Health Services and Outcomes Research

Degree Offered

• Doctor of Philosophy

What is Health Services and Outcomes Research?

The Health Services and Outcomes Research program emphasizes population-based, health services delivery and outcomes, and policy research.

Health services research examines how people get access to health care, how much care costs, and what happens to patients as a result of this care. The main goals of health services research are to identify the most effective ways to organize, manage, finance, and deliver high quality care; reduce medical errors; and improve patient safety. (AHRQ, 2002)

Outcomes research refers to the scientific design, data collection, and analysis of the end results of medical care. It focuses on quality, cost-effectiveness and the effect of treatment on quality of life in patients. Outcomes research evaluates the effectiveness of health interventions through changes in outcomes such as improvements in patient functional status, satisfaction with care, and mortality. Apart from traditional experimental and quasi-experimental designs, outcomes research methodology embraces epidemiological research designs (such as retrospective or prospective, longitudinal or cross-sectional, case-control or cohort study designs), or econometric modeling (such as decision-tree analysis, cost-benefit analysis, cost-effectiveness analysis), and survey research methods (such as quality of life measurements, satisfaction with care).

Why study Health Services and Outcomes Research?

With health care costs increasing five folds in the last two decades, there has been increasingly greater accountability demanded of health care systems and providers. There has been growing recognition that resources are limited, and health care interventions have to be cost-effective, and not just efficacious in clinical trials. Three particular factors have contributed to growing interest in determining effectiveness of health care interventions: (1) unexplained differences in quality of care or effectiveness by region, population, and type of systems; (2) the desire to control rising health care costs and spread the availability of services to those who do not currently have access; and (3) concern that cost-containment strategies and improving quality of health care are two competing goals.

These factors also led to the passing of the Patient Protection and Affordable Care Act in March 2010. The Affordable Care Act’s main focus is on providing more Americans with access to affordable health insurance, improving the quality of health care and health insurance, regulating the health insurance industry, and reducing health care spending in the US. The shift from fee-for-service to fee-for-value necessitates that healthcare providers and institutions optimize their operations and align costs with clinical outcomes.

How is Outcomes Research Used?

Data collected from outcomes research provide patients, physicians, and providers information about what does and does not work in real life settings. It provides other measures of effectiveness such as what treatment provides the best return on investment, and from a patient perspective, what is the most preferred or satisfying treatment option. Overall, outcomes research will lead to better use of limited resources, informed decision-making by patients, providers, and payers, development of guidelines for better disease management - especially for chronic diseases, and better health policy decisions.

What are the goals of the graduate program in Health Services and Outcomes Research?

The focus of Health Services and Outcomes Research is to prepare highly qualified graduate students for careers in academia, industry, government, and institutional settings through training in health outcomes and policy research. Areas of specialization include: pharmacoeconomics, health services research, pharmacoepidemiology, health behavior and risk.

What are the job opportunities for graduates of the program?

Job opportunities for those with PhD's in this field are excellent and will continue to be so in the near future. Our students are trained to take jobs in Universities, the pharmaceutical industry, government agencies, clinical research organizations, and the managed care industry. Please visit our Alumni – Where are They Now? (http://pharmacy.hsc.wvu.edu/pharmaceutical-systems-and-policy/phd-program-in-health-services-and-outcomes-research/information-for-new-applicants/alumni-where-are-they-now) page to see where recent graduates of our program are employed.

Frequently Asked Questions

Does this program offer a Master's degree?

This program does not at this time have a terminal Master's degree. Students are only admitted into the PhD Program. Students with a Bachelor or Doctor of Pharmacy degree who are admitted to the program are required to complete a MS on the way to a PhD. Students with a non-thesis Master’s degree (e.g. M.P.H.) are required to complete a research project and publish a manuscript by the end of the first year of their PhD studies. Students who already have a research (with thesis) Master’s degree are admitted with no such stipulations. All students have to complete the PhD graduation
requirements (http://pharmacy.hsc.wvu.edu/pharmaceutical-systems-and-policy/phd-program-in-health-services-and-outcomes-research/information-for-new-applicants/phd-graduation-requirements) to be awarded a PhD.

How long does it take to finish a PhD degree in this field?
Typically, a student starting without a research Master’s degree could take anywhere from 4 to 5 years to complete all of the degree requirements. Students who already have a research Master’s degree take less time, about 3 to 4 years.

Is financial assistance available?
A limited number of teaching and research assistantships (with a stipend of $25,000 a year) and fellowships are available within the department. These include an annual stipend and full tuition waiver with the student required to perform 20 hours/week of assistantship duties. Students with assistantships have to pay approximately $625/semester towards the use of the recreation center, the public rapid transport system (PRT), and other such conveniences. The assistantships are available to students throughout the duration of their studies (typically 3 or 4 years) as long as they are performing well in their duties, and making satisfactory progress toward their degree objective. The stipends are sufficient for graduate students to live comfortably and devote sufficient time to their educational program and research training. These assistantships are awarded on a competitive basis each year with the highest ranked applicants given the first offer of available assistantships. Some qualified students may be also offered admission without an assistantship. These students are provided guidance to seeking other campus employment opportunities subject to Immigration and Naturalization Services’ regulations in case of foreign students.

Is BS in Pharmacy or Pharm.D. degree (or a pharmacy background) required for admission?
No. Generally, a professional degree in pharmacy, medicine, or a health-related discipline is preferred. Students with Masters Degrees in related fields such as epidemiology, economics, and public health are also encouraged to apply. Students with Master’s degree in marketing management, psychology, or sociology with a demonstrated interest or experience in health care may also apply.

What is the entry date into the program?
Because of the sequence of core courses, students are admitted only in the Fall semester only, which typically begins in the middle or last week of August every year. In very rare instances, a student may be admitted in the Spring semester if they already have a research Master’s degree, and if the PSP faculty agree that the circumstances of his/her admission warrant special consideration.

How do I apply to the program and what is the application deadline?
All application materials, transcripts, test scores, three letters of recommendation, curriculum vitae of educational qualifications and training and job experiences, and statement of purpose must be submitted to WVU Graduate Admissions (https://app.applyyourself.com/AYApplicantLogin/fl_ApplicantConnectLogin.asp?id=wvugrad) by February 1st of the year for consideration of admission in the Fall semester of that year. It is best to start the admission process by September of the year before the Fall semester that you want to be considered to give yourself sufficient time to complete the process and not be affected by unexpected delays. Reviews are completed by the middle or end of March, and applicants are notified of acceptance or rejection with a signed acceptance from those offered an admission required no later than April 15.

