

# Pharm.D. Courses and Curriculum

University at Buffalo General Education Requirements .....	1
Pharm.D. Courses and Curriculum .....	1
Tracks.....	2
Community/Ambulatory Care Track (Default track) .....	2
Applied Pharmacotherapy Track .....	2
Clinical Research Track.....	2
Pharmaceutical Sciences Research Track.....	2
Electives.....	2
First Professional Year.....	3
Second Professional Year .....	3
Third Professional Year .....	4
Fourth Professional Year .....	5
Advanced Pharmacy Practice Experiences.....	5
Required Advanced Pharmacy Practice Experiences .....	6
Elective Advanced Pharmacy Practice Experiences.....	6

## University at Buffalo General Education Requirements

Transfer students entering with less than 24 credit hours and current UB students must also satisfy the University at Buffalo's general education requirements, which include one 3-credit course in the Arts, World Civilization I (UGC 111), World Civilization II (UGC 112), and American Pluralism or US History (UGC 211). Although these courses are not required for admission to the Pharm.D. program, they must be completed by the end of the 3<sup>rd</sup> professional year. This note does not apply to transfer students with 24 or more credit hours or students who have earned a degree.

## Pharm.D. Courses and Curriculum

**The Doctor of Pharmacy curriculum** consists of courses in basic biomedical sciences, clinical sciences, pharmaceutical sciences, and pharmacy practice. The course work is integrated with patient-centered practice experiences and is capped by a 9-month experiential program, with its focus centered on educating entry-level practitioners capable of providing pharmaceutical care. The curriculum contains courses in the following areas:

**Pharmaceutical and Clinical Sciences** consisting of Physical Pharmacy, Pharmacy Calculations, Pharmacokinetics, Pharmacodynamics, Pharmacogenomics, and Pharmacotherapy;

**Biomedical Sciences** consisting of Physiology, Microbiology, Biochemistry, and Pharmacology;

**Pharmaceutical Care** consisting of Pharmacoeconomics/Pharmacoepidemiology, Pharmacy Informatics, Drug Literature Evaluation, Biostatistics, Disease Management, Ethics, Pharmacy Law, Professional Practice, Physical Assessment, Communication, and Portfolio; and

An **Experiential** year consisting of required and elective/selective 1-2 month rotations organized into four areas of concentration: Ambulatory/Community Care, Acute/Long-Term Care, Clinical Research, and Pharmaceutical Sciences Research. Professional students may select from one of four tracks to enhance their educational program through specialized courses and experiences. Students select their track during the second professional year and then take courses in their third year followed by the opportunity to utilize this during the *experiential* year.

## Tracks

The doctor of pharmacy curriculum provides the educational foundation for an entry-level pharmacy practitioner. These tracks were developed to enable students to learn more about specific areas of pharmacy practice while completing their program. Students choose their track during their second professional (P2) year. All tracks enable interested students to pursue post-doctoral training opportunities such as residencies, fellowships, or graduate studies. Students select one of the four tracks listed below during the second professional year. Students in these tracks take additional courses during their third professional year, which apply as elective credit.

### Community/Ambulatory Care Track (Default track)

Students learn about and gain experiences in areas such as community pharmacy care (e.g. CVS, Walgreens, and Rite Aid) or ambulatory pharmacy care (e.g. In-patient clinics).

PHM 537: Pharmacy Management (3 Hours) - Fall Semester

PHM 594: Advanced Ambulatory Pharmacotherapeutics (2 Hours) - Spring Semester

### Applied Pharmacotherapy Track

Students learn about and gain experiences in patient care across various settings including long term care, hospice, and hospitals.

PHM 529: Topics in Health Pharmacy Practice Systems (2 Hours) - Fall Semester

PHM 595: Advanced Pharmacotherapeutics (2 Hours) - Spring Semester

### Clinical Research Track

Students work one-on-one with a faculty member conducting a research project and complete a two month research rotation during their experiential (P4) year. Students must have at least a 3.0 GPA or permission to enter this track.

PHM 516: Clinical Research Methods 1 (3 Hours) - Fall Semester

PHM 615: Clinical Research Methods II (1 Hour) - Spring Semester

PHC 543: Molecular Genetic Methods (1 Hour) - Between Fall and Spring Semester

PHM 505: Biometry in the Pharmaceutical Sciences (3 Hours) - Spring Semester

### Pharmaceutical Sciences Research Track

Students work one-on-one with a faculty member conducting a research project and complete a two month research rotation during their experiential (P4) year. Students must have at least a 3.0 GPA or permission to enter this track.

