

PHARMACEUTICAL SCIENCES (PSCI)

PSCI 101. Career Exploration in Pharmaceutical Sciences I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course will expose students to a selection of career options within pharmaceutical sciences, illustrate the roles played by pharmaceutical scientists in health care and prepare students to take appropriate electives and participate in extra and co-curricular activities to achieve their goals. The sessions will include formal didactic lectures, presentations by practicing pharmaceutical scientists and faculty led discussions.

PSCI 102. Career Exploration in Pharmaceutical Sciences II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. This course will explore additional career options within pharmaceutical sciences with an emphasis on scientific and health care ethics, including research conduct and reporting, diversity, animal testing and product marketing. The sessions will include formal didactic lectures, presentations by practicing pharmaceutical scientists and faculty led discussions.

PSCI 201. Introduction to Pharmaceutical Sciences and Pharmaceutical Product Development I. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: PSCI 102 or permission of the instructor. This course will introduce students to pharmaceutical sciences topics, including analysis and pharmaceutical quality, biotechnology, clinical pharmacology and translational research, drug discovery and development interface, formulation design and development, manufacturing science and engineering, pharmacokinetics, pharmacodynamics and drug metabolism, physical pharmacy and biopharmaceutics, regulatory sciences and artificial intelligence in drug development. The emphasis of this course will be basic understanding of the stages of the drug development pipeline and the contributions of the various disciplines of the pharmaceutical sciences with a focus on traditional or standard approaches to meeting patients' needs. In class presentations will be complemented with laboratory demonstrations and industrial site visits.

PSCI 202. Introduction to Pharmaceutical Sciences and Pharmaceutical Product Development II. 1 Hour.

Semester course; 1 lecture hour. 1 credit. Prerequisite: PSCI 201 or permission of the instructor. This course will introduce students to pharmaceutical sciences topics, including analysis and pharmaceutical quality, biotechnology, clinical pharmacology and translational research, drug discovery and development interface, formulation design and development, manufacturing science and engineering, pharmacokinetics, pharmacodynamics and drug metabolism, physical pharmacy and biopharmaceutics, regulatory sciences and artificial intelligence in health care. The emphasis of this course will be on situations requiring more complicated or innovative approaches to therapeutic treatment. Manufacturing of drug products and regulatory science will be also emphasized. In class presentations will be complemented with laboratory demonstrations and industrial site visits.

PSCI 320. Molecules to Medicine I. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Concurrent prerequisite: PSCI 202. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. Part one of a three-course series designed to build on principles from prior courses to develop a deeper understanding of the multidisciplinary process of drug development, this course will explore concepts such as identification of a drug target, design/discovery of a chemical/biological agent, lead development and optimization, homology and pharmacophore modeling, biochemical/biophysical characterization, bulk manufacturing and process development, including concepts of Quality Control and Assurance and Good Manufacturing Practice, and the use of artificial intelligence in drug discovery and development.

PSCI 330. Molecules to Medicine II. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PSCI 320. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. Part two of a three-course series designed to build on principles from prior courses to develop a deeper understanding of the multidisciplinary process of drug development, this course will transition from early discovery to pre-clinical evaluation, including early formulation development, metabolic profiling and toxicity, pharmacokinetic studies in animals and regulatory aspects, including the use of compendial (e.g., United States Pharmacopeia) testing in pre-clinical development and concepts of Quality Control and Assurance and Good Laboratory Practice.

PSCI 370. Drug Dosage Form Development. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Concurrent prerequisite: PSCI 330. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. This course will introduce students to the basic principles and foundations of drug delivery and dosage form development, including solubility, kinetic processes, bioavailability, and excipient activities, basic colloidal and interfacial sciences concepts, as well as concepts in Quality-by-Design and artificial intelligence in pharmaceutical drug product development. Situations requiring innovative approaches to therapeutic treatment, such as design of pro-drugs for active pharmaceutical ingredients with low oral bioavailability and formulation of nanomedicines to improve drug stability, as in mRNA vaccines, will be discussed. Oral dosage forms such as capsules and tablets and non-oral drug delivery approaches, including orally inhaled products, injectables and others will be explored.

PSCI 420. Molecules to Medicine III. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PSCI 330. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. Part three of a three-course series designed to build on principles from prior courses to develop a deeper understanding of the multidisciplinary process of drug development, this course will explore moving from the pre-clinical space to first-in-human studies, including clinical trial phases and their purpose, dosing regimen, pharmacokinetic profiling, therapeutic safety and efficacy, and the drug regulatory approval process, including guidance and regulations such as ICH, and the development of Chemistry Manufacturing and Controls to support filing of Abbreviated and New Drug Applications. Concepts in pharmacovigilance and surveillance and the use of artificial intelligence in drug manufacturing will be also be introduced in this course.

PSCI 430. Principles of Drug Action. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PSCI 420. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. This course will use principles of organic chemistry, biochemistry, medicinal chemistry, anatomy, physiology, pathophysiology and pharmacology to build an understanding of drug mechanisms of action used to treat selected diseases. Drugs used to treat autonomic/endocrine, cardiovascular/renal, CNS, and cancers and infectious diseases will be surveyed.

PSCI 450. Molecular and Cellular Therapy. 2 Hours.

Semester course; 2 lecture hours. 2 credits. Prerequisite: PSCI 420. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. This course will explore the most recent advances in molecular and cellular therapies and how they are used to design new treatments to human diseases. Topics will include discovery, development, and manufacturing of molecular and cellular therapies, clinical trials and application of these therapies to disease states, as well as ethical perspectives and regulatory requirements. In addition to didactic lectures the course will include in-class or in-lab demonstrations on topics such as generating therapeutic recombinant human proteins, humanized monoclonal antibodies, gene editing using CRISPR/Cas 9 and mRNA vaccines.