How many applications do you receive each year?
The number of applications we receive vary from year to year but has shown a dramatic increase in the last few years. In recent years the numbers have ranged from 25 to 40.

How many students are accepted each year?
The number of students accepted each year vary depending on the number of students who have graduated in the preceding year. Typically, 3-4 students have been admitted per year in the recent past. A total number of 13-16 students are maintained in the program to enable close mentoring and training relationships with faculty advisors.

How is an application to the graduate program evaluated?
An application to the graduate program along with all supporting materials is reviewed by all members of the department graduate faculty. Each application is holistically reviewed first in terms of meeting the minimum academic (a ‘B’ average or a 3.0 GPA on 4.0 scale) and TOEFL (550 on the paper-based exam and 213 on the computer-based exam) criteria. Applications not meeting these criteria are immediately rejected. The subsequent reviews take place in a committee meeting in which all applications are discussed and ranked through a consensus process. While individual faculty may weigh each criteria slightly different, sustained academic excellence, good to outstanding GRE scores, past work or research experience in areas of interest, well written statement of purpose, leadership and extracurricular activities are all considered important and considered in a holistic way. Telephone or personal interview are typically required by the graduate faculty. Students ranked according to merit are offered admission with an assistantship in the order of listing until no more assistantships are available. A few additional students may be offered admission without an assistantship. A verbal offer by telephone is made to students who are offered admission with assistantships, and upon verbal acceptance of the offer, are sent formal letters of acceptance.

How are grades, GRE/GMAT scores considered in the overall admissions evaluation?
While sustained academic excellence is considered to be among the best predictors of academic performance, GRE scores are also important to compare students from different domestic and international education systems. For students from English speaking parts of the world, quantitative and analytical scores are given more weight than the verbal scores. Faculty participating in application reviews typically look for overall educational achievements, competitive GRE scores, extracurricular and leadership activities, and demonstrated interest in research in the chosen area of study.

What role does TOEFL play in the admission process?
Since all of the education process and research training is in English, students from non-English speaking parts of the world are required to provide TOEFL scores by the University with a score of 500 on the paper-based exam, 173 on the computer-based exam, 61 for TOEFL internet-based, and 60 for IELTS considered to be minimum University requirement. Once admitted, and if awarded a Teaching Assistantship, students are also required to pass a test of spoken English before they are allowed to teach in classes or labs.

Can TOEFL be waived?
Students who have received a high school, bachelor's or Master's degree in the United States need not submit TOEFL scores. Please contact the Office of International Students and Scholars (http://oiss.wvu.edu/students) to request a waiver.

What are acceptable GRE (or GMAT) scores?
Scores on the GRE (or GMAT) are reported in terms of percentiles. So, for example, if a student scores at the 65th percentile, this means that he or she scored at or better than 65 percent of the students who took that test. We obviously want the best students who apply.

If my GRE (or GMAT) or TOEFL scores are not good, should I retake these exams?
These tests are standardized tests, and typically, student scores do not change much on retaking of these exams. Make sure that you are familiar with the format of these tests and the time constraints for their completion. Practice books are available to familiarize yourself with the exam. If you take these exams and are not satisfied with your scores, you should retake them only if you feel certain that retaking them will help you improve your test scores. If you do retake them, Educational Testing Service will report the results of all attempts within the previous three years.

Are applicants interviewed?
All applicants are interviewed either by video-chats (Skype, or Go-to Meeting) or in person in Morgantown. International students are interviewed by video-chats.

Can I transfer graduate coursework from my current institution if I have not completed a Masters degree?
Yes, on admission to the graduate program and upon forming a PhD committee with an advisor, the committee will take into consideration whatever recent graduate coursework you have completed that can contribute to your plan of study given your educational goals and program needs. WVU allows up to 18 credit hours of coursework to be transferred that are not part of a degree program. See Application for Transfer of Graduate Credit to WVU

Are there examples of Master's thesis and PhD dissertations completed by recent graduates to get a flavor of the type of research projects that graduate students do at WVU?
Yes, please visit Recent MS thesis and PhD dissertations (http://pharmacy.hsc.wvu.edu/pharmaceutical-systems-and-policy/phd-program-in-health-services-and-outcomes-research/information-for-new-applicants/recent-ms-thesis-and-phd-dissertations) for titles completed by recent graduates.

What is it like to study at West Virginia University (WVU) and live in Morgantown?
West Virginia University, founded in 1867, is located in Morgantown, West Virginia, is one of only 46 public universities that serve their state as research and land-grant institutions. Through 15 colleges and schools, WVU offers 193 bachelors, master’s, doctoral and professional degree programs.

WVU is a Doctoral/ Research University - Extensive as classified by the Carnegie Classification of Institutions of Higher Education -- based on the complexity and breadth of the institution's mission. As West Virginia's major research and development center and only comprehensive doctoral-granting institution, WVU faculty conducts over $150 million in sponsored contracts and grants per year.

The WVU System spans the state, including 518 buildings on 15,880 acres (main campus 430 buildings/1,456 acres). Eleven main campus buildings are on the National Register of Historic Places, and WVU operates eight experimental farms and four forests throughout the state. The University’s total operating budget is approximately $900 million. WVU’s student body is comprised of over 31,524 students with 28,776 on the Morgantown campus. These students hail from all West Virginia counties, nearly all 50 states, and close to 100 foreign nations. Chartered in 1873, the WVU Alumni Association is made up of more than 190,000 graduates worldwide in some 135 nations. For more information about West Virginia University and a virtual tour of the campus, visit: http://www.wvu.edu/.

Morgantown, W.Va., population 31,073 (US Census Bureau, 2014), was rated “No. 1 Small City in America” by BizJournals.com, Business Insider named Morgantown the ninth best college town in America. Within easy traveling distance of Washington, D.C., to the east, Pittsburgh, Pa., to the north, and Cleveland and Columbus, Ohio, to the northwest. Other recent rankings: Kiplinger.com included Morgantown in their 10 great places to live list; one of “Best Sports Cities” by Sporting News; 5th “Best Small Metro” by Forbes; 12th overall “Hottest Small City” by Inc.; one of “50 Smartest Places to Live” by Kiplinger’s; and the second-ranking “Best College Town for Jobs” by Forbes. WVU has divisional campuses in Charleston, Keyser, Martinsburg and Montgomery.