PHM 516: Clinical Research Methods 1 (3 Hours) - Fall Semester

PHC 543: Molecular Genetic Methods (1 Hour) - Between Fall and Spring Semester

PHC 332: Introduction to Research (1 Hour) - Spring Semester

### Electives

Students in the doctor of pharmacy program must complete ten elective credits throughout their first three professional years. The courses in their tracks will count as electives. In addition, students may take a maximum of three-credit hours of electives outside the School of Pharmacy and Pharmaceutical Sciences if the Office of the Associate Dean for Academic Affairs has approved this course.

**Course designations refer to courses taught by the following departments:**

- (BCH) Biochemistry
- (BCP) Biochemical Pharmacology
- (MCH) Medicinal Chemistry
- (MIC) Microbiology
- (PHC) Pharmaceutics
- (PHM) Pharmacy
- (PGY) Physiology

\* All requirements are subject to change

## First Professional Year

BCH 403. *Principles of Biochemistry*. A general biochemistry course for science majors and students of pharmacy. Covers protein structure and function, metabolism, and nucleic acid structure and molecular biology.

MIC 301. *Fundamentals of Microbiology*. Principles of microbiology for students of medical technology, pharmacy and nursing programs; microorganisms and immunologic phenomena of importance for man.

MCH 311. *The Chemistry of Drug Action*. Physicochemical and structural basis of drug action; drug sources; mechanisms of drug action; drug design and drug selectivity; drug incompatibility; drug interactions.

PGY 451, 452. *Human Physiology 1, 2*. A two-semester lecture course in human body function.

PHM/PHC 311. *Pharmaceutical Calculations*. Prescription interpretation and a variety of mathematical calculations used in pharmacy practice. The course is a prerequisite for Physical Pharmacy (PHC 312).

PHC 312. *Physical Pharmacy*. Physical chemical properties of drugs; theory and practice applicable to design and evaluation of drug dosage forms; principles of solubility, solution equilibria, chemical kinetics, heterogenous systems, solids.

PHM 315. *Pharmaceutical Care I*. Introduction to the profession of pharmacy, professionalism, and the concept of pharmaceutical care. Small group and large group discussions of areas involved in practice which include but are not limited to career options, U.S. health care system, prescriptions, medical orders, introduction to compounding and the professional practice laboratory, patient-oriented pharmaceutical care, adherence, and interpersonal and interprofessional communication practices as encountered in contemporary pharmacy practice. Students will be involved in small group problem based learning exercises and videotaping. Students will be taking PHC 311 Pharmacy Math concurrently.

PHM 316. *Pharmaceutical Care 2*. A continuation of PHM 315 with further emphasis on patient-oriented education, interpersonal and interprofessional communication, patient interviewing, history taking, patient adherence and counseling, pharmacy law, the evaluation of drug orders and prescriptions for accuracy and safety, drug informatics and management of medication distribution and control systems. A continuation of the professional practice laboratory.

PHM 430. *Pharmacy Law*. A detailed presentation of the laws that govern and affect the practice of pharmacy. Major topics include general legal principles, non-controlled and controlled prescription requirements, over-the-counter drug requirements, NYS Board of Pharmacy law and regulations, Poison Prevention Packaging Act, hypodermic syringes and needles, regulations affecting hospitals, and Food and Drug law.

## Second Professional Year

BCP 511, 512. *Principles of Pharmacology I, II*. A two semester course on the action of drugs in humans. Biochemical and physiological concepts necessary for understanding drug mechanisms and the factors influencing drug action are discussed. Included are discussions of chemical structure activity relationships, sites of drug action, absorption and metabolism of principle drugs as well as therapeutic and toxicological aspects.

PHC 531, 532. *Introduction to Pharmacokinetics and Biopharmaceutics I, II*. A study of factors influencing the absorption, distribution, excretion and metabolism of drugs in man and the role these processes play in the therapeutic and adverse effects of drugs. Elementary compartmental modeling, mechanisms of drug absorption, mechanisms of renal clearance, and assessment of drug bioavailability.

