select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2D</td>
<td>Multivariable Calculus</td>
<td></td>
</tr>
<tr>
<td>MATH 3A</td>
<td>Introduction to Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>STATS 7</td>
<td>Basic Statistics</td>
<td></td>
</tr>
<tr>
<td>STATS 8</td>
<td>Introduction to Biological Statistics</td>
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</tr>
</tbody>
</table>

3. Select one of the following physics sequences and accompanying labs:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 3A- 3B- 3C</td>
<td>Basic Physics and Basic Physics</td>
<td>and Basic Physics</td>
</tr>
<tr>
<td>PHYSICS 3LB- 3LC</td>
<td>Basic Physics Laboratory and Basic Physics Laboratory</td>
<td></td>
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</tbody>
</table>

or

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 7C- 7D- 7E</td>
<td>Classical Physics and Classical Physics</td>
<td>and Classical Physics</td>
</tr>
<tr>
<td>PHYSICS 7LC- 7LD</td>
<td>Classical Physics Laboratory and Classical Physics Laboratory</td>
<td></td>
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</tbody>
</table>

4. Complete:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO SCI 93</td>
<td>From DNA to Organisms</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 94</td>
<td>From Organisms to Ecosystems</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 97</td>
<td>Genetics</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 98</td>
<td>Biochemistry</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 99</td>
<td>Molecular Biology</td>
<td></td>
</tr>
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</table>

5. Complete:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHRMSCI 42</td>
<td>Life 101</td>
<td></td>
</tr>
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</table>
### B. Upper-Division Requirements:

Complete:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO SCI 100</td>
<td>Scientific Writing</td>
</tr>
<tr>
<td>BIO SCI 194S</td>
<td>Safety and Ethics for Research</td>
</tr>
<tr>
<td>PHRMSCI 120-120L</td>
<td>Human Physiology and Human Physiology Lab</td>
</tr>
<tr>
<td>PHRMSCI 170A-170B</td>
<td>Molecular Pharmacology I and Molecular Pharmacology II</td>
</tr>
<tr>
<td>PHRMSCI 171</td>
<td>Physical Biochemistry</td>
</tr>
<tr>
<td>PHRMSCI 172</td>
<td>Topics in Pharmaceutical Sciences</td>
</tr>
<tr>
<td>PHRMSCI 173</td>
<td>Pharmacotherapy</td>
</tr>
<tr>
<td>PHRMSCI 174-174L</td>
<td>Biopharmaceutics and Nanomedicine and Biopharmaceutics and Nanomedicine Lab</td>
</tr>
<tr>
<td>PHRMSCI 176</td>
<td>Ethics Conduct of Research</td>
</tr>
<tr>
<td>PHRMSCI 177-177L</td>
<td>Medicinal Chemistry and Medicinal Chemistry Laboratory</td>
</tr>
</tbody>
</table>