Monongalia County in which Morgantown is located is a community of about 80,000 people in the Appalachian Mountains on West Virginia's northern border. While the state is rural and the community quiet, Morgantown is within easy traveling distance from Pittsburgh, which is 75 miles (115 kilometers) north, and Baltimore and Washington, both of which are 200 miles (325 kilometers) east. Two major four-lane highways, Interstate 79 and Interstate 68, pass through Morgantown. U.S. 19 and U.S. 119 also pass through Morgantown.


What if I have more questions or concerns?
If your question is not addressed anywhere in the list of frequently asked questions...

- For questions about other programs, life at WVU, and other information for prospective students please visit Graduate Education at http://graduate.wvu.edu/.
- For questions about University policies on graduate programs at West Virginia University, please visit: Undergraduate, Graduate, and Health Sciences Center Catalogs (http://catalog.wvu.edu).

For application related inquiries, status of application file, confirmation of materials, scores, received, admission status, etc., please contact:

Kimberly M. Kelly, Ph.D.
Associate Professor
HSOR Admissions Coordinator
Pharmaceutical Systems & Policy
Telephone: 304-293-1453
E-mail: kmkelly@hsc.wvu.edu

For specific Health Services and Outcomes Research graduate program related inquiries, please contact:

Usha Sambamoorthi, Ph.D.
Professor
HSOR Graduate Program Director
Pharmaceutical Systems & Policy
Telephone: 304-293-1451
Email: usambamoorthi@hsc.wvu.edu

For more details about the PhD program in HSOR go to: http://pharmacy.hsc.wvu.edu/department-of-pharmaceutical-systems-and-policy/phd-program-in-health-services-and-outcomes-research/

**Admission Requirements**

Applicants considered for admission to the doctoral program must meet the following minimum requirements.

- A professional degree in Pharmacy (Pharm.D.), Medicine (M.D.), or a Master's degree in pharmacy administration. Students with a Master’s degree in related fields such as epidemiology, public health, health care administration, are also encouraged to apply. Students with a Master’s degree in related fields such as marketing, management, economics, psychology, or sociology with a demonstrated interest or experience in health care may also apply.
- Outstanding students with a B.S. in pharmacy or pharmaceutical sciences may be considered for direct admission into the Doctoral program
- College transcript with a minimum of a B average (3.0 on a 4.0 scale)
- GRE or GMAT scores (International applicants must also take the TOEFL examination and score at least 550 on the paper exam, 213 on the computer-based exam, or 79-80 on the internet exam) evaluating potential for graduate studies
- Supportive letters of recommendation (at least three)
- Satisfactory personal or telephone interview (whenever possible)
- Statement (one page) of personal goals describing background, academic/ research interests and career objectives
- A resume or curriculum vitae listing educational and employment history
- Application deadline is February 1st of each year

**International Applicants**

International students should also be aware of the following:

- International applicants must present the Test of English as a Foreign Language or TOEFL (minimum of 550 on the paper-based exam, 79-80 on the internet exam, or 213 on the computer-based exam) if they are from a non-English speaking country or the official language of the country is not English. Applicants are urged to arrange for one of these tests well in advance of the desired enrollment period.
- International students who have completed a M.S. degree or any degree in the U.S. may request a waiver for submitting TOEFL results. They should contact the Office of International Students and Scholars (https://oiss.wvu.edu) for approval.
- International students should not plan to leave their country without a formal notification of admission from the Office of Admissions at WVU. International students admitted without an assistantship must submit a statement of financial status in order to be registered at WVU.
- International students admitted to the program must report to the Office of International Students and Scholars upon arrival at WVU. Students are responsible for making sure that they are in compliance with immigration requirements.

**Application Process (Major Code 8980)**
Deadline: February 1

Application to the Health Services and Outcomes Research PhD program is completed electronically at https://app.applyyourself.com/AYApplicantLogin/fi_ApplicantConnectLogin.asp?id=wvugrad

Please choose Major Code: 8980.

West Virginia University requires the following information for application through the WVU online application portal. Please note that all materials are submitted through the portal. Do not send materials to the School of Pharmacy unless instructed to do so by the Office of Student Services.

1. One copy of official transcripts (original or certified; minimum of a B average or a 3.0 GPA on a 4.0 scale) in a sealed envelope from each college you have attended.
2. Original or certified copies of all degrees/diplomas/certificates received in the original language.
3. Translation of an applicant’s foreign transcripts and diplomas/certificates may be sent directly to a foreign transcript service for evaluation. If using a foreign transcript service, please have the evaluated documents submitted the WVU Office of Graduate Admissions.
4. Official GRE Scores and TOEFL or IELTS scores.
5. Statement of personal goals describing your background, academic interests, and career objectives.
6. A resume or curriculum vitae listing educational and employment history.
7. Three letters of recommendation from persons who are in a position to evaluate your potential for graduate school. At least one recommendation must be from a person at the last school you attended for full-time study, unless you have been out of school for five years or longer.

Direct admission related inquiries to:
Kimberly M. Kelly, Ph.D.
Associate Professor
HSOR Admissions Coordinator
Pharmaceutical Systems & Policy
Telephone: 304-293-1453
E-mail: kmkelly@hsc.wvu.edu

Direct program related inquiries to:
Usha Sambamoorthi, Ph.D.
Professor
HSOR Graduate Program Director
Pharmaceutical Systems & Policy
Telephone: 304-293-1451
Email: usambamoorthi@hsc.wvu.edu

Students considered for admission will participate in an interview and will be notified of their candidacy in the spring prior to admission.

- See more at:  http://pharmacy.hsc.wvu.edu/department-of-pharmaceutical-systems-and-policy/phd-program-in-health-services-and-outcomes-research/

### Curriculum Requirements

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## Suggested Electives

### Quantitative Emphasis
- **BIOS 610**: Biostatistical Theory and Methods 1  
  - 4 credits
- **BIOS 611**: Data Management and Reporting  
  - 3 credits
- **BIOS 612**: Biostatistical Theory and Methods 2  
  - 3 credits
- **BIOS 620**: Applied Linear Models HS  
  - 3 credits
- **BIOS 621**: Categorical Data Analysis HS  
  - 3 credits
- **PSYC 711**: Seminar in Methodology  
  - 3 credits
- **PHAR 768**: HEOR/HSOR Internship  
  - 1-6 credits

### Behavioral Emphasis
- **PHAR 759**: Clinical and Population Practicum  
  - 1 credit
- **SBHS 613**: Public Health Program Evaluation  
  - 3 credits
- **SBHS 614**: Community-Based Participatory Research  
  - 3 credits
- **SBHS 615**: Intervention Design  
  - 3 credits
- **SBHS 761**: Qualitative Research Methods  
  - 3 credits

