Graduate Assistantships and Fellowships in the UNC Eshelman School of Pharmacy

Graduate teaching and research assistantships in the UNC Eshelman School of Pharmacy provide a stipend of $30,000 for 12 months' service. All awards are made on a competitive basis with consideration given to the applicant's academic record and Graduate Record Examination scores. Information concerning these assistantships, fellowships, and traineeships may be obtained by writing directly to the Office of Research and Graduate Education at the UNC Eshelman School of Pharmacy.

Chemical Biology and Medicinal Chemistry

Chemical biology and medicinal chemistry are multidisciplinary fields that integrate organic chemistry, biochemistry, molecular biology, structural biology, pharmacology, and physiology. The research in the division applies and extends the basic concepts of chemistry, biochemistry, and pharmacology to the investigation of biomedical problems. General areas of study include structure-activity relationships, drug-receptor interactions, synthetic drug design, and target discovery and validation. Specific focus areas include cancer chemotherapy, computer-aided drug design, enzymology, glycobiology, molecular modeling, natural products, neurochemistry, parasitology, and structural biology.

A Ph.D. is offered with a concentration in chemical biology and medicinal chemistry.

Pharmacoengineering and Molecular Pharmaceutics

Pharmacoengineering and molecular pharmaceutics represents interdisciplinary specialties encompassing a range of scientific endeavors, including

1. The design, fabrication, evaluation, use of, and delivery strategies for dosage forms
2. Elucidation of the behavior of pharmacologic agents in biologic systems
3. Determination of the ability of pharmacologic agents to reach the relevant site of biologic effect
4. Determination of the time course of biologic activity

These areas of specialization represent critical steps in the development of new therapeutic agents, the evaluation of new and existing drugs, and the optimal clinical use of pharmacologic agents.

Students in the Division of Pharmacoengineering and Molecular Pharmaceutics are required to participate in a common core of entry-level graduate courses. This core provides a broad perspective of the pharmaceutical sciences as well as an appreciation for how different subdisciplines interact. Many dissertation projects are collaborative in nature and rely upon interactions with faculty in other divisions of the UNC Eshelman School of Pharmacy, as well as with colleagues in the UNC School of Medicine, the Department of Chemistry, or at pharmaceutical companies or institutions located in the Research Triangle Park area.

A Ph.D. is offered with a concentration in pharmacoengineering and molecular pharmaceutics.
Pharmaceutical Outcomes and Policy
The Division of Pharmaceutical Outcomes and Policy offers a Ph.D. program in pharmaceutical sciences emphasizing an interdisciplinary approach to addressing issues relevant to medication use at the patient, provider, community, and societal levels. Faculty research interests and course offerings reflect this interdisciplinary orientation. Students develop knowledge and skills that enable them to conduct high quality research directed at improving the use and cost effectiveness of medications, technology, and services. Education and research in the division draws heavily upon expertise in numerous fields such as health services research, health policy, health communication, health behavior and behavior change, epidemiology, and psychometrics. Areas of faculty and student research include communication and decision making, comparative effectiveness of medications and pharmacy practice models, medication adherence and self-management, health disparities, health literacy, patient reported outcomes assessment, pharmaceutical policy analysis, and policy and ethical issues related to pharmacogenomics.

A Ph.D. is offered with a concentration in pharmaceutical outcomes and policy.

Pharmacotherapy and Experimental Therapeutics
The Division of Pharmacotherapy and Experimental Therapeutics offers a Ph.D. program in the pharmaceutical sciences with a focus on translational research that integrates biomedical and pharmaceutical sciences in both laboratory-based models and in humans. The goal of the program is to develop scientists who are prepared to generate and disseminate new knowledge in pharmacotherapy and accelerate its application to improve patient care. Graduate students engage in clinical experiences throughout the program that are designed to complement each student’s research interests while also facilitating their development as translational scientists. Areas of graduate coursework and research include drug metabolism and transport, pharmacokinetics/pharmacodynamics/pharmacometrics, pharmacogenomics, clinical research, drug development, experimental therapeutics, and mechanisms of drug toxicity. Therapeutic and research areas of particular strength include cardiovascular disease, infectious disease/HIV, oncology/hematology, drug metabolism and transport, pharmacokinetics/pharmacometrics, pharmacogenomics, clinical research, drug development, experimental therapeutics, and mechanisms of drug toxicity. Therapeutic and research areas of particular strength include cardiovascular disease, infectious disease/HIV, oncology/hematology, hepatology/gastroenterology/transplant, and pulmonary disease.

