

Pharmacology And Toxicology

Department of Pharmacology and Toxicology

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Overview

Pharmacology, simply defined, is the study of the interaction of drugs with living systems. This subject has a fascinating history and continues to be relevant in modern times. Pharmacology deals with a number of questions, for example: What is the molecular site of action? What are the changes caused by a drug in the normal function of tissues and organs? What is the relationship between the dose of a drug and its effect? How do drugs produce their effects? What happens to drugs once they enter the body? Since a drug is traditionally defined as a chemical that interacts with living systems, this subject has a very broad relevance from its obvious importance in the diagnosis and treatment of disease to the impact of abused substances or environmental chemicals on health. Students in the department are encouraged to do research projects with the faculty who have interdisciplinary research interests in neuropharmacology, behavioral pharmacology, toxicology, pharmacogenomics & toxicogenomics.

The broad academic background provides students with a wide array of career opportunities. Many graduates enter medical or dental schools or pursue graduate studies in pharmacology or other biochemical sciences. Pharmacology graduates find employment in technical, production/analytical, or sales positions as research scientists or drug information specialists in the pharmaceutical industry, government, university laboratories, and hospitals. Students have also pursued careers in law and management following completion of their BS degree in pharmacology.

About our Degrees

Acceptance Criteria - BS

BS Degree

The BS in Pharmacology & Toxicology is offered to undergraduates who are interested in gaining a comprehensive understanding of the actions of drugs and toxic agents on living cells and tissues.

Acceptance Criteria

The Admissions Committee will review the applicant's prerequisite GPA, entire transcript (including non-UB courses) and research experience. Applicants must have a minimum pre-requisite GPA of 2.5 to be considered, but this does not guarantee acceptance into the program.

The program is very competitive as the department receives about 50-80 applications and enrolls about 35-40 per year. The Fall 2011 incoming class had an average prerequisite GPA of 3.316.

Advising notes:

The department encourages students to apply by February 14th of their sophomore year. Students can obtain an application on the Department website at: <http://medicine.buffalo.edu/education/undergraduate/apply.html>. The department strongly encourages all students to complete all general education requirements before they apply to the BS degree program.

Students admitted and matriculated into the BS Program in Pharmacology & Toxicology have the opportunity to apply for a joint BS/MS Program during the spring semester of their junior year.

Students admitted to the BS/MS Program begin their work as graduate students during the fall of the 4th year. This program is designed so that students can get a combined degree in 5 years.

Acceptance Criteria - BS/MS

Minimum GPA of 3.0 overall

Applicants must have a minimum overall GPA of 3.0 (B) to be considered, but this does not guarantee acceptance into the program. Must be a registered University at Buffalo PMY major during their junior year

Advising notes:

The department encourages students to apply by February 14th of their junior year. Students should contact the departmental office to obtain

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application instructions. In addition to the application, students must submit three letters of recommendation and a personal statement.

Minor

A Minor in Pharmacology and Toxicology is offered to science and non-science majors interested in acquiring an introductory understanding of the actions of drugs and toxic agents on living cells and tissues.

Acceptance Criteria - Minor

Minimum GPA of 2.5 in prerequisite courses.
Minimum GPA of 2.0 overall in minor to graduate.

Acceptance Information (For BS)

Number of accepted majors/year: 40

Total number of majors currently enrolled: 86

Number of applicants (2011-2012): Approximately 150 applications total for both major and minor

Degree Requirements

Please see [Degrees and Policies](#).

About our Courses

The typical class size for upper level/advanced courses is 20-130. A T.A. is used for our upper level-courses.

Although not required for majors, [PMY 302](#) and [PGY 300](#) are good courses for those students who are interested in exploring Pharmacology and Toxicology. These courses are required for the minor.

For course descriptions, please see [Courses](#).

About our Faculty

Our faculty has extraordinarily broad and diverse areas of research interest. These areas include, neuropharmacology, behavioral pharmacology, hormone mechanisms, drug use and abuse, toxicology, biophysics and genetics of ion channels, pharmacogenomics & toxicogenomics, circadian rhythms, neuroscience, and cancer.

The Director of Undergraduate Studies, Dr. James Olson, is regularly available to discuss the program.

See a list of our [Undergraduate Faculty](#).

Transfer Policy

Transfer students should obtain admission to the university through the Office of Admissions before applying to the Department of Pharmacology and Toxicology. Students must complete their university application (which includes sending official transcripts of the fall semester work) prior to February 14. The department will evaluate prerequisite courses previously taken as possible substitutes for required courses.

Extracurricular Activities

Pharmacology and Toxicology Club.

See the [UB Student Association](#).

