

# PHARMACOLOGY AND NEUROSCIENCE

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## Graduate Study in Pharmacology & Neuroscience

The Department of Pharmacology and Neuroscience offers programs of study culminating in the Ph.D. and M.S. degrees. Upon successful completion of the chosen program, the individual will be prepared for careers in research and education in the field of Pharmacology & Neuroscience. Acquiring expertise in the broad field of pharmacology requires an interdisciplinary approach; and therefore, the student may choose to concentrate his or her studies in numerous specialized areas of pharmacology. These areas include:

- Neuropharmacology
- Autonomic pharmacology,
- Cardiovascular pharmacology
- Cancer pharmacology,
- Exocrine pharmacology
- Immunopharmacology
- Renal pharmacology
- Toxicology

Specific areas of interest include drug-receptor interactions, signal transduction, ion channel function, and molecular and tissue system approaches to studying receptors, signaling and gene function. It is important to note that the interdisciplinary nature of pharmacology offers the student a broad range of options for research endeavors and might include investigations of neurodegenerative diseases, epilepsy, asthma, cancer, teratogenicity of environmental toxins and pharmaceuticals, drugs of abuse, and pulmonary hypertension.

### Mission Statement

The mission of the Department of Pharmacology & Neuroscience graduate programs is to create an intellectually rich environment in which students and trainees are able to develop fully their creative and scientific potential.

### Program Goals

The student will carry out the following objectives for completion of the graduate program in pharmacology & neuroscience:

1. Demonstrate an advanced knowledge of pharmacology and a detailed comprehension of the student's specialized field of pharmacology.
2. Illustrate critical and analytical thinking in studying literature, developing hypotheses, executing research, solving scientific problems, and interpreting results.
3. Effectively communicate research results and scientific information in an oral as well as verbal format to both scientific and lay audiences.
4. Demonstrate the ability to independently propose, defend and conduct research in pharmacology for the benefit of science and in the service to others.
5. Display ethical behavior with regard to professional conduct.

6. Exhibit skills that will educate and train others in the field of pharmacology.

### Admission Requirements

Factors taken into consideration during admission decisions (not necessarily listed in order of importance):

#### Educational Background:

Bachelor of Art or Science from an accredited college/university. Applicants should have some undergraduate training in the life sciences, but a STEM-based undergraduate degree is not required. In general, students with strong biology, chemistry, physics, engineering, computer science or mathematics backgrounds are most successful and encouraged to apply. Opportunities to remedy deficiencies in basic undergraduate courses exist in the first year of graduate school.

#### Undergraduate Performance:

Ideally, the undergraduate record should be strong in all areas. However, evidence of ability to perform well in all science courses, particularly those stressing quantitative skills, is most important. Our program requires a minimum 3.0 GPA for admission.

#### Research Experience:

Research experience is not required; however, it is recommended as it demonstrates an experience-based understanding of and commitment to a research career.

#### Recommendations:

Strong statements of support from three persons in a position to evaluate the applicant's potential for success as a graduate student have significant impact on admissions decisions. Letters from instructors supervising research are strongly encouraged.

#### GRE scores:

The applicant must submit official GRE scores obtained in the last five years. A strong performance on the GRE carries considerable weight. A specific subject GRE is not required, but if submitted allowances are made for differences in undergraduate preparation. Use school code 6121 for this program.

#### Personal Statement:

The personal statement should articulate and give evidence of a strong commitment to research. Mention of specific, well-focused interests and descriptions of specific research experiences or activities are useful, but not essential, in applicant evaluation. Overly vague statements may be detrimental. The statement offers the applicant a unique opportunity to demonstrate critical thinking ability.

A personal interview may be requested in addition to the above requirements. The interview may be conducted in-person or virtually.

### Application and Admission Timeline

All completed applications (which MUST include letters of recommendation) received through February 1<sup>st</sup> are guaranteed to be reviewed on this schedule for entrance for the fall semester. Applications received after the February 1<sup>st</sup> date will need to reapply for the following year.

January 2<sup>nd</sup>: Review of completed applications begins.

February 1<sup>st</sup>: Application deadline.

January-March: Interviews for applicants.

January 15<sup>th</sup>-April 10<sup>th</sup>: Applicants are notified of admissions decision.

April 15<sup>th</sup>: Decision date for acceptance of admission offers by applicants.

August: Program Starts

## Degree Program in Pharmacology & Neuroscience

### Doctor of Philosophy (Ph.D.) Program

The objectives of this program are to prepare highly qualified students for careers in research and teaching in the field of pharmacology & neuroscience. Ph.D. candidates will be required to demonstrate a broad knowledge of the field of pharmacology and detailed expertise in their research area. Graduate studies in pharmacology will provide graduate students with a comprehensive educational program in pharmacology. During the program of studies, the graduate student will work closely with his or her mentor and department faculty to master the program goals. These goals include student demonstration of an advanced mastery of pharmacology & neuroscience as evidenced by the ability to critically judge research in the field, initiate scholarly activity based on current literature, and maintain the highest ethical and professional standards.

- Ph.D., Pharmacology & Neuroscience (<http://catalog.creighton.edu/graduate/graduate-programs-courses/pharmacology/pharmacology-phd/>)

### Master of Science (M.S.) Program

The objectives of the program include preparation of the student for the following career paths:

1. Teaching of Pharmacology and/or Neuroscience at the undergraduate level
2. Participation in team research in universities, industry or government.

In addition, the M.S. program is an excellent method for students to receive additional preparation for pursuit of a M.D. or Ph.D. degree. The Master's program emphasizes a combination of course work, laboratory experience and training in the scientific method.