A Ph.D. is offered with a concentration in pharmacotherapy and experimental therapeutics.

Master of Science in Pharmaceutical Sciences
The Division of Practice Advancement and Clinical Education (PACE) offers the master of science in pharmaceutical sciences with a specialization in health system pharmacy with a goal of preparing pharmacists for leadership positions in health care. To accomplish this goal, the program will provide students with the knowledge, skills, and experience necessary to assume a variety of roles and responsibilities. Our graduates will serve as vibrant, committed professionals with a focus on improving patients’ health, health care delivery, and the profession of pharmacy. This will occur through both didactic education and experiential opportunities in class and in the workplace.

Following the faculty member’s name is a section number that students should use when registering for independent studies, reading, research, and thesis and dissertation courses with that particular professor.

Distinguished Professors
Kim L.R. Brouwer (62), Hepatobiliary Drug Disposition, Drug Transport, Prediction of Drug Interactions and Hepatotoxicity, Clinical Pharmacokinetics and Quantitative Systems Pharmacology
Angela Kashuba (114), Clinical Pharmacology of Antiretroviral Agents in HIV Treatment, Prediction of Drug-Drug and Drug-Cytokine Interactions and Adverse Effects, Role of Sex and Ethnicity in Drug Disposition
Leaf Huang (121), Gene Therapy, Targeted Gene/Drug Delivery in Tumor Microenvironment
Michael Jay (137), Pharmaceutical Formulation Development, Nuclear Sciences
Weili Lin, Cerebral Ischemia, Human Brain Development, PET, MR
Betsy L. Sleath (91), Provider-Patient Communication about Medications, Child and Adolescent Health, Health Disparities, Improving Adherence to Medication Regimens
Dhiren R. Thakker (87), Mechanisms of Drug Transport, Pro-Drug Strategies for Enhanced and Targeted Drug Delivery, Disposition of Macromolecules (e.g., Genes)
Xiao Xiao (126), Gene Therapy for Muscular Dystrophy and Other Genetic Diseases

Professor of the Practice
Jerry Heneghan, Practice Advancement and Clinical Education

Professors
Jeffery Aube, Synthetic Organic/Medicinal Chemistry, Neuroscience, Infectious Disease, Cytochrome P450 Biochemistry
J. Herbert Patterson (47), Individualized Pharmacotherapy of Heart Failure
Robert A. Blouin, Effects of Infectious Disease and Trauma on Altered Physiologic States (i.e., Aging and Obesity) and the Expression and Regulation of Drug Metabolizing Enzymes
Stephen Frye, Drug Design and Discovery, Chemical Biology of Choratin Regulation
Alexander Kabanov, Polymer-Based Drug, Gene, and Protein Delivery Systems and Novel Therapeutics for Cancer and Neurodegenerative and Neurodevelopmental Diseases
Jennifer Elston Lafata, Cancer Care Delivery; Quality Improvement; Patient-Provider Communication and Decision Making; Medication Adherence
David Lawrence (133), Application of Chemical Tools to Biological Questions: Enzyme Sensors; Light-Activated Inhibitors, Sensors, and Signaling Proteins; Light-Induced Gene Expression; Chemical Genomics
Andrew Lee (111), Structural Biology, NMR Spectroscopy, Protein Dynamics, Biophysical Dissection of Proteins and Protein-Ligand Interactions
Kuo-Hsiung Lee (13), Medicinal Chemistry of Bioactive Natural Products and Synthetic Analogs including Antitumor, Anti-Aids, Antimalarial, Antihypertensive, Anti-Inflammatory, Anti-Arthritis, and Antiviral Agents, Antifungal Antibiotics; Insect Antifeedants; Chinese Herbal Medicine
Jian Liu (108), Carbohydrate Biochemistry, Structural and Functional Relationships of Heparan Sulfate
Bryan Roth, GPCR Structure and Function
Alexander Tropsha (81), Molecular Modeling, Computer-Assisted Drug Design, Molecular Dynamics of Proteins, Protein Folding
Paul Watkins, Clinical Pharmacology, Drug-Induced Liver Injury
**Associate Professors**

**Kristy Ainslie**, Formulation of Vaccines and Drug Delivery Treatments for Immune Modulation to Treat and Prevent Infectious and Other Diseases

**Stacy Bailey** (81), Health Literacy, Health Disparities, Medication Understanding and Use

**Gang Fang** (84), Pharmacoepidemiology, Medication Adherence, Evaluation of Treatment Utilization and Outcomes in Populations, Comparative Treatment Effects Research, Patient-Centered Outcomes, Health Disparities

