Graduate Program in Pharmacological Sciences

Andrej Luptak, Graduate Program Director/Advisor for the Interdisciplinary Program
Graduate Student Affairs: 949-824-1991 (Program administered by the Department of Pharmaceutical Sciences)

Overview
The Departments of Pharmacology and Pharmaceutical Sciences offer an interdisciplinary program leading to a Ph.D. in Pharmacological Sciences. The Ph.D. prepares students for careers in academic research institutions, in the biotechnology and pharmaceutical industry, in federal and state agencies, and in private research institutions by providing a research-intensive approach to the study of pharmacology. Students applying to the Ph.D. program choose either a Concentration in Pharmaceutical Sciences or a Concentration in Pharmacology.

Faculty research programs in Pharmacological Sciences include molecular and cellular pharmacology, circadian rhythms, epigenetic modifications, neuropharmacology, psychopharmacology, cardiovascular pharmacology, the pharmacology of aging, structure-based drug design, screening-based drug discovery, medicinal chemistry, structural biology, natural product biosynthesis, and synthase engineering, cancer detection, prevention and therapy, gene regulation and intercellular signaling, computational biology and bioinformatics, and nanomedicine for targeted drug and gene delivery testing.

Program Requirements
Admission
A strong background in the physical and biological sciences is required for admission, including courses in mathematics, physics, chemistry, and biochemistry, with laboratory experience. The Graduate Record Examination (GRE) and Subject Test in Biology or Chemistry are required for direct admission into the Pharmacology Concentration. The Pharmaceutical Sciences Concentrations requires the GRE test and recommends a Subject Test in Biology, Chemistry, Biochemistry, or Cell & Molecular Biology. Students admitted into the one-year INP gateway program and who complete all of its requirements may transfer into the Pharmacology Concentration in the Pharmacological Sciences Ph.D. program at the end of their first academic year. Similarly, students completing all MCP gateway requirements may transfer into the Pharmacological Sciences Ph.D. program, either concentration, at the end of their first year of study. All gateway students must have chosen a Doctoral Advisor by mutual agreement no later than the end of the first year, prior to transferring into the Pharmacological Sciences program.

Course Requirements
The primary difference between the two concentrations are the first-year course requirements, which in the Pharmacology Concentration focuses on mainline pharmacology topics while the Pharmaceutical Sciences Concentration encompasses a broad range of allied fields. Courses are offered by faculty from both departments in the Pharmacological Sciences program.

Coursework Requirements - Pharmacology Concentration: New students admitted directly into the Pharmacology Concentration are subject to the coursework requirement as listed below.

Required Courses:

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>PHARM 241</td>
<td>Advanced Topics in Pharmacology</td>
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<tr>
<td>PHARM 251</td>
<td>Experimental Pharmacology</td>
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<tr>
<td>PHARM 254</td>
<td>Introduction to Pharmacology</td>
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<tr>
<td>PHARM 255</td>
<td>Chemical Transmission</td>
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<tr>
<td>PHARM 256</td>
<td>Experimental Design for Pharmacologists</td>
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<tr>
<td>PHARM 257</td>
<td>Ethics in Research</td>
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<tr>
<td>PHARM 298</td>
<td>Seminar</td>
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<tr>
<td>PHARM 299</td>
<td>Research</td>
</tr>
<tr>
<td>PHYSIO 206A</td>
<td>Introduction to Medical Physiology</td>
</tr>
<tr>
<td>PHYSIO 206B</td>
<td>Introduction to Medical Physiology</td>
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</tbody>
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Courses from in the Pharmaceutical Sciences Concentration required course list may be substituted for some of the Pharmacology Concentration required courses with the consent of the Concentration Advisor, according to the interests of the student.

Students who complete all requirements of the one-year INP or MCP gateway programs qualify to transfer into the Pharmacology Concentration at the end of their first academic year. These gateways have different first year requirements. Students entering the concentration from a gateway are required to pass the Comprehensive Exam.