PHM 402. *Pharm.D. Student Portfolio I*. The Pharm.D. Student Portfolio I (PHM 402) serves as an avenue for pharmacy students to acquire practical experience within the profession of pharmacy prior to the final experiential year (P-4). The School of Pharmacy and Pharmaceutical Sciences requires that all pharmacy students develop a Pharmacy Student Portfolio beginning the summer after completion of the first year of pharmacy school. Pharmacy students will not be

assigned to the advanced pharmacy practice experiences during the fourth and final year of the pharmacy program without completion of the required portfolio. This mandatory experience requires that all students work in a pharmacy setting (e.g. inpatient, community, long-term care, clinic setting, HMO, etc.) involved with the direct delivery of medications to patients. This work experience must be patient oriented and exclude the activities of store managers, assistant managers, cashiers, stock persons, etc. All students must successfully complete the Shadow program during the first year of pharmacy school (P-1).

PHM 510, 511. *Pharmacotherapeutics I, II*. A course series in clinical pharmacology and advanced therapeutics which includes major disease problems and use of therapeutic interventions in areas such as: fluids and electrolytes, nephrology, cardiology, pediatrics, neurology, endocrinology, infectious diseases, psychiatry, immunology, rheumatology, hematology, pulmonary, gastroenterology, critical care, dermatology, women's health, nutrition, and oncology. Course material typically includes disease symptomology, current concepts regarding appropriate drug treatment, patient monitoring, drug mechanism/effects/pharmacokinetics, and drug interactions. Literature review and case studies are included.

PHM 517. *Pharmaceutical Care 3*. A continuation of the pharmaceutical care sequence with emphasis on patient-oriented pharmaceutical care. Disease and therapeutics will be reinforced by application to case studies. Included are practitioner consultations and therapy recommendations, use of information technology in the maintenance of records and in retrieval of medical information, pharmacy law, patient interviewing, evaluation of patient-specific medical information, patient case studies and interventions with resultant positive outcomes.

PHM 518. *Pharmaceutical Care 4*. A continuation of the pharmaceutical care sequence with further emphasis on patient-oriented pharmaceutical care. Introduction of pharmacy informatics and disease state management. Modules and patient cases will be used to reinforce learning of diseases covered in the Disease and Therapeutics sequence of courses. Monitoring and modifying patient care plans are studied with the goal of assuring positive outcomes. Pharmaceutical care through application of the ASHP modules is emphasized.

PHM 531. *Professional Practice I*. Practical application of drug dosage formulation, the storage, preparation, dispensing and compounding of medicines and the use of non-medications which include but are not limited to: solid and liquid dosage forms, intravenous admixtures, and devices. Emphasis is on application of pharmaceutical preparations, mathematical skills, pharmacy law, critical thinking, patient education/counseling and practitioner consultation.

PHM 532. *Professional Practice II*. A continuation of PHM 431 with emphasis on more advanced product selection. In addition, drug and non-drug products include, but are not limited to: advanced intravenous therapy, pre-packing and unit dose, chemotherapy, total parenteral nutrition, home health care, and home infusion therapy. Emphasis is on patient education, counseling, practitioner consultations, as well as product incompatibilities, preparation, law, and critical thinking.

## **Third Professional Year**

PHC 517. *Principles of the Human Genome, Pharmacogenomics and Bioinformatics*. Introduces the principles and concepts in pharmacogenomics and pharmaceutical genetics. The course goal is to give an understanding of the principles of human genetics and genomics such that these skills can then be applied to problems in therapy optimization and patient care.

PHC 533. *Applied Clinical Pharmacokinetics I*. The study of the factors that influence drug disposition and drug effects in disease states and the factors that influence therapeutic monitoring of drugs in patients and patient care.

PHM 502. *Pharm.D. Student Portfolio II*. The Pharm.D. Student Portfolio II, which is for the students entering the third year of pharmacy school, serves as an avenue to acquire additional practical experience within the profession of pharmacy prior to the final experiential year (P-4). The School of Pharmacy and Pharmaceutical Sciences requires that all pharmacy students continue development of the Pharmacy Student Portfolio I (PHM 402) initiated during the second year of pharmacy school. Pharmacy students will not be assigned to the advanced pharmacy practice experiences during the fourth and final year of the pharmacy program without completion of this required portfolio. This mandatory experience

requires that all students work in a pharmacy setting (e.g. inpatient, community, long-term care, clinic setting, HMO, etc.) involved with the direct delivery of medications to patients. This work experience must be patient-oriented and exclude the activities of store managers, assistant managers, cashiers, stock persons, etc. All students must successfully complete the Shadow program during the first year of pharmacy school (P-1).

PHM 504. *Statistics in Pharmacy*. Methods used in statistical analysis and evaluation of studies in health care.