**Federico Innocenti**, Clinical Pharmacology—Oncology/Pharmacogenomics

**Michael B. Jarstfer** (112), Chemical Biology to Study Social Behavior and Telomere Biology

**Sam Lai**, Mucosal Immunity, Antibody Engineering, Antibody Response to Nanomaterials, Targeted Drug Delivery, Bacteriophage Engineering, Vaccines

**Craig R. Lee** (128), Cardiovascular Biology, Genomics and Biomarkers, Eicosanoid Metabolism, Inflammation

**Rihe Liu** (113), Proteomics and Functional Genomics

**Mary T. Roth-McClurg** (125), Medication Management in Primary Care, Clinical Pharmacists and the Medical Home, Medication Management and Medical Home, the Quality of Medication Use and Drug Administration

**Wayne Pittman** (30), Hypertension, Clinical Pharmacokinetics, Cardiology and Drug Administration

**Scott Singleton** (116), Bio-Organic and Biophysical Chemical Investigations of the Mechanisms DNA Repair, Directed Evolution of Novel Enzymes, Development of Alternate Strategies for Targeting Drug-Resistant Pathogenic Microorganisms

**Philip C. Smith** (85), Pharmacokinetics, Drug Metabolism, Quantitative Targeted Proteomics

**Dennis M. Williams** (92), Inhalation Therapy for Pulmonary Disease, Hypertension, Clinical Pharmacokinetics

**Timothy J. Wiltshire**, Preclinical and Clinical Pharmacogenetics, and Genomics

**William C. Zamboni**, Optimization of Chemotherapeutic Treatment of Cancer, Pharmacokinetics, Pharmacodynamics, Pharmacogenetics

**Qisheng Zhang** (130), Lipid Signaling and Small GTPases, Chemical Biology and Drug Discovery

**Assistant Professors**

**Aaron Anselmo**, Microbiome delivery, targeted drug delivery, cell-based delivery, determining the role of physicochemical properties in the delivery of nanoparticles and microbes

**Albert Bowers**, Drug Discovery, Natural Products and Synthetic Biology

**Yanguang Cao**, Pharmacokinetics, Pharmacodynamics, and Quantitative Pharmacology

**Delesha Carpenter** (88), Chronic Disease Self-Management, Medication Adherence, Patient-Provider Communication, mHealth, eHealth, Rural Health, Measurement, Asthma

**Daniel James Crona**, Pharmacokinetics and Pharmacodynamics of Therapeutic Treatments in Oncology

**Julie Dumond**, Pharmacometrics, Clinical Pharmacokinetics

**Daniel Gonzalez**, Pediatric Clinical Pharmacology

**Nate Hathaway**, Investigating the Regulation of the Mammalian Genome, Developing New Chemical-Mediated Tools to Examine Chromatin Structure and Function, and Drug Discovery

**Shawn Hingtgen**, Personalized Cell-Based Therapies for Cancer, Developing Novel Polymer Implant Strategies to Treat Surgically Resected Brain Cancer

**Jacqui Mclaughlin**, Practice Advancement, Clinical Education, Computational Modeling

**Robert McGinty**, Structural Biology, Protein Chemistry, Epigenetics

**Gauri Rao**, Quantitative Systems Pharmacology, Pharmacometrics, Pharmacokinetic and Pharmacodynamic Modeling

**Research Professors**

**Dmitri Kireev**, Computational Biophysics, Computer-Aided Design, Drug Discovery Informatics

**Kenneth Pearce**, Lead Discovery and Characterization, Assay Development, Biochemistry

**Michael Wagner**, Pharmacogenomics, Translational Pharmacology

**Tim Wilson**, Director of SGC Center for Chemical Biology, Medicinal Chemistry, Kinase Inhibitors

**Research Associate Professors**

**Elena Batrakova**, Development of Active Targeted Delivery of Therapeutic Polypeptides to the Brain for Treatment of Parkinson’s Disease Using Inflammatory-Response Cells as Vehicles, Development of Exosome-Mediated Drug Delivery Systems for Treatment of Cancer