### Health Policy Emphasis
- **HPML 601**: Foundations of Health Policy  
  - 3 credits
- **HPML 622**: Analytic Methods for Health Policy, Management, and Leadership  
  - 3 credits
- **HPML 624**: Advanced Issue Analysis for Health Policy  
  - 3 credits
- **HPML 670**: Policy Analysis for Population Health 1  
  - 3 credits
- **HPML 671**: Population Health Policy Analysis Informatics 1  
  - 3 credits

### Epidemiology Emphasis
- **EPID 611**: Concepts and Methods of Epidemiology  
  - 3 credits
- **EPID 664**: Chronic Disease Epidemiology  
  - 3 credits
- **EPID 712**: Quantitative Methods in Epidemiology  
  - 3 credits
- **EPID 761**: Cardiovascular Epidemiology  
  - 3 credits
  - or **EPID 762**: Cancer Epidemiology  
  - 3 credits
- **EPID 764**: Mind-body Medicine  
  - 3 credits

### Disease Emphasis
- **SBHS 634**: Issues in Women's Health  
  - 3 credits
- **EPID 767**: Maternal and Child Health Epidemiology  
  - 3 credits
- **SBHS 633**: Women and Violence  
  - 3 credits

### Health Care Administration
- **PUBA 671**: Healthcare Organization and Operation  
  - 3 credits
- **PUBA 672**: Healthcare Finance  
  - 3 credits
- **PUBA 673**: Alternative Healthcare Delivery Systems  
  - 1 credit
- **PUBA 674**: Rural Healthcare  
  - 1 credit
- **PUBA 675**: Organization Performance Improvement  
  - 1 credit
- **PUBA 774**: Healthcare Law and Ethics  
  - 1 credit
- **PUBA 770**: Managed Care  
  - 1 credit
- **PUBA 775**: Healthcare Policy  
  - 1 credit
- **PUBA 776**: Healthcare Planning/Marketing  
  - 1 credit
Major Learning Outcomes

The overall goals of the PhD program in Health Services and Outcomes Research are:

1. To educate and train highly qualified individuals to pursue independent research in health services and outcomes research (HSOR) within interdisciplinary teams, and to function and contribute as a member of a research team.
2. To prepare competent scientists able to contribute to health-related research, industrial research and development, pharmaceutical education, and scholarship.
3. To advance research in pharmaceutical and healthcare delivery.
4. To provide leadership for the pharmacy profession in research, graduate education, and health policy making.

The program is designed to prepare students to become independent researchers. Students will develop competencies in the scientific research process through didactic studies and conceptualizing, designing, conducting, and reporting original research.

Didactic Studies

1. To learn basic principles and apply these principles to specific disciplines and related fields to cultivate a broad background of knowledge.
2. To develop research skills, including scientific communication and critical thinking/problem solving abilities by participating in seminars and designated research skill courses.

Research Training

1. To acquire practical experience in conducting original research, including acquisition of background information (e.g. literature research), problem development, experimental design and experimentation, collecting primary data and using secondary data, and data analyses.
2. To foster research communication skills by writing abstracts for research presentations, manuscripts for publication, research grant proposals, and a thesis or dissertation.
3. To gain additional insight into research and scholarship by participating in scholarly exchanges with faculty and students in the WVU School of Pharmacy, the Health Sciences Center (HSC), as well as the national and international healthcare community.

COURSES

PHAR 691A-Z. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

PHAR 693. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

PHAR 694A-Z. Seminar. 1-6 Hours.
Seminars arranged for advanced graduate students. (Grading may be S/U.).

PHAR 696. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

PHAR 697. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

PHAR 700. Pharmacy as a Profession. 1 Hour.
PR: First professional year standing or consent. Introduces students to the concept of professionalism, the scope of pharmacy practice opportunities, the health care system as it relates to pharmacy, and other contemporary issues in pharmacy practice. (Grading will be S/U.).

PHAR 701. Pharmaceutical Care Lab 1. 2 Hours.
PR: First professional year standing or consent. Students will develop skills in medical terminology, communications, information retrieval, dispensing, compounding, calculations, pharmaceutical care, and problem-solving skills.

PHAR 702. Pharmaceutics 1. 3 Hours.
PR: First professional year standing or consent. Introduces drug physical-chemical characteristics relevant to the design and performance of delivery systems. Pharmaceutical dosage forms taught include disperse and polydisperse systems (suspensions, emulsions, creams, ointments, aerosols and transdermals).

PHAR 703. Pharmacy Practice Experience 1. 1 Hour.
PR: First professional year standing or consent. Provides an overview of the roles and responsibilities of community pharmacists and provides experiential learning in a community pharmacy setting. First course in a six-semester sequence that introduces students to various pharmacy practice settings.

PHAR 704. Introduction to Research. 1 Hour.
Provides pharmacy students with a forum for the discussion of a wide variety of research activities and careers. Also provides an appreciation for the science on which the pharmacy profession is based and continually evolves.
PHAR 706. Biopharmaceutics. 2 Hours. 
Introduces the fundamental principles of biopharmaceutics. This area of knowledge deals with the drug performance at the delivery system – human body interface, and addresses how physico-chemical drug properties, delivery system characteristics, and physiological processes influence drug distribution and affect the body, as well as drug bioavailability.

PHAR 707. Drug-Induced Diseases. 2 Hours. 
Focused study of adverse effects of prescription and non-prescription medications designed for practical application across multiple disease states.

PHAR 708. Pharmaceutics 2. 3 Hours. 
PR: PHAR 702. Continuation of PHAR 702. Solids dosage forms (tablets, capsules, sustained-release), regulatory pathways for marketing drugs, and biopharmaceutical principles (dosage form behavior in body).

PHAR 709. Immunology and Biotechnology. 2 Hours. 
PR: First year professional standing or consent. Students will learn basic functions of the immune system, elements of the pharmaceutical applications of biotechnology, and be introduced to the chemotherapy of infections.

PHAR 710. Pharmacy Practice Experience 2. 1 Hour. 
PR:PHAR 703 or consent. Provides an overview of the roles and responsibilities of community pharmacists and provides experiential learning in a community pharmacy setting. Second course in a six-semester sequence that introduces students to various pharmacy practice settings.

PHAR 711. Chemical Properties of Drugs. 2 Hours. 
PR: First year professional standing or consent. Principles of chemical stability and chemical properties as they relate to drug molecules. Topics to be covered include functional group analysis, solubility, oil/water partitioning, organic acids and bases, and drug decomposition and metabolism.

PHAR 712. Pharmaceutical Care Lab 2. 2 Hours. 
PR: First professional year standing or consent. Continuation of PHAR 701.