Practical Experience and Special Academic Opportunities

Outstanding Senior Award - Presented to the student who has maintained a high level of academic performance throughout their undergraduate

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career.

Independent Study and Undergraduate Research are available with permission of an instructor.

Career Information and Further Study

The broad academic background provides students with a wide array of career opportunities. Many graduates enter medical or dental schools or pursue graduate studies in pharmacology or other biochemical sciences. Pharmacology graduates find employment in technical, production/analytical, or sales positions as research scientists or drug information specialists in the pharmaceutical industry, government, university laboratories, and hospitals. Students have also pursued careers in law and management following completion of their BS degree in pharmacology.

Alumni in Pharmacology and Toxicology have been employed in the following fields:

- Administrator
- Armed forces services
- Biochemist
- Educator
- Health careers
- Manufacturer's representative
- Marketing
- Pharmacologist
- Research scientist
- Sales
- Toxicologist

A large percentage of graduates go on to graduate and professional schools.

Degree Options

In addition to the BS program, the department offers a combined BS/MS degree that provides the laboratory research training and advanced courses needed for entry-level professional positions in the pharmaceutical industry and in academia. In this combined degree program, students have the opportunity to earn the combined degree in five years versus the usual six years needed to obtain both a BS and an MS degree. The program is available only to registered Pharmacology and Toxicology (PMY) majors during their junior year at the University at Buffalo.

Degrees Offered

Undergraduate: BS, Minor

Combined: BS/MS

Graduate: MA, PhD, MD/PhD

Links to Further Information About this Program

- [Undergraduate Catalog](#)
- [Undergraduate Admissions](#)
- [Graduate Admissions](#)
- [Department of Pharmacology and Toxicology](#)
- [School of Medicine and Biomedical Sciences](#)

Pharmacology And Toxicology - B.S.

Acceptance Criteria

As part of the application review process the Admissions Committee will review the applicant's prerequisite GPA, entire transcript (including non-UB courses), research experience and other application materials.

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The Admissions Committee will look at the applicant's GPA for prerequisite courses and other accomplishments. Applicants must have a minimum prerequisite GPA of 2.5 to be considered, but this does not guarantee acceptance into the program.

The program is very competitive as the department receives about 50-80 applications and enrolls about 35-40 per year. The fall 2011 incoming class had an average prerequisite GPA of 3.316.

Advising Notes

The department encourages students to apply by February 14th of their sophomore year. Students can obtain an application on the department website at: www.buffalo.edu/smbps/pmy/education_BS_major.php.

The department strongly encourages all students to complete all general education requirements before they apply to the BS degree program.

Prerequisite Courses

[BIO 200](#) Evolutionary Biology

[BIO 201](#) Cell Biology

[CHE 101](#) General Chemistry or [CHE 105](#) Chemistry: Principles and Applications

[CHE 102](#) General Chemistry or [CHE 106](#) Chemistry: Principles and Applications

[CHE 201](#) Organic Chemistry

[CHE 202](#) Organic Chemistry

[MTH 121](#) Survey of Calculus and Its Applications I or [MTH 141](#) College Calculus I

[MTH 122](#) Survey of Calculus and Its Applications II or [MTH 142](#) College Calculus II

[PHY 101/PHY 151](#) College Physics I/Lab* or [PHY 107](#) General Physics I

[PHY 102/PHY 152](#) College Physics II/Lab* or [PHY 108/PHY 158](#) General Physics II/Lab*

Required Courses

[BCH 403](#) Principles of Biochemistry

[PMY 405](#) Principles of Pharmacology

[PMY 406](#) Principles of Pharmacology

[PMY 409](#) Experimental Pharmacology

[PMY 455](#) Toxicology Fundamentals

[BIO 302](#) Introduction to Molecular Biology

[PMY 311](#) Chemistry of Drug Action

[PGY 451](#) Human Physiology I

[PGY 452](#) Human Physiology II

Science electives**

Summary

Total required credit hours for the major...90-101

See [Baccalaureate Degree Requirements](#) for general education and remaining university requirements.

Recommended Sequence of Program Requirements

FIRST YEAR

Fall [BIO 200](#); [CHE 101](#) or [CHE 105](#); [MTH 121](#) or [MTH 141](#)

Spring [BIO 201](#); [CHE 102](#) or [CHE 106](#); [MTH 122](#) or [MTH 142](#)

SECOND YEAR

Fall [CHE 201](#); [PHY 101/PHY 151*](#) or [PHY 107](#)

Spring [CHE 202](#); [PHY 102/PHY 152*](#) or [PHY 108/PHY 158*](#)

THIRD YEAR

Fall [BCH 403](#), [PGY 451](#), science electives**

Spring [PGY 452](#), [PMY 311](#), [PMY 409](#), science electives**

FOURTH YEAR

Fall [PMY 405](#), [PMY 455](#), [BIO 302](#), science electives**

Spring [PMY 406](#), science electives**

*Only one (1) physics lab is required.

