

Minor in Pharmaceutical Sciences

The Pharmaceutical Sciences minor offers unique training for students pursuing careers in health care and the pharmaceutical industry. Flexible in design, this minor permits students from both science and non-science disciplines to learn about drug science in a variety of contexts.

The minor in Pharmaceutical Sciences requires a minimum of 12 credit hours. **All students must complete PHR 2500.** Students must fulfill the remaining 9 hours from a list of Pharmacy courses, including **at least one designated contemporary issues course.** 6 of the 12 required hours should be 3000+. Students should meet with an Advisor from the undergraduate program in order to customize a program.

Required: PHR 2500 – Drug Discovery, Development, and Delivery

- ❖ 3 credit hours
- ❖ This course provides a comprehensive overview of the drug discovery, development, and delivery process within the U.S. healthcare system, exploring the roles of vested stakeholders (e.g. patients, pharmaceutical industry, providers, insurers, society, etc.) during a drug’s “bench to bedside” development. Additionally, the course discusses post-approval issues with respect to access, social impact, and safety.

Electives: at least 9 hours

Students must take courses from the following list to bring total hours to 12, including at least 1 contemporary issues course (designated by *).



***PHR 2010 –Pharmacology: How Drugs Work**

- ❖ 3 credit hours
- ❖ AU only
- ❖ This course presents an overview of basic principles underlying drug action.

PHR 2100 – Career Development in the Pharmaceutical Sciences I

- ❖ 0.5 credit hour
- ❖ AU only, 2nd Session
- ❖ This class introduces students to diverse careers in the field of pharmaceutical and health sciences. Students will be strategically grouped based on their career interests, and will work closely with their instructor and peers to gain knowledge on various career paths. Through this class, students will engage with guest speakers and will come away with a sense of their options and a critical understanding of career and professional development.

PHR 2101 – Career Development in Pharmaceutical Sciences II

- ❖ 0.5 credit hour
- ❖ Spring semester only, 1st session course
- ❖ Prerequisite: PHR 2100, Junior standing
- ❖ Introduces students to diverse careers in the field of pharmaceutical and health sciences. Students will be taken through multiple professional development initiatives, and will work closely with their instructor and peers to gain knowledge on various career paths. Through this class, students will engage with guest speakers and will come away with a plan of how to pursue their future goals.

PHR 2367 –Drug Use in American Culture

- ❖ 3 credit hours
- ❖ Prerequisite: ENG 1110 or equivalent; fulfills a GE second writing course; offered online and in person
- ❖ Investigates a given drug by assessing its historical use, clinical properties and risks, role in American culture, and other issues surrounding its use/abuse in the United States. Students will engage in activities that will teach them to appropriately analyze various sources of information and effectively communicate key messages using a variety of platforms.
- ❖ Both online and in-person sections are available.

***PHR 2400 – Addicting Drugs: Effects, Introductory Neurobiology, and Regulation**

- ❖ 2 credit hours
- ❖ Overview of effects, regulation, and mechanism of action of addicting drugs with an introduction to function of the nervous system and how this function is altered by drugs.

PHR 2410 – Drugstore Science

- ❖ 2 credit hours
- ❖ SP only
- ❖ Distance-learning course (100% online)

† - concurrent enrollment acceptable

- ❖ This course introduces the science behind common drugstore products, including over-the-counter (OTC) medications and drug-cosmetics, including how these products work, potential non-drug alternatives, and various drug-related issues involving their use. Note: Content of this course is not intended to be considered as professional medical advice or to replace advice from a healthcare provider.

***PHR 2510 – Introduction to Pharmacy**

- ❖ 2 credit hours
- ❖ AU only
- ❖ A survey of the profession of pharmacy, dealing with its history, educational requirements, organization, regulation, and contemporary developments

***PHR 3400 – Therapeutic Frontiers**

- ❖ 2 credit hours
- ❖ SP only
- ❖ Investigation of newly emerging (and at times) controversial strategies for treating disease, including biologics, cell replacement therapy, and vaccines among others. This course also explores the science behind important therapeutic factors such as the placebo effect, the microbiome, and pharmacogenomics.

***PHR 3420 – Generation Rx: America’s Drug-Taking Culture**

- ❖ 3 credit hours
- ❖ Distance-Learning course (100% online)
- ❖ Fulfills GE Cultures & Ideas course
- ❖ In this course, we analyze America’s drug-taking culture through examining its past, present, and future. Students will identify factors that fuel it, discuss its influence on a patient’s medication experience, and evaluate its role in a current public health crisis – America’s opiate epidemic. The course will conclude with discussing ideas that promote a culture of health.

***PHR 3500 – Pharmacoethics: Dilemmas and Decision-Making**

- ❖ 2 credit hours
- ❖ This course will develop core competencies in dealing with ethical issues in healthcare and research settings amidst a biologically, socially, and culturally diverse patient population. This will include a discussion of the ethical responsibilities and professional conduct of the pharmaceutical industry, including clinical drug trials and studies, research, and marketing and promotion. This course will also provide a discussion of basic principles of business ethics and proper ethical conduct in other healthcare industries.