PHAR 715. Pharmacotherapeutics 1. 4 Hours. 
PR: Second professional year standing or consent. Principles and concepts of pathophysiology and pharmacotherapeutics. An organ system approach to disease states and their therapeutic management is followed.

PHAR 716. Chemistry of Drug Action 1. 3 Hours. 
PR: PHAR 711 or consent. Provides a basic understanding of relationships between the chemical structure of a drug and its biological effect. Physiochemical properties, enzymatic transformations and structure-activity relationships (SAR) of important pharmaceutical agents are discussed.

PHAR 717. Pharmacy Practice Experience 3. 1 Hour. 
PR: Second professional year standing or consent. Introduces students to the principles of service learning through development of an on-site healthcare-related service project. Third course of a six-semester sequence that introduces students to various pharmacy practice settings.

PHAR 718. Pediatric Pharmacotherapy. 2 Hours. 
PR: Second professional year standing or consent. Overview of common pathophysiology and pharmacotherapy principles in the pediatric population and selection of drug therapy to treat the pediatric patient.

PHAR 719. Pharmacy Practice Experience 4. 1 Hour. 
PR: PHAR 717 or consent. Introduces students to the principles of service learning through implementation of an on-site healthcare related service project. Fourth course of a six-semester sequence that introduces students to various pharmacy practice settings.

PHAR 720. Patient Health Education. 2 Hours. 
PR: Second professional year standing or consent. Interpersonal communication skills will be enhanced in the areas of patient-centered and colleague-centered communications. Students will learn processes for providing pharmaceutical care (e.g., interviewing and counseling patients; formulating a plan; monitoring; and documenting information).

PHAR 721. Advocacy and Leadership. 2 Hours. 
PR: Second and third professional year standing or consent. The course will focus on developing the student’s leadership skills as an advocate for the profession of pharmacy.

PHAR 722. Weapons of Mass Destruction and Disaster Planning. 1 Hour. 
Through didactic, hands on instruction, and participation in real world disaster planning sessions and/or drills, students learn about weapons of mass destruct (WMD) surveillance and mitigation in addition to disaster planning principles.

PHAR 723. Pharmaceutical Care Lab 3. 1 Hour. 
PR: Second professional year standing or consent. Continuation of PHAR 712.

PHAR 724. Pharmaceutical Care Lab 4. 2 Hours. 
PR: Second professional year standing or consent. Continuation of PHAR 723.

PHAR 725. Pharmacotherapeutics 2. 4 Hours. 
PR: PHAR 715 or consent. A continuation of PHAR 715.

PHAR 726. Chemistry of Drug Action 2. 2 Hours. 
PR: PHAR 716 or consent. A continuation of PHAR 716.
PHAR 727. Medical Literature Evaluation. 2 Hours.
PR: Second professional year standing or consent. Emphasis is placed on the critical analysis and evaluation of the primary literature. Secondary and computerized information resources are also discussed, including other selected aspects of drug information.

PHAR 728. Pharmacy Management. 2 Hours.
PR: Second professional year standing or consent. This course provides an introductory survey of the basic principles of personnel and fiscal management as they apply to organizational planning and decision-making, organizational design and structure, leadership and control in organizations, and the issues facing pharmacy managers.

PHAR 730. Pharmacotherapeutics 3. 4 Hours.
PR: PHAR 725 or consent. A continuation of PHAR 725.

PHAR 731. Pharmacogenomics and Pharmacokinetics. 3 Hours.
PR: Third year professional standing or consent. Fundamental principles of pharmacogenomics (how genetic influences affect drug dosing and efficacy) and pharmacokinetics (pharmacokinetic and biological processes a drug undergoes upon entering the body).

PHAR 732. Non-Prescription Drugs. 3 Hours.
PR: Third year professional standing or consent. An advanced level course on the appropriate selection, and use of non-prescription drug products in the contemporary practice setting, the basis for self-medication, assessment of patient condition, and approach to patient counseling.

PHAR 733. Pharmacy Systems. 2 Hours.
PR: Third year professional standing or consent. Basic principles of financial management as they apply to the day-to-day operations in pharmacy systems present in institutional, community, long-term care facilities and other pharmacy venues.

PHAR 734. Pharmacy Practice Experience 5. 1 Hour.
PR: Third professional year standing or consent. Provides experiential learning in an acute or ambulatory care pharmacy practice setting. Fifth course in a six-semester sequence that introduces students to various pharmacy practice settings.

PHAR 735. Teach to Learn: Learn to Teach. 2 Hours.
Provides pharmacy students the opportunity to learn how to teach in higher education/pharmacy and develop their teaching skills by participating in select teaching and learning activities.

PHAR 736. Education Journal Club. 1 Hour.
PR: PHAR 734 or Consent. Evaluate educational research articles from pharmacy education and other healthcare disciplines. Students will present and critically analyze educational literature and develop presentation skills.

PHAR 737. Critical Care Pharmacotherapy. 2 Hours.
PR: Third professional year standing or consent. Gain knowledge in multiple facets of critical care pharmacotherapy, particularly for students interested in pharmacy residency training in a clinical setting.

PHAR 738. Pharmacy Practice Experience 6. 1 Hour.
PR: Third professional year standing or consent. Provides experiential learning in an acute or ambulatory care pharmacy practice setting. Sixth course in a six-semester sequence that introduces students to various pharmacy practice settings.
PHAR 747. History of Pharmacy. 2 Hours.
Gives the student a deeper appreciation of the background of pharmacy and its development from ancient times to present.

PHAR 748. Acute Care Case Studies. 2 Hours.
PR: Third professional year standing or consent. Gain experience developing pharmaceutical care plans in an acute care setting. Further prepares students interested in pursuing pharmacy residency training.

PHAR 749A. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749B. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy or clinical pharmacy. (Grading may be P/F.).

PHAR 749C. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy or clinical pharmacy. (Grading may be P/F.).

PHAR 749D. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy or clinical pharmacy. (Grading may be P/F.).

PHAR 749E. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems, and policy, or clinical pharmacy. (Grading may be S/U.).

PHAR 749F. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749G. Pharmaceutical Investigation. 2-3 Hours.
PHAR 749G. Pharmaceutical Investigation. 2-3 Hr, PR: Consent. Original Investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749H. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749I. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749J. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749K. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749L. Pharmaceutical Pharmacy. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749M. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749N. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749O. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).