Coursework Requirements - Pharmaceutical Sciences Concentration: New students admitted directly into the Pharmaceutical Sciences Concentration are required to take three courses chosen from the list below, and three electives chosen from 1) the same list, 2) from the Pharmacology
Concentration required courses above, and/or 3) from the MCP electives list. Electives must be approved by the Pharmaceutical Sciences Concentration Advisor. Coursework must also include training in the ethical conduct of research (e.g., PHARM 257 or equivalent).

Required course list (must choose three from the following list, plus three electives):

Choose three of the following plus three electives:

<table>
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<tr>
<td>PHARM 254</td>
<td>Introduction to Pharmacology</td>
</tr>
<tr>
<td>PHARM 255</td>
<td>Chemical Transmission</td>
</tr>
<tr>
<td>PHRMSCI 223</td>
<td>Biological Macromolecules</td>
</tr>
<tr>
<td>PHRMSCI 270</td>
<td>Advanced Pharmacology</td>
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<tr>
<td>PHRMSCI 272</td>
<td>Special Topics in Pharmaceutical Sciences</td>
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<tr>
<td>PHRMSCI 274</td>
<td>Nanomedicine</td>
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<tr>
<td>PHRMSCI 277</td>
<td>Medicinal Chemistry</td>
</tr>
<tr>
<td>PHRMSCI 278</td>
<td>Stem Cell Therapy</td>
</tr>
<tr>
<td>PHRMSCI 298</td>
<td>Research Seminar</td>
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</tbody>
</table>

Students who complete all requirements of the one-year MCP gateway program qualify to transfer into the Pharmaceutical Sciences Concentration at the end of their first academic year. The MCP gateway has different first-year requirements. Students entering the concentration from a MCP gateway are required to pass the Pharmacological Sciences Comprehensive Exam. In addition, MCP students who have passed fewer than the six courses required for the concentration during the first-year must bring the total up to six by the end of the second year (the full year of PHRMSCI 250A-PHRMSCI 250B-PHRMSCI 250C may be counted as one course for this purpose).

Comprehensive Exam

After completion of first year courses (whether in the concentration itself or one of the gateways), each student must pass a Comprehensive Exam covering first year coursework subjects. It will be offered once per year during the summer and normally will taken prior to the second year. It may be deferred to the following year only under unusual circumstances and with the prior approval of the Graduate Advisor. There will be a single Comprehensive Exam offered, covering subjects appropriate for students in either concentration. Each candidate for the Ph.D. must pass the Comprehensive Exam or equivalent no later than the end of their second year.

Advancement to Candidacy

Upon completion of first-year course requirements, in order to be recommended for candidacy, each student will take a written qualifying examination set by the program faculty to determine competence in pharmacological sciences. After completing this requirement successfully, the student will complete an oral qualifying examination in accordance with Graduate Council procedures. Advancement normally will take place no earlier than the sixth quarter or later than the ninth; exceptions must be approved by the Pharmacological Sciences and Concentration Advisor. For each student, the Graduate Advisor will assign four Advancement-to-Candidacy Committee members chosen from faculty of both departments/concentrations, plus the required outside member.

Dissertation

A three-member Doctoral Committee formed from the Advancement to Candidacy Committee will meet with the candidate annually to assess and guide the student's progress toward completion of the dissertation. When the student's research advisor and Doctoral Committee members determine that a sufficient body of original research has been completed, the student will prepare the dissertation for a public defense before the Doctoral Committee.

Final Examination

Upon completion of the dissertation the student will take a public oral examination on the content of his or her dissertation or related topics. The examination will be conducted by the student's Doctoral Committee.