***PHR 3520 – Principles of Therapeutics**

- ❖ 2 credit hours
- ❖ SP only
- ❖ Prerequisite: PHR 4000†

† - concurrent enrollment acceptable

- ❖ Designed to provide knowledge about medication therapies and treatment guidelines for common illnesses affecting patients.

PHR 3530 – Drugs, Human Enhancement, and the Mastery of Nature

- ❖ 3 credit hours
- ❖ Fulfills GE Cultures & Ideas course
- ❖ How should we navigate questions of identity in the world of cognitive and mood enhancing drugs? Where do we draw the line on “smart drugs” for intellectual endeavors or the use of performance enhancing drugs in athletics pursuits? More broadly, we will debate whether and how as a society we might enact particular restraints on our pursuit of human enhancements.

PHR/HISTORY 3708 – Vaccines: A Global History

- ❖ 3 credit hours
- ❖ Fulfills GE History course
- ❖ This course examines the history and biology of vaccines. We explore the discovery and development of vaccines, along with the political and cultural controversies that have surrounded them for centuries.

***PHR 4000 – Molecules to Medicine: An Integrated Approach to the Pharmaceutical Sciences I**

- ❖ 5 credit hours
- ❖ SP only
- ❖ Prerequisite: PHR 3200 or PHR 4100 or BIOCHEM 4511 or BIOCHEM5614†, EEOB 2520†;
- ❖ The first course in a two-course series covering principles governing the design, synthesis, delivery, action, and use of drugs in disease treatment. Model disease pathophysiology and treatment will be investigated, discussing how biological differences can be targeted for therapeutic gain.

***PHR 4010 – Molecules to Medicine: An Integrated Approach to the Pharmaceutical Sciences II**

- ❖ 5 credit hours
- ❖ AU only
- ❖ Prerequisite: PHR 4000, EEOB 2520
- ❖ The second course in a two-course series covering principles governing the design, synthesis, delivery, action, and use of drugs in disease treatment. Model disease pathophysiology and treatment will be investigated, discussing how biological differences can be targeted for therapeutic gain.

PHR 4193 – Individual Studies in Pharmaceutical Sciences

- ❖ Credit hours vary
- ❖ Laboratory and library work designed to give the qualified student an opportunity to complete an original investigation or pursue an interest in a special problem.

PHR 4210 – Problem Solving in Biomedical Chemistry

- ❖ 2 credit hour
- † - concurrent enrollment acceptable

- ❖ SP only
- ❖ Prerequisite: PHR 3200 or PHR 4100 or permission of instructor
- ❖ A course designed to use problem-based learning to promote understanding of biomedical concepts. Case studies will be assigned, allowing students to apply biochemical principles and communicate with their colleagues in the course.

PHR 4330 – Basic Pharmacokinetics

- ❖ 2 credit hours
- ❖ SP only
- ❖ Prerequisite: MATH 1151
- ❖ An elementary course designed to introduce the student to the topic of pharmacokinetics. The application of biopharmaceutics and pharmacokinetic principles as they relate to drug absorption, distribution and elimination will be discussed.

PHR 4420 – Molecular Pharmacology: From DNA to Biopharmaceutical Products

- ❖ 2 credit hours
- ❖ AU only
- ❖ Prerequisite: PHR 3200 or PHR4100 or BIOCHEM 4511 or BIOCHEM5614†
- ❖ Overviews the production of biopharmaceutical (recombinant biologic) products including therapeutic proteins and antibodies.

PHR 4430 – GPCR Pharmacology

- ❖ 1 credit hour
- ❖ SP only
- ❖ Focuses on the pharmacology of G-protein-coupled receptors (GPCRs). GPCRs constitute a large and diverse family of proteins whose importance is underscored by the fact that at least one third of the currently marketed drugs target these proteins.

***PHR 4440 – Pharmacology of Neurologic and Psychiatric Disorders**

- ❖ 3 credit hours
- ❖ AU only
- ❖ Prerequisite: NEUROSC 3000 or PHR 3200 or PHR 4100 or BIOCHEM 4511 or BIOCHEM 5613 or instructor permission
- ❖ This course is designed for pharmaceutical science majors, neuroscience majors, or non-majors with a basic knowledge of biology. This course will serve as an introduction to principles of pharmacological therapy of neurologic and psychiatric diseases.

***PHR 4460 – Contemporary Drug Addiction Literature**

- ❖ 1 credit hour (repeatable up to three times for minor credit)
- ❖ Prerequisite: introductory knowledge of neurobiology; instructor permission required
- ❖ Current research findings related to neurobiology of addiction are explained and interpreted.