PHAR 749P. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy. (Grading may be P/F.).
PHAR 749Q. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 749R. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 749S. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 749T. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 749U. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 749V. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 749W. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 749X. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 749Y. Pharmaceutical Investigation. 2-3 Hours.
PR: Consent. Original investigation in pharmaceutics, medicinal chemistry, pharmacology, pharmaceutical systems and policy, or clinical pharmacy.
(Grading may be P/F.).

PHAR 751. Geriatrics. 2 Hours.
PR: Second or third year pharmacy students. A review of common pharmacotherapeutic and social issues of importance to older adult patients.

PHAR 752. History of Drug Discovery. 2 Hours.
This course is concerned with the way in which advances in chemistry and biochemistry have influenced advances in drug discovery and therapeutics beginning with the late 18th century through today.

PHAR 753. Social and Behavioral Theory and Health Outcomes Research. 3 Hours.
Basic social and behavioral theories related to the health behavior change and health outcomes. Open to graduate students in pharmacy, public health, or other health care fields.

PHAR 754. Decision Analysis in Healthcare. 3 Hours.
Core skills in clinical decision analysis which builds on concepts derived from epidemiology, biostatistics, computing, economics and operations research and applies them to medical and pharmacological decisions.

PHAR 755. Pharmacoeconomics. 3 Hours.
This graduate-level course is intended to train graduate students in evaluating and conducting pharmacoeconomic research.

PHAR 756. Health Survey Research Methods. 3 Hours.
This course seeks to increase students’ understanding of survey research methods and to develop basic skills in survey development and administration.

PHAR 757. Patient Reported Outcomes. 3 Hours.
Provides a foundation in health outcomes research with an emphasis on patient reported outcomes in health service research.

PHAR 758. Ethical and Regulatory Aspects of Clinical Research. 2 Hours.
Provides overview of ethical and regulatory aspects of clinical research.

PHAR 759. Clinical and Population Practicum. 1 Hour.
Expose students to a population of interest in preparation for a research project. This course will help students to understand the lived experience of the population of interest and expose students to aspects of the healthcare system. Students will either work with a clinical population or community-based population to address one or more disease states. Grading will be Pass/Fail.
PHAR 760. Acute Care Rotation 1. 5 Hours.
PR: Fourth year professional standing or consent. Five-week experience in the delivery of pharmaceutical care in an acute care setting.

PHAR 761. Acute Care Rotation 2. 5 Hours.
PR: Fourth year professional standing or consent. Experience in the delivery of pharmaceutical care in an acute care setting.

PHAR 762. Ambulatory Care Rotation 1. 5 Hours.
PR: Fourth year professional standing or consent. Experience in the delivery of pharmaceutical care in an ambulatory care setting.

PHAR 763. Ambulatory Care Rotation 2. 5 Hours.
PR: Fourth year professional standing or consent. Five-week experience in the delivery of pharmaceutical care in an ambulatory care setting.

PHAR 764. Elective Rotation 1. 5 Hours.
PR: Fourth year professional standing or consent. Five-week experience in a pharmacy practice setting, such as acute care, ambulatory, community, hospital, poison center, drug information, home health, long term care, or research.

PHAR 765. Elective Rotation 2. 5 Hours.
PR: Fourth year professional standing or consent. Five-week experience in a pharmacy practice setting, such as acute care, ambulatory, community, hospital, poison center, drug information, home health, long term care, or research.

PHAR 766. Selective Rotations. 5 Hours.
PR: Fourth year professional standing or consent. Five-week experience in a pharmacy practice setting, selected from a list and includes: pharmacy administration, discharge counseling, drug information, informatics, long term care, managed care, medication reconciliation, medication safety, nuclear pharmacy, clinical toxicology, and quality outcomes.

PHAR 767. Scientific Writing: Health Services and Outcomes Research. 3 Hours.
Students will be trained in effective written communication skills by developing scientific journal articles in health services and outcomes research.

PHAR 768. HEOR/HSOR Internship. 1-6 Hours.
Strengthen practical knowledge and hands-on experience in the areas of Health Services and Outcomes Research/Health Economics and Outcomes Research by working with pharmaceutical companies, clinical research organizations, federal, state, and local governments, policy think tanks, or health care systems.

PHAR 769. Advanced Health Service Research Methods. 3 Hours.
Provides a working knowledge of health services research methods and how to apply these methods to answer typical research questions in health services research. The course will examine concepts but will have an applied focus with hands-on research using publicly available datasets or those that students have access for their dissertations/manuscripts.

PHAR 770. Community Rotation. 5 Hours.
PR: Fourth year professional standing or consent. Five-week experience in the delivery of pharmaceutical care in a community pharmacy setting.

PHAR 772. Institutional Rotation. 5 Hours.
PR: Fourth year professional standing or consent. Five-week experience in the delivery of pharmaceutical care in a health system setting.

PHAR 775. Advanced Biopharmaceutics. 3 Hours.
Concepts of biopharmaceutics and pharmacokinetics in relation to the design and evaluation of dosage forms and determination of rational dosage regimens in health and disease.

PHAR 776. Preparing Residency Applicants. 2 Hours.
Increase knowledge and skills needed to pursue postgraduate residency training in pharmacy, and implement measures to increase pharmacy residency competitiveness.

PHAR 777. Health Outcomes Research Designs. 2 Hours.
Focuses on the skills required to design, conduct, and analyze research topics in health outcomes research. Includes a study of statistics, analysis of research design and methodology, use of library resources, and evaluation of current literature.

PHAR 778. Travel Medicine and Global Pharmacy Practice. 2 Hours.
Identifies and explores major issues in global health with a specific focus on global pharmacy practice and medication therapy. Students will also learn fundamentals in travel medicine so they can assist international travelers in preventing and treating travel-related maladies.

PHAR 779. Drug Discovery. 3 Hours.
PR: Graduate Standing or permission of instructor. Instruction in the process of drug discovery to the development of new forms for therapeutic use. Topics covered included drug design/discovery, target identification and development, lead optimization, and pre-clinical and clinical development.

PHAR 780. Introduction to Molecular Modeling. 4 Hours.
PR: Graduate standing or permission of instructor. Introduction to molecular modeling describes computational methods for chemical and biological problems and is designed to enable the student to use molecular modeling methods as a research tool in their current or future research activities.

PHAR 781. Drug Metabolism. 3 Hours.
PR: Graduate standing or permission of instructor. This course presents a comprehensive review of the field of drug metabolism with an emphasis on the chemistry and enzymology of drug biotransformation, and current methods in drug metabolism research.
PHAR 782. Tumors of the Central Nervous System Journal Club. 1 Hour.
(May be repeated for a maximum of 15 credit hours.) Fundamental and advanced topics focused on drug distribution into normal brain, brain pathology and brain cancers. Other areas of focus include, advanced drug delivery methods, pharmacokinetics, experimental design and statistical analysis. Students will present and critically analyze scientific literature and develop presentation skills.