**David Drewry**, Medicinal Chemistry, Kinase Inhibitors

**Elia P. Rosen**, HIV, Infectious Diseases

**Juan Li**, Gene Therapy

**Alexander Golbraikh**, Chemical Biology and Medicinal Chemistry, Informatics

**Chunping Qiao**, Gene Therapy

**Susan Morris-Natschke** (102), Design, Synthesis, and Structural Optimization of Antiviral Phospholipids

**Eric Smith**, Radiopharmacy

**Xiaodong Wang**, Drug Discovery for Therapeutic Targets in Oncology

**Research Assistant Professors**

**Alison Axtman**, Synthesis of Small Molecules that Selectively Modulate Proteins Implicated in Disease-Propagating Pathway

**Rachel Julia Church**, Institute for Drug Safety Sciences

**Mackenzie Cottrell**, HIV, Infectious Diseases

**Merrie W. Mosedale**, Institute for Drug Safety Sciences

**Eric Bachedler**, Treatment of Autoimmune Diseases through Modulation of Immune Responses with Microparticles

**Doung Fu**, Liver Cell Biology and Hepatic Pharmacology

**Weigang Huang**, Chemical Approaches to Explore the Phosphoinositides Related Cellular Process: 1) Development of Fluorogenic, Fluorescent, and Photoaffinity Labeling Probes; 2) Development of Small-Molecule Inhibitors for Phosphoinositides Metabolic Enzymes

**Kevin Frankowski**, Organic/Medicinal Chemistry, Therapeutic Areas of Interest: CNS Modulation and Cancer Treatment

**Lindsey James**, Chemical Biology of Chromatin Regulation, Chemical Probe Development for Epigenetic Regulatory Proteins

**Andrew Lucas**, Translational Oncology and Nanoparticle Drug Development Initiative

**Devika Soundara Manickam**, Protein and Gene Delivery to the CNS

**Samantha Pattenden**, Chemical Biology of Chromatin Regulation

**Melanie Priestman**, Chemical Biology

**Paul Sapienza**, Biophysical Studies of Proteins and Macromolecular Interactions

**Marina Sokolsky-Papkov**, Stimuli Actuated Theranostic Drug Delivery Systems

**Ruhan Tang**, Molecular Pharmaceutics

**Qunzhao Wang**, Biochemistry

**Xiang Wang**, Molecular Modeling
Zhao Wang, Drug Metabolism and Pharmacokinetics
Kuo Yang, Pharmacometrics
Hao Zhu, Molecular Modeling

Clinical Professors

Thomas Angelo, Practice Advancement and Clinical Education
Robert E. Dupuis, Clinical Pharmacokinetics, Drug Metabolism of Immunosuppressant in Organ Transplant Recipients, Relationship between Drug Metabolism, Toxicity and Outcomes
Alan Forrest, Pharmacokinetic and Pharmacodynamics Modeling
Adam M. Persky, Pharmacy Education, Pharmacokinetics and Pharmacodynamics of Dietary Supplements

Clinical Associate Professors

Amanda H. Corbett, Pharmacology of Antiretrovirals, Opportunistic Infection Therapies in Resource-Poor Countries
Wendy Cox, Practice Advancement and Clinical Education
Stephen F. Eckel, Practice Advancement and Clinical Education
Jo Ellen Rodgers, Clinical and Translational Research in Heart Failure

Clinical Assistant Professors

Amber Frick, Clinical Pharmacology and Pharmacogenomics
Jessica Greene, Learner Experiences in Active-Learning Classrooms
Stephanie Kiser, Practice Advancement and Clinical Education
Nicole Pinelli-Reitter, Practice Advancement and Clinical Education
Amber Proctor, Thoracic Oncology, Hematology
David Steeb, Practice Advancement and Clinical Education

Adjunct Professors

Kirkwood Adams Jr., Heart Failure and Cardiovascular Disease
Wayne Anderson
Nancy Allbritton, Signaling in Single Cells, Microfabrication Systems for Cellular Analysis
Ramprakash Govindarajan, Computational Biology
Nancy Klyachko, Biochemistry, Catalysis, Nanotechnology

Adjunct Associate Professors

Elizabeth Andrews, Drug Safety and Compliance
Ronald Brashare, Chemical Heritage Foundation
Andrea K. Biddle, Health Economics and Public Policy Analysis
Matthew Burke, Pharmaceutical Development
Kenneth Brouwer, Biotechnology
William Brock, Toxicology, Pharmacology
David M. Cocchetto, Clinical Pharmacology, Antiviral/Antibacterial