Faculty

Geoffrey W. Abbott, Ph.D. University of London, *Professor of Pharmacology; Physiology and Biophysics*

Amal Alachkar, Ph.D. University of Manchester, *Associate Adjunct Professor of Pharmacology*

James D. Belluzzi, Ph.D. University of Chicago, *Adjunct Professor of Pharmacology*

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

Stephen C. Bondy, Ph.D. University of Birmingham, *Professor of Medicine; Environmental Health Sciences; Pharmacology; Program in Public Health*

Emiliana Borrelli, Ph.D. University of Strasbourg, *Professor of Microbiology and Molecular Genetics; Pharmacology*
Catherine M. Cahill, Ph.D. Dalhousie University, Acting Associate Professor of Anesthesiology and Perioperative Care; Anesthesiology and Perioperative Care; Pharmacology

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

John Charles Chaput, Ph.D. University of California, Riverside, Professor of Pharmaceutical Sciences

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)

Sue P. Duckles, Ph.D. University of California, San Francisco, Professor Emerita of Pharmacology

Frederick J. Ehlert, Ph.D. University of California, Irvine, Professor of Pharmacology

Pietro R. Galassetti, Ph.D. Vanderbilt University, Associate Professor of Pediatrics; Pharmacology

Kelvin W. Gee, Ph.D. University of California, Davis, Professor of Pharmacology

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)

Naoto Hoshi, Ph.D. Kanazawa University, Assistant Professor of Pharmacology; Physiology and Biophysics

Mahtab F. Jafari, Ph.D. University of California, San Francisco, Vice Chair and Professor of Pharmaceutical Sciences; Ecology and Evolutionary Biology; Pharmacology

Diana N. Krause, Ph.D. University of California, Los Angeles, Adjunct Professor of Pharmacology

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)

Arthur D. Lander, Ph.D. University of California, San Francisco, Donald Bren Professor and Professor of Developmental and Cell Biology; Biomedical Engineering; Logic and Philosophy of Science; Pharmacology (systems biology of development, pattern formation, growth control)

Frances L. Leslie, Ph.D. University of Aberdeen, Professor of Pharmacology; Anatomy and Neurobiology

Ellis Levin, M.D. Thomas Jefferson University, Jefferson Medical College, Professor in Residence of Medicine; Biological Chemistry; Pharmacology

Shahrdad Lotfipour, Ph.D. University of California, Irvine, Assistant Professor of Pharmacology

Sandra E. Loughlin-Burkhead, B.A. University of California, San Diego, Specialist of Pharmacology

Zhigang D. Luo, Ph.D. State University of New York at Buffalo, Professor of Anesthesiology and Perioperative Care; Pharmacology

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, Associate Professor of Pharmaceutical Sciences; Chemistry (chemical biology, physical chemistry and chemical physics, theoretical and computational)

Daniele Piomelli, Ph.D. Columbia University, Louise Turner Arnold Chair in the Neurosciences and Professor of Anatomy and Neurobiology; Biological Chemistry; Pharmacology

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 Chancellor's Professor of Molecular Biology and Biochemistry; Chemistry; Pharmaceutical Sciences; Physiology and Biophysics (chemical biology)

Ralph E. Purdy, Ph.D. University of California, Los Angeles, Professor Emeritus of Pharmacology
Samuel E. Schriner, Ph.D. University of Washington, Lecturer with Potential Security of Employment of Pharmaceutical Sciences
Stefano Sensi, M.D. Gabriele D’Annunzio University of Chieti Pescara, Associate Adjunct Professor of Neurology; Pharmacology
Robert Spitale, Ph.D. University of Rochester, Assistant Professor of Pharmaceutical Sciences
Larry Stein, Ph.D. University of Iowa, Professor Emeritus of Pharmacology
Jeffrey R. Suchard, M.D. University of California, Los Angeles, Professor of Emergency Medicine; Pharmacology
Weian Zhao, Ph.D. McMaster University, Associate Professor of Pharmaceutical Sciences; Biomedical Engineering (stem cell therapy, diagnostics, biosensors, nano- and microtechnology, aptamers)
Qun-Yong Zhou, Ph.D. Oregon Health & Science University, Professor of Pharmacology
Xiaolin Zi, Ph.D. Shanghai University, Associate Professor of Urology; Pharmacology

Affiliate Faculty
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)
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)
Anthony D. Long, Ph.D. McMaster University, Professor of Ecology and Evolutionary Biology; Pharmaceutical Sciences
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
Shiou-Chuan (Sheryl) Tsai, Ph.D. University of California, Berkeley, Professor of Molecular Biology and Biochemistry; Chemistry; Pharmaceutical Sciences