**13-23 credit hours of science electives are required; [STA 119](#) Statistical Methods or [PSY 207](#) Psychological Statistics is strongly recommended.

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Electives and Course Groupings

Students may choose from the following science electives:

[ANA 113](#) Anatomy
[APY 107](#) Introduction to Physical Anthropology
[APY 275](#) Introduction to Medical Anthropology
[APY 276](#) Introduction to Ethnomedicine
[BIO 319](#) Genetics
[BIO 328](#) General Physiology
[BIO 401](#) Advanced Biological Chemistry
[BIO 461](#) Basic Radiation Science
[BIO 468](#) Molecular Immunology
[BPH 303](#) Principles of Biophysics
[CHE 214](#) Analytical Chemistry
[CHE 312](#) Chemistry of Biological Systems
[CHE 349](#) Physical Chemistry for Life Sciences
[CSE 101](#) Computers A General Introduction
[MCH 300](#) Herbs and Phytomedicinals
[MIC 301](#) Fundamentals of Microbiology
[MIC 401](#) General Microbiology
[MIC 412](#) Fundamentals of Immunology
[MT 402](#) Fundamentals of Immunology
[MT 428](#) Forensic Science
[NTR 108](#) Human Nutrition
[NTR 401](#) Nutrition and Health
[PGY 405](#) Cell Physiology
[PGY 412](#) Applied Physiology
[PHI 337](#) Social and Ethical Values in Medicine
[PMY 498](#) Undergraduate Research
[PSY 207](#) Psychological Statistics
[STA 119](#) Statistical Methods

Pharmacology And Toxicology - B.S./M.S.

Acceptance Criteria

Minimum GPA of 3.0 overall.

Applicants must have a minimum overall GPA of 3.0 to be considered, but this does not guarantee acceptance into the program.

Must be a registered University at Buffalo PMY major during their junior year

Three (3) supportive letters of recommendation from the faculty.

A personal statement from the student.

The department encourages students to apply by February 14 of their junior year. Students should contact the departmental office to obtain application instructions.

Advising Notes

Applications are accepted only from registered University at Buffalo PMY majors during their junior year. The Graduate Record Exam is not a requirement for admission. Forms and applications should be filed by February 14.

Prerequisite Courses

[BCH 403](#) Principles of Biochemistry
[BIO 200](#) Evolutionary Biology
[BIO 201](#) Cell Biology
[CHE 101](#) General Chemistry or [CHE 105](#) Chemistry: Principles and Applications
[CHE 102](#) General Chemistry or [CHE 106](#) Chemistry: Principles and Applications
[CHE 201](#) Organic Chemistry
[CHE 202](#) Organic Chemistry
[PMY 311](#) Chemistry of Drug Action
[MTH 121](#) Survey of Calculus and Its Applications I or [MTH 141](#) College Calculus I
[MTH 122](#) Survey of Calculus and Its Applications II or [MTH 142](#) College Calculus II

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[PGY 451](#) Human Physiology I
[PGY 452](#) Human Physiology II
[PHY 101/PHY 151](#) College Physics I/Lab* or [PHY 107](#) General Physics I
[PHY 102/PHY 152](#) College Physics II/Lab* or [PHY 108/PHY 158](#) General Physics II/Lab*

Required Courses

[PMY 626](#) Toxicology Principles and Practice
[PMY 627](#) Target Organ Toxicity
[PMY 511](#) Principles of Pharmacology I
[PMY 512](#) Principles of Pharmacology II
[BIO 302](#) Introduction to Molecular Biology
[BMS 501](#) Cell Biology I
[BMS 506](#) Cell Biology IIB
[PHI 640](#) Graduate Research Ethics
[PMY 506](#) Pharmacology Seminar
Research credits**

Summary

Total required credit hours for the undergraduate portion...77-81

See [Baccalaureate Degree Requirements](#) for general education and remaining university requirements.