- Master of Science (M.S.), Pharmacology & Neuroscience

## Courses

### PHR 531. Topics in Pharmacology and Drug Discovery Journal Club. 1 credit. FA

The most ground-breaking studies (classic through recent) in the field of pharmacology are discussed in a round-table format. Students will learn the basics of the scientific method, study design, experimental technique theory and general chemical principles, physiochemical properties and drug-receptor interactions used to derive structure-activity relationships for important drug classes and predict biological properties.

### PHR 532. Hot Topics in Neuroscience Journal Club. 1 credit. SP

Continuation of PHR 531. P. DC.

### PHR 537. Fundamentals of Neuroscience. 3 credits. FA, OD

This course will provide a detailed exploration of cellular, molecular and systems neuroscience and provide foundational knowledge necessary to becoming a neuroscientist. The class format will include didactic lectures with open discussions and self-directed computer simulated learning activities.

### PHR 595. Directed Independent Study. 0-5 credits. FA, OD, SP, SU

Supervised independent projects that may include laboratory work, assigned readings, research papers, etc. Available in autonomic pharmacology, cardiovascular pharmacology, exocrine pharmacology, and neuropharmacology. P. Undergraduate or Gr. stdg. and DC.

### PHR 597. Directed Independent Research. 1-4 credits. FA, OD, SP, SU

Supervised independent research for motivated students to become involved in ongoing original research projects of the pharmacology faculty. P. Undergraduate or Gr. stdg. and DC.

### PHR 631. Medical Pharmacology I. 5 credits. FA

Human pharmacology and therapeutics. Lectures, conferences, and demonstrations.

### PHR 632. Medical Pharmacology II. 5 credits. SP

A continuation of Medical Pharmacology I.

### PHR 650. Introduction to Neuropharmacology. 3 credits. SP

This course is designed for graduate students with a background in biology, chemistry, biochemistry, psychology, pre-pharmacy and/or pre-medicine. Pharmacology is more than the study of the mode of action of drugs. It is a science which uses the basic concepts of biology and chemistry to determine how drugs affect the organism; it gives a unique perspective in understanding how cells, organ systems, and organisms function. Unlike other basic science fields, pharmacology is a special field in which one can systematically investigate the mechanism for a biological event—from the molecular level to the whole animal. Pharmacology also allows us to study how biological systems fail to function, providing information on the etiology of disease. Pharmacologic research is essential for the development, testing and clinical use of drugs to treat disease.

### PHR 667. Developmental Biology. 4 credits.

This is the graduate course designation for the undergraduate course BIO 467. Students are expected to fulfill all of the requirements for the undergraduate course (including the laboratory). To fulfill the graduate component of this course, students will write a research review article throughout the semester under the supervision of Dr. Kristina Simeone (and their research PI) that bridges material learned in class and their research.

### PHR 711. Receptor and Molecular Pharmacology. 3 credits. AY, SP

Exhaustive treatment of receptor and molecular pharmacology that considers historical development of concepts, radioligand receptor binding, drug-receptor interactions, receptor characterization and isolation, and signal transduction. P. PHS 601; BCH 600 or DC.

### PHR 715. Foundational Science. 5 credits. OD

This intensive foundation course introduces the students to the scientific fields of cell and molecular biology, genetics, immunology and pharmacology.

### PHR 717. Neuroscience and Molecular Pharmacology Laboratory. 2 credits. FA, OD

This laboratory bootcamp will introduce students to basic laboratory techniques followed by focused, hands-on experiences in performing advanced techniques in neurophysiology and pharmacology.

**PHR 750. Research Discussions In Pharmacology & Neuroscience. 1 credit. FA, SP, SU**

Students will meet with their course director once weekly to discuss laboratory research topics as assigned by the course director. Topics will usually be pertinent to the research activity of the course director. Instruction will be given through a combination of didactics, small group sessions, student presentations and independent study. P. DC.

**PHR 760. Research Rounds In Pharmacology & Neuroscience. 1-3 credits. FA, SP**

This course will teach students how to formally present their research progress and results, and will provide students with frequent feedback by faculty members and fellow students. P. DC.

**PHR 790. Research Laboratory Rotations. 1-5 credits. FA, OD, SP, SU**

Laboratory rotations in which graduate students perform or observe methods used in pharmacological research. The value of the method and its application to the research efforts of the pharmacology faculty are described in detail. P. DC.

**PHR 791. Pharmacology & Neuroscience Seminar. 1 credit. FA, SP**

Seminars in selected subjects for pharmacology & neuroscience graduate students.

**PHR 794. Special Topics in Pharmacology & Neuroscience. 1-4 credits. FA, OD, SP, SU**

**PHR 795. Directed Independent Study. 1-6 credits. FA, SP, SU**

**PHR 797. Master's Directed Independent Research. 1-6 credits. FA, SP, SU**

Supervised original research. P. DC.

**PHR 799. Master's Thesis. 1-6 credits. FA, SP, SU**

Review of the literature and research data; writing of the thesis. Student must register for this course in any term when engaged in formal preparation of the Master's thesis; however, six credit hours are the maximum applicable toward the degree. P. DC.

**PHR 897. Doctoral Directed Independent Research. 1-6 credits. FA, SP, SU**

Supervised original research. P. DC.

**PHR 899. Doctoral Dissertation. 1-6 credits. FA, SP, SU**

This investigative work is the principal area of research carried out by the candidate during doctoral studies. It is conducted under the direct supervision of the candidate's major adviser and dissertation committee in preparation for the doctoral dissertation. Twenty credit hours are the maximum applicable toward the degree. Students will register for this course during formal preparation of the doctoral dissertation. P. PHR 897.