PHAR 783. Pharmacy Cell Biology Seminar. 1 Hour.
A literature review course in which each student will present and critically analyze primary literature in cell and molecular biology as pertinent to pharmaceutical and biomedical sciences.

PHAR 784. Pharmacology Journal Club. 1 Hour.
A primary literature based course that critically evaluates the latest findings and methods used in pharmacological research.

PHAR 785. Pharmacoepidemiology. 3 Hours.
This course covers basic principles and research study designs used in pharmacoepidemiology, as well as a review of the primary literature that details case examples of drugs withdrawn from the US drug market.

PHAR 786. Health Services Research and Secondary Database. 3 Hours.
PR: PHAR 785. This course presents various topics related to large databases including common study designs, advantages and limitations, and basic steps to extracting and analyzing large databases.

PHAR 787. Drug Discovery and Development. 1 Hour.
This seminar will teach students in the Pharmaceutical Sciences and related disciplines the current state-of-the-art of drug discovery, design, and development, develop student presentation skills, and convey the importance of staying current with key developments.

PHAR 788. Graduate Seminar in Health Outcomes Research. 1 Hour.
(May be repeated for credit toward graduation.) Forum for graduate students to present research, discuss research issues and contemporary topics of interest, develop an understanding of research methods through discussion, while focusing on scientific presentation skills. Topics vary from semester to semester.

PHAR 789. Seminar in Nanoscience. 2 Hours.
(May be repeated for a maximum of 4 hours.) Facilitates interdisciplinary research at the nanoscale by providing a forum for discussion and exploration of nanoscale science and engineering from a variety of perspectives including research and development of nanoscale devices and systems. Grading will be Pass/Fail.

PHAR 790. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in college teaching of pharmacy. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be P/F.).

PHAR 791A-Z. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

PHAR 792A-H. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

PHAR 793A-Z. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

PHAR 794A-Z. Seminar. 1-6 Hours.
Seminars arranged for advanced graduate students.

PHAR 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

PHAR 796. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

PHAR 797. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

PHAR 798. Thesis or Dissertation. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.

PHAR 799. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking coursework credit but who wish to meet residency requirements, use the University's facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department's 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is P/F; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.
PHAR 800. Pharmacy Practice and Management 1. 4 Hours.
Introduces student to the practice of pharmacy, with a focus on community pharmacy. PPM 1 is the first course in a five-course sequence (PPM 1-5) that introduces and reinforces the distributive, clinical, and administrative roles of pharmacists in various practice settings.

PHAR 801. Drug Delivery. 5 Hours.
An introduction to the concepts and techniques involved in the design and evaluation of pharmaceutical dosage forms, principles of physical pharmacy and drug delivery, and their applications in patient care.

PHAR 802. Preparation of Pharmaceutical Products. 2 Hours.
Gain experience in pharmaceutical calculations and preparing sterile and non-sterile dosage forms. Students will apply the principles of pharmaceutics to the preparation of pharmaceutical products.

PHAR 803. Physical Pharmacy. 2 Hours.
Provides an overview of the principles of physical pharmacy and their application in drug formulation and administration. Topics include: drug dissolution, acid-base chemistry, drug solubility, diffusion, distribution, and drug stability.

PHAR 804. Drug Delivery Systems. 3 Hours.
Introduces the students to the principles and technologies involved in the preparation and evaluation of pharmaceutical dosage forms and drug delivery systems. Students will develop skills in dosage form design and evaluation, as well as their applications in patient care. The course integrates and applies basic physicochemical and biological principles to solve problems in drug delivery in pharmacy practice.

PHAR 805. Drug Chemistry. 2 Hours.
Introduces principles of chemical stability and chemical properties as they relate to drugs and to the basic metabolic processes observed for drug molecules. Topics include functional group analysis, solubility, oil/water partitioning, organic acids/bases, drug decomposition, basic metabolic processes including oxidation, reduction, hydrolysis, and conjugation.

PHAR 806. Pharmaceutical Biotechnology. 1 Hour.
Basic principles of biotechnology with an emphasis on pharmaceutical applications is addressed. Knowledge from cell and molecular biology will be applied to solve biomedical problems and to make useful products for diagnostic and therapeutic purposes. Key processes used in the making, analysis, and application of biopharmaceuticals, such as proteins and nucleic acids as well as their stability, delivery, and handling.

PHAR 807. Pharmacogenomics. 2 Hours.
Introduces the fundamental principles of pharmacogenomics and individualized medicine. It provides a basis for understanding how an individual's genetic background affects their response to a specific drug or class of drugs. Pharmacogenomic principles include pharmacogenetic characteristics of drug metabolizing enzymes, drug transporter activity, and receptor sensitivity. Other basic concepts of genetic counseling, personalized medicine, ethics and costs will be discussed.

PHAR 808. Principles of Drug Action. 2 Hours.
Provides a basis for understanding the biochemical and molecular mechanisms by which drugs and the body interact. This course will use drug classes to introduce foundational concepts of drug action and the application of pharmacological tools to better understand how drugs work in the body.

PHAR 809. Pharmacy Practice and Management 2. 4 Hours.
PR: First professional year standing or consent. The second course in a five-course sequence (PPM 1-5). Introduces and reinforces the distributive, clinical, and administrative roles of pharmacists in various practice settings, with a focus on community pharmacy practice.

PHAR 810. Foundational Pharmacy Skills. 1 Hour.
PR: First professional year standing or consent. Provide students with foundational skills necessary for the provision of patient care including physical assessment, point of care testing, and oral and written communication. Many skills learned during this course will be further strengthened throughout pharmacy school.

PHAR 811. Drug Chemistry and Biotechnology. 3 Hours.
PR: First year professional standing or consent. Introduces principles of chemical stability and chemical properties as they relate to drugs and to the basic metabolic processes observed for drug molecules. Biotechnology will focus on pharmaceutical applications of cell and molecular biotechnology.

PHAR 812. Biopharmaceutics and Pharmacogenomics. 4 Hours.
PR: First professional year standing or consent. Develops an understanding of fundamental principles of biopharmaceutics and pharmacogenomics.

PHAR 813. Biochemical Pharmacology. 4 Hours.
PR: First professional year standing or consent. Provides a basis for understanding the biochemical and molecular mechanisms by which drugs and the body interact. This course will use drug classes to introduce foundational concepts of drug action and the application of pharmacological tools to better understand how drugs work in the body.