Recommended Sequence of Program Requirements

FIRST YEAR

Fall [BIO 200](#); [CHE 101](#) or [CHE 105](#); [MTH 121](#) or [MTH 141](#)
Spring [BIO 201](#); [CHE 102](#) or [CHE 106](#); [MTH 122](#) or [MTH 142](#)

SECOND YEAR

Fall [CHE 201](#); [PHY 101/PHY 151*](#) or [PHY 107](#)
Spring [CHE 202](#); [PHY 102/PHY 152*](#) or [PHY 108/PHY 158*](#)

THIRD YEAR

Fall [BCH 403](#), [MCH 311](#), [PGY 451](#), science elective
Spring [PGY 452](#), science electives

FOURTH YEAR

Fall [PMY 511](#), [BIO 302](#), [PMY 626/627](#), thesis research**
Spring [PMY 512](#), [GSC 640](#), thesis research**

FIFTH YEAR

Fall [BMS 501](#), thesis research**
Spring [PMY 506](#), thesis research**
Accepted Thesis

*Only one(1) physics lab is required.

**9-22 credit hours of research are required.

Pharmacology And Toxicology - Minor

About the Minor

A minor in pharmacology and toxicology is offered to science and non-science majors interested in acquiring an introductory understanding of the actions of drugs and toxic agents on living cells and tissues.

Acceptance Criteria

Applications should be made when the student has completed the prerequisite courses or is in the process of completing them during the semester when the application is made.

Minimum GPA of 2.5 in prerequisite courses.
Minimum GPA of 2.0 overall in minor to graduate.

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Prerequisite Courses

[BIO 200](#) Evolutionary Biology and [BIO 201](#) Cell Biology
[CHE 101-CHE 102](#) General Chemistry
[CHE 201-CHE 202](#) Organic Chemistry

Required Courses

[BIO 205](#) or [BCH 403](#) Principles of Biochemistry
[PMY 302](#) Introduction to Pharmacology
[PMY 455](#) Toxicology Fundamentals
[PGY 300](#) Human Physiology
 One elective science course selected with approval of program director

PMY 302: Introduction to Pharmacology

Credits: 4

Pre-requisites: [PGY 300](#) or [PGY 451](#)

Type: LEC

Introductory survey of the major drug groups commonly used in therapeutics. Presents the scientific bases of drug action and the utilization of their properties in the diagnosis and treatment of disease. Content and instruction is largely directed toward students in biomedical and life sciences programs. Students are expected to have significant exposure to the basic sciences of chemistry, biology and biochemistry and must have completed a human physiology course at least equivalent to [PGY 300](#).

PMY 311: Chemistry of Drug Action

Credits: 3

Type: LEC

PMY 405: Principles of Pharmacology

Credits: 4

Type: LEC/REC

Explores principles of drug action on biological systems, action mechanism of each agent class on specific organ systems, a review and extension of pertinent physiologic concepts of that system, chemical structure-drug activity relationships, sites of action, metabolic patterns of principal drugs, and therapeutic and toxicologic aspects. Dual-listed with [PMY 511](#).

PMY 406: Principles of Pharmacology

Credits: 4

Type: LEC/REC

Explores principles of drug action on biological systems, action mechanism of each agent class on specific organ systems, a review and extension of pertinent physiologic concepts of that system, chemical structure-drug activity relationships, sites of action, metabolic patterns of principal drugs, and therapeutic and toxicologic aspects. Dual-listed with [PMY 512](#).

PMY 409: Experimental Pharmacology

Credits: 4

Type: LAB/REC

PMY students only

PMY students only Applies principles of pharmacology and toxicology in a lab course, which includes in vivo and in vitro techniques, including: assessing the duration of drug action in a rat model, preparing subcellular fractions of liver, quantifying total protein, cytochrome P450 (CYP) protein content and activity, CYP2B1/2 protein and mRNA, biochemical and morphological assessment of liver injury, training in the proper care and use of lab animals and radiation safety. The course will provide the students with basic laboratory techniques commonly utilized in research and experience with writing two detailed lab reports which follow the format used in scientific journals.

PMY 455: Toxicology Fundamentals

Credits: 2

Semester(s): Fall

Type: LEC

Introduces students to the basic principles of toxicology. Toxicology is defined as the study of adverse effects of natural compounds or manmade chemicals on living organisms. Specific areas covered will include: the history of toxicology, general principles, chemical carcinogenesis, specific organ toxicology and ways to determine the risk to humans associated with toxic compounds. Uses innovative approaches to teach toxicology by utilizing real life examples and historical information of mass poisonings from natural or environmental disasters. Introduces the student to general principles and practices of toxicology.

PMY 498: Undergraduate Research Participation in Pharmacology and Toxicology

Credits: 1-6

Type: LAB

Direct involvement in original research involving a literature search and laboratory work.

PMY 499: Independent Study

Credits: 1-8

Type: TUT

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Involves a literature search and library work on a current topic in pharmacology or toxicology. Includes interdisciplinary projects, such as analyses of trends in drug use, toxicological projects, and applied clinical aspects.