

PHARMACOLOGY (PHMCOL-M)

PHMCOL-M/PHM SCI 522 – PHARMACOLOGY II

3-4 credits.

Pharmacological actions of important drugs, including hematopoietic, thrombolytic, antihyperlipidemic, immunopharmacologic, anticancer, anti-inflammatory, diuretic, antihypertensive, antianginal, and anti-arrhythmic agents, and agents used to treat congestive heart failure.

Requisites: PHM SCI 521

Repeatable for Credit: No

Last Taught: Spring 2026

Learning Outcomes: 1. Recall the names of different drugs, and be able to link these drug names to not only specific uses, but also to more general concepts about physiology, disease, and drug mechanism of action
Audience: Undergraduate

2. Describe and differentiate the pharmacology of drugs that act on organ systems, including the endocrine, gastrointestinal, cardiovascular, renal, hematopoietic, and immune systems

Audience: Undergraduate

PHMCOL-M/B M E/MED PHYS/PHYSICS/RADIOL 619 – MICROSCOPY OF LIFE

3 credits.

Survey of state of the art microscopic, cellular and molecular imaging techniques, beginning with subcellular microscopy and finishing with whole animal imaging.

Requisites: PHYSICS 104, 202, 208, or 248 or PHYSICS/MED PHYS 265

Course Designation: Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2025

PHMCOL-M/M&ENVTOX/ONCOLOGY/PHM SCI/POP HLTH 625 – TOXICOLOGY I

3 credits.

Basic principles of toxicology and biochemical mechanisms of toxicity in mammalian species and man. Correlation between morphological and functional changes caused by toxicants in different organs of the body.

Requisites: (BIOCHEM 501 or 508) and (ANAT&PHY 335, 435, or (BIOCORE 485 and 486)) and PATH 404; or graduate/professional standing

Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2025

Learning Outcomes: 1. Discuss the physiology and pathology of toxicology, understanding the basic fundamentals of toxicology and toxic agents

Audience: Both Grad & Undergrad

2. Demonstrate metabolism and breakdown of toxicants using a given dataset

Audience: Both Grad & Undergrad

3. Recognize various experimental models to obtain scientific results

Audience: Both Grad & Undergrad

4. Implement knowledge to design experiments applicable to one's own research

Audience: Both Grad & Undergrad

5. Critique an example of toxicology in media and develop a presentation of this example

Audience: Both Grad & Undergrad

6. Explore new areas to assist in career development via journal club

Audience: Graduate

PHMCOL-M/M&ENVTOX/PATH/PHM SCI/POP HLTH 626 – TOXICOLOGY II

3 credits.

Survey of the basic methods and fundamental biochemical mechanisms of toxicity. Toxicity in mammalian organ systems, techniques for evaluating toxicity, as well as mechanisms of species specificity, and environmental interactions (with toxicant examples) are presented.

Requisites: POP HLTH/M&ENVTOX/ONCOLOGY/PHM SCI/PHMCOL-M 625

Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2026

Learning Outcomes: 1. Explain and identify the effects of toxicants on specific organs within the human body

Audience: Both Grad & Undergrad

2. Demonstrate metabolism and reactions of toxicants within organ systems using a given dataset

Audience: Both Grad & Undergrad

3. Classify different means of risk assessment and the conceptual rationale behind these methods

Audience: Both Grad & Undergrad

4. Implement knowledge to design experiments applicable to one's own research

Audience: Both Grad & Undergrad

5. Relate specific organ concepts with conceptual examples from M&ENVTOX 625 to enhance scientific understanding

Audience: Undergraduate

6. Appraise concepts to research to identify future research concepts.

Audience: Graduate

PHMCOL-M 699 – INDEPENDENT STUDY

1-3 credits.

Directed study projects for juniors and seniors.

Requisites: Consent of instructor

Course Designation: Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Fall 2025

Learning Outcomes: 1. Apply concepts learned in coursework to real life situations

Audience: Undergraduate

2. Read and effectively search scientific literature

Audience: Undergraduate

3. Develop critical, analytical, and independent thinking skills

Audience: Undergraduate

PHMCOL-M 715 – GRANT WRITING

1 credit.

Develop a predoctoral fellowship application based on the student's proposed thesis project. Receive input on ideas and writing, both from the instructor and peers.