PHAR 814. Self-Care. 3 Hours.
PR: First professional year standing or consent. Provides an introduction to nonprescription medications and the application to patient care. Learners will assess the patient, make appropriate recommendations, and educate the patient on self-care treatment options for commonly encountered disease states and patient complaints.

PHAR 815. Pharmacokinetics. 2 Hours.
Introduces fundamental principles of the pharmacokinetic and biological processes that the drug undergoes once it enters the body. The students will be exposed to various pharmacokinetics techniques and problem-solving methods, which should prepare them to design and refine drug therapeutic regimens.
PHAR 818. Intro Community Rotation. 1,3 Hour.
PR: PHAR 800 or PR or CONC: PHAR 810. Introductory pharmacy practice experience in a community pharmacy setting.

PHAR 820. Pharmacy Practice and Management 3. 3 Hours.
PR: Second professional year standing or consent. The third course in a five-course sequence (PPM 1-5). Introduces the role of the pharmacist in public health initiatives, pharmacoepidemiology, and enhancing quality in the healthcare system.

PHAR 822. Service Learning Practice Experience 1. 1 Hour.
PR: Second professional year standing or consent. The first course in a 2-semester series that introduces students to the basic principles of service learning through on-site healthcare-related service projects. Interprofessional education is a component of the course.

PHAR 823. Pulmonology. 3 Hours.
PR: Second professional year standing or consent. First course in the systems-based therapy series with a focus on pulmonology. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with pulmonary diseases.

PHAR 824. Cardiology. 5 Hours.
PR: Second professional year standing or consent. Second course in the systems-based therapy series with a focus on cardiology. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with cardiovascular diseases.

PHAR 825. Nephrology. 2 Hours.
PR: Second professional year standing or consent. Third course in the systems-based therapy series with a focus on nephrology. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with kidney diseases.

PHAR 826. Evidence-Based Practice. 3 Hours.
PR: Second professional year standing or consent. The components of evidence-based practice are reviewed. Emphasis is placed on the appropriate use of information resources in practice and the critical analysis and evaluation of primary literature and other types of information.

PHAR 830. Pharmacy Practice and Management 4. 3 Hours.
The fourth course in a five-course sequence (PPM 1-5). Introduces and reinforces the distributive, clinical, and administrative roles of pharmacists with a focus on health-systems pharmacy practice and highlights the pharmacist's role in financial management, pharmacoconomics, and patient reported outcomes.

PHAR 832. Service Learning Practice Experience 2. 1 Hour.
PR: PHAR 822. The second course in a 2-semester series that introduces students to the basic principles of service learning through on-site healthcare-related service projects.

PHAR 833. Endocrinology. 3 Hours.
Fourth course in the systems-based therapy series with a focus on endocrinology. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with endocrine diseases.

PHAR 834. Immunology. 3 Hours.
Fifth course in the systems-based therapy series with a focus on immunology. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with immunological diseases and hypersensitivities.

PHAR 835. Rheumatology and Pain. 2 Hours.
Sixth course in the systems-based therapy series with a focus on management of rheumatologic disorders and pain. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with these diseases.

PHAR 836. Research in the Pharmaceutical Sciences. 3 Hours.
An overview of the process of conducting health-related research focusing on concepts, principles and methodology involved with the research process. Students gain experience in research proposal development and practice writing skills. Student learning is facilitated by didactic lectures, active learning and independent small group sessions.

PHAR 838. Intro Institutional Rotation. 1 Hour.
PR or CONC: PHAR 830. Gain experience in an institutional pharmacy setting.

PHAR 840. Pharmacy Practice and Management 5. 3 Hours.
The fifth course in a five-course sequence (PPM 1-5). This course focuses on pharmacy management related to financial and operational management of pharmacies, marketing of pharmacy services, health and pharmacy policy and advocacy, and human resources management.

PHAR 843. Gastroenterology and Nutrition. 3 Hours.
Seventh course in the systems-based therapy series with a focus on gastroenterology and nutrition. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with gastrointestinal diseases and nutrition support.

PHAR 844. Infectious Diseases. 3 Hours.
Eighth course in the systems-based therapy series with a focus on infectious diseases. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with infectious diseases.

PHAR 845. Neurology and Psychiatry. 4 Hours.
Ninth course in the systems-based therapy sequence with a focus on neurology and psychiatry. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with neurologic and psychiatric diseases.
**PHAR 848. Acute Care Practice Experience. 2 Hours.**
Gain knowledge as well as hands-on experience in the acute care setting. Students will learn the key components of acute care practice, perform activities that would be expected to be completed in acute care experiential rotations (such as medication reconciliation and formulary monographs), and simulate rounding experiences in an interprofessional environment. Interprofessional education is a component of this course.

**PHAR 849. Ambulatory Care Practice Experience. 2 Hours.**
Gain knowledge as well as hands-on experience in the ambulatory care setting. Activities will include ambulatory patient assessment, medication regimen evaluation, patient presentations, direct patient education, and targeted group education. Interprofessional education is a component of this course.

**PHAR 853. Hematology/Oncology. 4 Hours.**
Tenth course in the systems-based therapy series with a focus on hematology-oncology. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems in patients with hematological diseases and cancer.

**PHAR 854. Special Populations. 3 Hours.**
The final course in the systems-based therapy series that addresses special populations such as geriatrics, pediatrics and women's health (pregnancy, lactation, menopause) as well as disease processes that involve multiple body systems. Integrates scientific principles with clinical practice to enable students to prevent, identify, and resolve drug therapy problems.

**PHAR 858. Comprehensive Assessment of Practice. 3 Hours.**
Assess students’ readiness for successful completion of the upcoming advanced pharmacy practice experiences curriculum. Provides focused reinforcement of essential material relative to ensuring a student is practice ready, as well as reviewing difficult material from throughout the curriculum. Students complete a final objective structured clinical examination, which requires the demonstration of specific skills, including communication.

**PHAR 859. Pharmacy Law and Ethics. 3 Hours.**
PR: Third professional year standing or consent. The legal and ethical basis of pharmacy practice. Students learn about federal and state statutes, rules, and regulations that affect pharmacy practice. Ethics related situations that can arise during pharmacy practice will also be discussed.

**PHAR 860. Current Topics in Pharmacy. 1 Hour.**
PR: Fourth professional year standing or consent. Discussion of current topics in pharmacy practice. Core components of giving a seminar and journal club will be practiced.