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

The upper-division electives may be selected from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO SCI D103</td>
<td>Cell Biology</td>
</tr>
<tr>
<td>BIO SCI D104</td>
<td>Developmental Biology</td>
</tr>
<tr>
<td>BIO SCI D111L</td>
<td>Developmental and Cell Biology Laboratory</td>
</tr>
<tr>
<td>BIO SCI D129</td>
<td>Biotechnology and Plant Breeding</td>
</tr>
<tr>
<td>BIO SCI D136</td>
<td>Human Anatomy</td>
</tr>
<tr>
<td>BIO SCI D137</td>
<td>Eukaryotic and Human Genetics</td>
</tr>
<tr>
<td>BIO SCI D140</td>
<td>How to Read a Science Paper</td>
</tr>
<tr>
<td>BIO SCI D145</td>
<td>Genomics, Development, and Medicine</td>
</tr>
<tr>
<td>BIO SCI D148</td>
<td>Development and Disease</td>
</tr>
<tr>
<td>BIO SCI D153</td>
<td>Molecular and Cellular Basis of Disease</td>
</tr>
<tr>
<td>BIO SCI D170</td>
<td>Applied Human Anatomy</td>
</tr>
<tr>
<td>BIO SCI E136</td>
<td>The Physiology of Human Nutrition</td>
</tr>
<tr>
<td>BIO SCI E137</td>
<td>Genetics of Complex Traits</td>
</tr>
<tr>
<td>BIO SCI E142W</td>
<td>Writing/Philosophy of Biology</td>
</tr>
<tr>
<td>BIO SCI E189</td>
<td>Environmental Ethics</td>
</tr>
<tr>
<td>BIO SCI M114</td>
<td>Advanced Biochemistry</td>
</tr>
<tr>
<td>BIO SCI M114L</td>
<td>Biochemistry Laboratory</td>
</tr>
<tr>
<td>BIO SCI M116L</td>
<td>Molecular Biology Laboratory</td>
</tr>
<tr>
<td>BIO SCI M118L</td>
<td>Experimental Microbiology Laboratory</td>
</tr>
<tr>
<td>BIO SCI M120</td>
<td>Signal Transduction in Mammalian Cells</td>
</tr>
<tr>
<td>BIO SCI M121</td>
<td>Immunology with Hematology</td>
</tr>
<tr>
<td>BIO SCI M122</td>
<td>General Microbiology</td>
</tr>
<tr>
<td>BIO SCI M122L</td>
<td>Advanced Microbiology Laboratory</td>
</tr>
<tr>
<td>BIO SCI M123</td>
<td>Introduction to Computational Biology</td>
</tr>
<tr>
<td>BIO SCI M124A</td>
<td>Virology</td>
</tr>
<tr>
<td>BIO SCI M124B</td>
<td>Viral Pathogenesis and Immunity</td>
</tr>
<tr>
<td>BIO SCI M124L</td>
<td>Virus Engineering Laboratory</td>
</tr>
<tr>
<td>BIO SCI M125</td>
<td>Molecular Biology of Cancer</td>
</tr>
<tr>
<td>BIO SCI M137</td>
<td>Microbial Genetics</td>
</tr>
<tr>
<td>BIO SCI M143</td>
<td>Human Parasitology</td>
</tr>
<tr>
<td>BIO SCI M144</td>
<td>Cell Organelles and Membranes</td>
</tr>
<tr>
<td>BIO SCI N110</td>
<td>Neurobiology and Behavior</td>
</tr>
<tr>
<td>BIO SCI N113L</td>
<td>Neurobiology Laboratory</td>
</tr>
<tr>
<td>BIO SCI N153</td>
<td>Neuropharmacology</td>
</tr>
<tr>
<td>BIO SCI N154</td>
<td>Molecular Neurobiology</td>
</tr>
</tbody>
</table>
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

1  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**
- BIO SCI 93
- CHEM 1A
- WRITING 39B or HUMAN 1A
- PHRMSCI 1

**Winter**
- BIO SCI 94
- CHEM 1B
- WRITING 39C or HUMAN 1B
- Gen. Ed.

**Spring**
- CHEM 1C- 1LC
- MATH 2A
- HUMAN 1C (or Gen. Ed.)
- Gen. Ed.

#### Sophomore

**Fall**
- BIO SCI 97
- CHEM 51A- 1LD
- MATH 2B
- BIO SCI 194S

**Winter**
- BIO SCI 98
- CHEM 51B- 51LB
- STATS 7, 8, MATH 2D, or MATH 3A
- PHRMSCI 42

**Spring**
- Chem 1C- 1LC
- CHEM 51C- 51LC
- PHRMSCI 90
- Gen. Ed.

#### Junior

**Fall**
- PHRMSCI 120- 120L
- PHRMSCI 172
- PHYSICS 3A
- BIO SCI 100

**Winter**
- PHRMSCI 170A
- PHYSICS 3B- 3LB
- Gen. Ed.
- Elective

**Spring**
- PHRMSCI 170B
- PHRMSCI 173
- PHYSICS 3C- 3LC
- Elective

#### Senior

**Fall**
- PHRMSCI 171
- PHRMSCI 174- 174L
- Gen. Ed.

**Winter**
- PHRMSCI 177- 177L
- Gen. Ed.
- Elective

**Spring**
- PHRMSCI 176
- Gen. Ed.
- Elective

### Graduate Programs

**Andrej Luptak,** Graduate Program Advisor/Vice Chair of Graduate Programs for the Pharmaceutical Sciences Department

Graduate Student Affairs: 949-824-1991

The Department of Pharmacology and Pharmaceutical Sciences join forces to offer an interdisciplinary program leading to the Ph.D. degree in Pharmacological Sciences with a concentration in Pharmacology or in Pharmaceutical Sciences. For complete program information, see the Interdisciplinary Studies section of the Catalogue.