PHM 508. *Pharmacy Informatics*. Sources of drug information and how to access them, systematic drug literature searches, case study approach to answering drug information questions received from patients, other health professionals; oral and written responses to questions.

PHM 509. *Patient Assessment*. Instruction to the basis of patient diagnosis with physical and historical examination of major organ systems.

PHM 512, 513. *Pharmacotherapeutics III, IV*. A course series in clinical pharmacology and advanced therapeutics which includes major disease problems and use of therapeutic interventions in areas such as: fluids and electrolytes, nephrology, cardiology, pediatrics, neurology, endocrinology, infectious diseases, psychiatry, immunology, rheumatology, hematology, pulmonary, gastroenterology, critical care, dermatology, women's health, nutrition, and oncology. Course material typically includes disease symptomology, current concepts regarding appropriate drug treatment, patient monitoring, drug mechanism/effects/pharmacokinetics, and drug interactions. Literature review and case studies are included.

PHM 519. *Pharmaceutical Care 5*. Student skills are further refined with respect to communication, managing a patient's and practice management skills.

PHM 520. *Pharmaceutical Care 6*. A continuation of PHM 519.

PHM 572. *Pharmacoeconomics and Managed Care Pharmacy*. Discussions of the origin, organization, delivery and financing of health care in the United States. Important health care issues and how they relate to pharmacy practice are discussed.

PHM 608, 609. *Pharmacy Project I, II*. Students in the entry-level doctor of pharmacy program will be expected to complete a project in one area of pharmacy practice. The areas may include patient care, disease state management, literature evaluation, clinical research, post-graduate education, scope of practice, and other areas of interest between faculty and students. Students will be given a list of potential projects and faculty preceptors for the project. The student will be expected to work on an independent basis to draft a written description of the project to be completed.

## **Fourth Professional Year**

### **Advanced Pharmacy Practice Experiences**

The advanced pharmacy practice experiences are designed to build on the previous academic base with a wide range of exposure to various clinical pharmacy practice environments and medical sub-specialty areas.

Advanced pharmacy practice experiences are academic learning experiences in patient care settings and are a vital component of the doctor of pharmacy program. The advanced pharmacy practice experiences involve the students in the provision of advanced clinical pharmacy services and provide experience in various medical sub-specialty environments. Major goals are the development of independent judgment and the integration of fundamental knowledge with clinical applications. These advanced pharmacy practice experiences are conducted throughout the Western New York region (Buffalo, Rochester, etc.). Each module of advanced pharmacy practice experiences time is four weeks.

## **Required Advanced Pharmacy Practice Experiences**

PHM 620. *Acute/Long-Term Care*

PHM 621. *Advanced Applied Pharmacotherapy 2*

PHM 623. *Ambulatory Care Medicine*

PHM 624. *Advanced Outpatient Care 2*

Required advanced pharmacy practice experiences include inpatient medicine and ambulatory care. Additional time may be spent in any of these areas if the student desires. Students with advanced standing may waive required advanced pharmacy practice experiences modules to allow more time for electives.

## **Elective Advanced Pharmacy Practice Experiences**

PHM 625. *Pharmacoinformatics Professional Experience Elective*. Pharmacoinformatics elective rotations are conducted at a variety Advanced Pharmacy Practice Experience (APPE) sites with various faculty preceptors. Each preceptor will assign an informatics project on the first day of the rotation and provide a description of the project, a schedule of activities as well as an outline of any additional requirements or projects utilizing the “Selected Activities Check List” in the manual.

PHM 630/631. *Clinical Research Elective*. This advanced course places directly in various research sites. Students will be given the opportunity to become reasonably proficient in clinical or basic research via the completion of a research project in close collaboration with a faculty member. This guided experience is intended to familiarize the student with all aspects of the research process from the initial development of the idea, completion of data collection, data analysis, and presentation of the results.

PHM 640/641. *Advanced Pharmacy Practice Experiences Electives*. This advanced course places the P4 doctor of pharmacy student in direct contact with pharmacotherapeutic issues from the perspective of a clinical pharmacist, physician or health administrator at a variety of health care facilities. Pharm.D. Students can also gain experience in the area of pharmacoinformatics based upon their specific professional interests and tracks. Specific required assignments will be tailored to the emphasis of the designated elective rotation which will give the student the opportunity to become reasonably proficient in the delivery of pharmaceutical care in a specific health care setting under the guidance of the assigned preceptor during this four week rotation.