† - concurrent enrollment acceptable

***PHR 4470 – Contemporary Pharmacology**

- ❖ 1 credit hour (repeatable up to 3 times for minor credit)
- ❖ Prerequisite: PHR4000 or PHR4400, or PHR4460; instructor permission required
- ❖ Exploration of current research topics in pharmacology through discussions of recently published pharmacology papers.

PHR 4600 – Pharmaceutical Sciences Laboratory

- ❖ 2 credit hours
- ❖ Prerequisite: CHEM 2520/2920H, PHR 3200†
- ❖ Laboratory experience in isolation, synthesis, and evaluation of pharmaceutically relevant compounds.

PHR 4610 –Experimental Techniques in Drug Discovery

- ❖ 3 credit hours
- ❖ Prerequisite: PHR 3200 or PHR 4100 or BIOCHEM4511 or BIOCHEM5614†
- ❖ Examination of the laboratory instrumentation and methods used in the drug discovery process

PHR 4998 – General Undergraduate Research

- ❖ 1-18 credit hours
- ❖ Repeatable to a maximum of 60 credit hours or 12 completions
- ❖ Course is graded S/U
- ❖ Course credit earned by conducting research while enrolled as an undergraduate student.

PHR 5402 – Introduction to Pharmacoeconomics

- ❖ 3 credit hours
- ❖ Prerequisite: Junior standing (not open to students with credit for NURSING 7402)
- ❖ Distance-learning course (100% online)
- ❖ Introduction to economic evaluation of pharmaceutical interventions and pharmacy services, including evaluating costs and health outcomes, using results to inform resource allocation, interpretation and evaluation of pharmacoeconomics literature, and decision analysis in health care.

PHR 5500 – History of Pharmacy

- ❖ 3 credit hours
- ❖ AU only
- ❖ Evolution and development of the profession of pharmacy from antiquity to the present, with emphasis on its Anglo-American development since the 18th century.

***PHR 5510 – Basics of Pharmaconutrition**

- ❖ 3 credit hours
- ❖ AU only
- ❖ Prerequisite: Senior standing
- ❖ Covers basic information on the effects of dietary factors on pharmaconutrition to be utilized as a foundation in solving patient-related cases in pharmacy practice.

† - concurrent enrollment acceptable

***PHR 5520 – Advanced Pharmaconutrition**

- ❖ 2 credit hours
- ❖ Prerequisite: PHR 5510 and instructor permission
- ❖ Provides concepts needed by pharmacists necessary to include nutrition into their daily assessment of patients and integrate their findings into therapeutic gain.

***PHR 5530 – Medical Applications of Radionuclides and Radiopharmaceuticals**

- ❖ 2 credit hours
- ❖ AU only
- ❖ Prerequisite: Junior standing
- ❖ Study of the theoretical and clinical aspects of the preparation, use, control, and handling of radionuclides and radiopharmaceuticals in medicine.

***PHR 5540 – Introduction to Clinical and Translational Pharmacy Research**

- ❖ 2 credit hours
- ❖ AU only
- ❖ Prerequisite: PHR 4000
- ❖ Course is graded S/U
- ❖ Introduction to conducting research in clinical pharmacy including research design issues and ethical considerations. Faculty conducting research in various populations will discuss their research, followed by class discussion.

PHR 5550 – Topics in International Pharmacy

- ❖ 2 credit hours
- ❖ Prerequisite: Junior Standing or higher
- ❖ Course is graded S/U
- ❖ Seminar on global pharmaceutical issues and international practices of pharmacy.

PHR 5560 – Success & Leadership in Pharmacy

- ❖ 1.5 credit hours
- ❖ AU only
- ❖ Prerequisite: instructor permission
- ❖ Course is graded S/U
- ❖ Explore the meaning of success and leadership, attributes of successful leaders, and what can be done to be a successful leader.

PHR 5580 – Professional Ethics

- ❖ 1.5 credit hours
 - ❖ Spring semester only
 - ❖ Prerequisite: Sophomore standing
 - ❖ The conceptual basis and content of pharmaceutical ethics; significance of codified ethics, inter-professionally considered; individual and group analysis of ethical issues; methods of encouraging compliance.
- † - concurrent enrollment acceptable

PHR 5590 – Chemical Dependency and the Healthcare Professional

- ❖ 3 credit hours
- ❖ This lecture- and discussion-based course provides instruction, debate and exploration relating to the impact of chemical dependency on healthcare professionals, including the concepts of addiction, individuals at risk, intervention, withdrawal, emotions, recovery networks, regulatory actions and returning to practice.

PHR 5700 – Introduction to Personalized Therapeutics and Pharmacogenomics

- ❖ 3 credit hours
- ❖ Distance Learning 100% online
- ❖ Credit for Introductory Biology course *recommended* prior to enrollment
- ❖ Exploration of the trend to therapy tailored to the individual patient rather than “one drug fits all;” inter-individual difference in drug responses, with emphasis on genetic and genomic factors; ethical, regulatory, and economic issues that impact drug therapies.