The Department also admits students through the Graduate Gateway Program in Medicinal Chemistry and Pharmacology (MCP). The one-year graduate MCP Gateway Program is designed to function in concert with selected department programs, including the Ph.D. in Pharmacological Sciences. Upon successful completion of the MCP curriculum at the end of their first year, students choose a faculty advisor who is affiliated with one of the participating departments, and transition into their “home” department to complete the remaining degree requirements. They will receive their
Ph.D. degree from the department of their chosen advisor. Detailed information is available at Department of Pharmaceutical Sciences website (http://www.pharmsci.uci.edu/graduate).

Faculty

Claudia Benavente, Ph.D. University of Arizona, Assistant Professor of Pharmaceutical Sciences

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; Pharmacology (chemical biology, organic and synthetic)

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 Pharmaceutical Sciences; 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; Biological Chemistry; 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, Ph.D. University of California, San Francisco, Vice Chair of the Undergraduate Program in Pharmaceutical Sciences and Associate Professor of Pharmaceutical Sciences; Ecology and Evolutionary Biology; Pharmacology

Young Jik Kwon, Ph.D. University of Southern California, Associate 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, Vice Chair of Graduate Programs in Pharmaceutical Sciences and Associate Professor of Pharmaceutical Sciences; Chemistry; Molecular Biology and Biochemistry (chemical biology)

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

Lawrence Plon, PHAR University of Southern California, Assistant Adjunct Professor of Pharmaceutical Sciences

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

Jennifer A. Prescher, Ph.D. University of California, Berkeley, Assistant 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. Schriner, 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

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

Sun (Coco) Yang, Pharm D. Chinese Academy of Medical Science & Peking Union Medical College, Assistant Adjunct Professor of Pharmaceutical Sciences

Weian Zhao, Ph.D. McMaster University, Assistant 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 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. Course may be offered online.

PHRMSCI 90. Speaking about Science. 4 Units.
Introductory courses in research, composition, organization, and delivery of informative and persuasive speeches for various purposes, including scientific talks. Includes strategies for reducing speaker apprehension.

Restriction: Pharmaceutical Sciences majors have first consideration for enrollment.

PHRMSCI 120. Human Physiology. 4 Units.
Focuses on anatomy and physiology—organism structure and function, respectively—as they relate to human diseases and their treatment. Prepares students for more advanced studies in pharmacology, medicinal chemistry, biopharmaceutics, and other disciplines encompassing pharmaceutical sciences.

Prerequisite: BIO SCI 99.
Overlaps with BIO SCI E109.

PHRMSCI 120L. Human Physiology Lab. 3 Units.
Through an active learning environment, provides practical knowledge of topics covered in Human Physiology as they relate to health care professions. Participation in group projects that strengthen basic laboratory skills and teach students to work more efficiently in a team.

Corequisite: PHRMSCI 120.
Prerequisite: BIO SCI 194S or 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. Course may be offered online.

Corequisite: CHEM 51C or CHEM H52C.
Prerequisite: (CHEM 51C or CHEM H52C) and (PHRMSCI 120 or BIO SCI E109).
Restriction: Pharmaceutical Science majors have first consideration for enrollment.

PHRMSCI 170B. Molecular Pharmacology II. 4 Units.
Mechanism-based overview of pharmacology and therapeutic drugs in the fields of autonomic nervous system, central nervous system, and antimicrobials.

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: BIO SCI 99 and as a prerequisite or corequisite: CHEM 51C or CHEM H52C.

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: 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 176. Ethics 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 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 Science 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-through put 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 Science 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 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. 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: MCP Gateway Program students 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: MCP Gateway Program students 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: MCP Gateway Program students 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 270. Advanced Pharmacology. 4 Units.
Provides a mechanism-based overview of pharmacology with strong emphasis on clinical application of pharmacology. Students will learn the most recent advances in pharmacology as they relate to drug discovery, development, and clinical application.

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.

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.

(Design units: 0)

Same as BME 216.

Restriction: Graduate student only.

PHRMSCI 280. 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 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 399. University Teaching. 1-4 Units.
Limited to Teaching Assistants.

Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.