Requisites: Graduate/professional standing

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2026

Learning Outcomes: 1. Write a cogent specific aims page for a grant proposal.

Audience: Graduate

2. Summarize background information in a coherent and concise manner, highlighting the significance of research being proposed.

Audience: Graduate

3. Outline methodologies to address a specific set of research questions.

Audience: Graduate

4. Read and critique grant proposals written by peers.

Audience: Graduate

5. Design experiments which are properly controlled and which use appropriate statistical methods of data analysis.

Audience: Graduate

PHMCOL-M 739 – RIGOR, REPRODUCIBILITY AND BECOMING AN EFFECTIVE RESEARCHER

1 credit.

Focuses on two of the cornerstones of science advancement, which are rigor in designing and performing scientific research and the ability to reproduce biomedical research findings. Emphasizes the application of rigor that ensures robust and unbiased experimental design, methodology, analysis, interpretation, and reporting of results. Highlights topics of particular importance to first year graduate students, including the development of effective presentation skills, communication in a professional setting, and a strong mentor-mentee relationship.

Requisites: Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2025**Learning Outcomes:** 1. Select a well-controlled experimental design that is appropriate to answer a research question

Audience: Graduate

2. Consider all relevant biological variables to include in the experimental design

Audience: Graduate

3. Authenticate key biological and chemical resources used in experiments

Audience: Graduate

4. Perform statistical analyses appropriate for the experimental design

Audience: Graduate

5. Use transparency in reporting and publishing results, so that others may reproduce and extend the findings

Audience: Graduate

6. Develop skills to cope with the rigors of a graduate education in the pharmacological sciences

Audience: Graduate

PHMCOL-M 781 – MOLECULAR AND CELLULAR PRINCIPLES IN PHARMACOLOGY

4 credits.

Provides an in-depth introduction to the molecular and cellular principles of pharmacology. Emphasis is on the mechanisms of drug and small molecule action in cells, with a particular focus on downstream signaling pathways, second messenger systems, protein kinase cascades, and the regulation of gene transcription.

Requisites: Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2026**Learning Outcomes:** 1. Recognize the fundamental principles of drug actions at their target sites (e.g. receptors, enzymes, etc)

Audience: Graduate

2. Understand the various mechanisms by which drugs can mediate their pharmacological effect

Audience: Graduate

3. Describe how drugs mimic or modify physiological function, including the various actions and clinical uses

Audience: Graduate

4. Describe the major classes of therapeutic drugs that affect the primary systems within the body

Audience: Graduate

5. Choose a relevant experimental system to test experimental hypotheses (e.g. in vitro or in vivo; animal species, etc)

Audience: Graduate

6. Design experiments which are properly controlled and which use appropriate statistical methods of data analysis

Audience: Graduate

PHMCOL-M 875 – SPECIAL TOPICS IN PHARMACOLOGY

1-3 credits.

Special topics in pharmacology. Topics may vary.

Requisites: Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Spring 2022**Learning Outcomes:** 1. Apply, analyze, or evaluate advanced theories, concepts, or methods in pharmacology

Audience: Graduate

PHMCOL-M 901 – SEMINAR AND JOURNAL CLUB

1-2 credits.

Students and staff present research reports of current interest.

Requisites: Graduate/professional standing

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2026

Learning Outcomes: 1. Organize and present a research presentation, which includes background information, data slides, conclusions, and future directions

Audience: Graduate

2. Offer constructive feedback to peers on research presentation style and information delivery

Audience: Graduate

3. Design experimental approaches that are properly controlled and use appropriate statistical methods of data analysis

Audience: Graduate

4. Identify relevant experimental systems to test experimental hypotheses (e.g. in vitro or in vivo; animal species, etc)

Audience: Graduate

PHMCOL-M 990 – RESEARCH

1-12 credits.

Research facilities of the department available to qualified students.

Requisites: Graduate/professional standing

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2026

Learning Outcomes: 1. Exhibit a broad understanding of general pharmacology principles

Audience: Graduate

2. Conduct independent research using a variety of approaches

Audience: Graduate

3. Think critically to address research challenges

Audience: Graduate

4. Exhibit and foster professional and ethical conduct in their research

Audience: Graduate

5. Collaborate with other investigators within or outside the thesis lab

Audience: Graduate