PSCI 481. Capstone Experience in Pharmaceutical Sciences I. 2 Hours.

Semester course; 2 field experience hours. 2 credits. Prerequisite: PSCI 420. Corequisite: PSCI 493. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. This course will provide opportunities and facilitation for students to participate in mentored experiential learning in pharmaceutical sciences while on campus. The capstone course sequence serves to immerse senior student teams in hands-on learning experiences to solve real-world problems in pharmaceutical sciences. Real-world problems will be presented to student teams by community, industry and VCU research partners. Student teams will be assigned a faculty mentor expert. The faculty expert and a sponsor will coach student teams as they use resources in the School of Pharmacy and at VCU to come up with viable strategies to develop suitable solutions to problems. This hands-on experience spans two semesters, providing student teams ample opportunity to develop real-world solutions to the problems, adding an additional dimension to what can be achieved in traditional didactic courses and laboratories. The capstone course sequence requires a total of four credits and a minimum of 180 experiential hours for graduation. Grades for courses in the sequence will be assigned upon completion of both courses.

PSCI 482. Capstone Experience in Pharmaceutical Sciences II. 2 Hours.

Semester course; 2 field experience hours. 2 credits. Prerequisite: PSCI 481. Corequisite: PSCI 494. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. This course will continue opportunities and facilitation for students to participate in mentored experiential learning in pharmaceutical sciences while on campus, continuing the project in the capstone course sequence. At the conclusion of this course, student teams will present their work to sponsors and the community. The capstone course sequence requires a total of four credits and a minimum of 180 experiential hours for graduation.

PSCI 493. Seminar in Pharmaceutical Sciences I. 1 Hour.

Semester course; 1 seminar hour. 1 credit. Corequisite: PSCI 481. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. This course runs in conjunction with mentored capstone as a forum to communicate professionalism and scientific and related strategies to gain the most from the experience. Oral presentation skills will be emphasized, developed and practiced. In addition, using scientific forums for professional networking will be discussed and practiced. Seminar presenters will also include pharmaceutical scientists' expert guest lecturers.

PSCI 494. Seminar in Pharmaceutical Sciences II. 1 Hour.

Semester course; 1 seminar hour. 1 credit. Corequisite: PSCI 482. Enrollment is restricted to students in the B.S. in Pharmaceutical Sciences program or by permission of the instructor. This course runs in conjunction with mentored experiential learning as a forum to share student experiences. Oral presentation skills will be demonstrated by students in the form of formal seminars. Seminar presenters will also include pharmaceutical scientists' expert guest lecturers.

PSCI 607. Introduction to Pharmaceutical Sciences From Bench to Shelf. 2 Hours.

Yearlong course; 2 lecture hours. 2 credits. The purpose of this course is to familiarize students with the interdisciplinary nature of drug discovery and development, to acquaint them with where their research fits into the bigger drug discovery and development picture and to promote interdisciplinary discussions between the students and faculty. Current scientific, regulatory and health care trends impacting drug discovery, development and use will be discussed. Students will be introduced to current topics in the pharmaceutical sciences such as drug target selection, drug design, discovery and development, the drug approval process and regulatory sciences, product optimization, production, and marketing. Graded as CO in the fall semester with a letter grade and credits awarded in the spring.

PSCI 610. Frontiers of Pharmaceutical Research. 1-2 Hours.

Semester course; 1-2 lecture hours (delivered hybrid). 1-2 credits. May be repeated for a maximum of eight credits. A student-centered training course of scientific presentation and discussion for students using frontier research in pharmaceutical sciences. Students will present research data and/or literature and lead discussions among peer graduate students and faculty. Faculty may take a leading role in some of the classes. Students will also actively participate in small-group discussions led by peer graduate students and faculty.

PSCI 614. Research Techniques. 1-4 Hours.

Semester course; 1-4 lecture and/or 2-8 laboratory hours (delivered hybrid). 1-4 credits. May be repeated for a maximum of four credits. The course provides new graduate students with the skill set necessary to perform research in their discipline within pharmaceutical sciences. The course will use a combination of lectures, assignments, one-on-one training, laboratory and/or group discussion.

PSCI 690. Seminars in the Pharmaceutical Sciences. 1 Hour.

Semester course; 1 seminar hour. 1 credit. Enrollment is restricted to graduate students in the pharmaceutical sciences programs. The goal for the seminar series is to provide students an opportunity for self-learning. The course will familiarize students with topics of current research interest within the pharmaceutical sciences and related biological sciences, as well as expose students to nationally and internationally renowned scientists.

PSCI 691. Special Topics in Pharmaceutical Sciences I. 0.5-5 Hours.

Semester course. 0.5-5 lecture hours. 0.5-5 credits. Subject matter is presented by lecture, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the research training. Graded S/U/F.

PSCI 692. Special Topics in Pharmaceutical Sciences II. 0.5-5 Hours.

Semester course; 0.5-5 lecture hours. 0.5-5 credits. Subject matter is presented by lecture, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the research training.

PSCI 701. Post-candidacy Doctoral Research. 9 Hours.

Semester course; 9 research hours. 9 credits. May be repeated for credit. Enrollment is restricted to graduate research assistants or graduate teaching assistants who have been admitted to doctoral candidacy in the School of Pharmacy. Students will participate in supervised discipline-specific research related to their dissertation topic. Students must have approval from their current degree program coordinator to register. This course can be approved as a substitution for any post-candidacy degree requirement (e.g. directed research). Graded as satisfactory/unsatisfactory.