Ke Cheng, Regenerative Medicine
Gregory Daniel, Pharmaceutical Economics, Comparative Effectiveness, and Pharmaceutical, Biologic, and Vaccine Safety
Rowell Daniels, Practice Advancement and Clinical Education
Paul A. Dayton, Biomedical Engineering and Ultrasound
Patricia Deverka, Medical Technology Policy, Ethical Issues
Marisa Domino, Health Economics
Sean Ekins, Collaborative Drug Discovery
Michael Fath, Pharmaceutical Strategic Marketing, Medical Affairs, and Commercial Operations
Eric Faulkner, Personalized Medicine Development
John Edgar French, Toxicology
Alex Z. Fu, Cost Effectiveness and Pharmacoeconomics
Ramparakash Govindarajan, Pharmacy
John Grabenstien, Pharmacy
Sandra Greene, Health Care Policy
Zhen Gu, Biomaterials Design, Biomacromolecular Engineering, and Micro/Nano-Fabrication
Alan Higgins, Preclinical Drug Development
Geoffrey Hird, Liquidia Technologies
William Janzen, Drug Discovery, High Throughput Screening, and Automation and Process Improvement
Clark D. Jefferies, Developing Assays for Small RNAs in Human Cell Lines and Tissue Samples and Developing Software to Interpret Small RNA Signatures as Diagnostics or Theranostics
John Kessler, Practice Advancement and Clinical Education
Nancy Allen Lapointe, Translational Research of Antiarrhythmic Drug Therapy
T. Bryant Mangum, Business Management, Pharmacy Leadership, and Managed Care
Michael Murphy, Molecular Genetics
Kyoko Nakagawa-Goto, Discovery and Development of Drug Candidates through Total Syntheses and Synthetic Modifications of Bioactive Natural Products Focused on Antitumor and Anti-HIV Agents
David Nichols, Study of Hallucinogens (Psychedelics) and Discovery of Novel D1 Dopamine Receptor Full Agonists
Alan Parr, BioCeutics
William T. Sawyer, Drug Development
Susan Sutherland, Epidemiology Research, Statistical Computing, Data Management, Study Design
Michael Wascovich, Pharmacy Leadership and Hospital Pharmacy Management
Russell Thomas, Genomic Biology and Bioinformatics
Amelia Warner, Pharmacogenomics
Dan Weiner, Pharmacoanalytics, Pharmaceutical Biostatistics
Lan Xie, Chemical Biology and Medicinal Chemistry
David Zaharoff, Vaccine and Immunotherapy Delivery
Weifan Zheng, Chemical Biology and Medicinal Chemistry
Issam Zineh, Pharmacogenomics and Clinical Pharmacology
Zhiyang Zhao, Pharmacokinetics and Drug Metabolism
Mark Zylka, Molecules and Mechanisms for Pain and Autism, Angelman Syndrome Therapies

Adjunct Assistant Professors
Hisham Aljahedy, Pharmacoepidemiology and Drug Safety
Christopher Blanchette, Epidemiology, Pharmaceutical Health Services Research, Healthcare Economics
Peter Bonate, Pharmacokinetics Modeling Simulation
Alan Boyd, Neurocognitive Software Development
Yevgeny Brudno, Pharmacoeengineering
John Byrd, Evidence-Based Decision Making, Practice Outcomes Solutions and Application of Clinical, Economic, and Humanistic Outcomes Research
Jack W. Campbell, Pharmacy Law and Ethics
Scott Clark, Pharmacogenomics
Michael Cohen-Wolkowicz, Pediatrics
Austin Combest, Clinical Scientist, Global Product Development, PPD
Mike Decoske, Practice Advancement, Pharmacy Law and Clinical Education Ethics
Lynn Dressler, Pharmacogenomics
Stephanie Earnshaw, Quality Management, Linear and Integer Programming and Network Optimization
Heather Edin
Eric Faulkner, Personalized Medicine Development
Mona Fiuza, Heart Failure Drug Development and Pharmacogenomics

Kathy Foley, Rural Health, Demography, Sociology, and Health Outcomes Research
Justin Lee Geurink, Experimental Education
Giulia Ghibellini, Pharmacokinetics, Clinical Pharmacology
Alicia Gilson, Pharmacoe epidemiology and Therapeutic Risk Management
Zongchao Han, Gene Expression Patterns
Allison Harrill, Toxicology, Drug-Induced Liver Injury
Charles Lee, Provider-Patient Communication
Martin Marciniak, Health Outcomes, Oncology, Neuroscience and Cardiovascular
Phil Mendys, Cardiovascular Drug Development and Preventive Cardiology
Steven R. Moore, Health Policy and Planning
Alison A. Motsinger, Pharmacogenomics, Bioinformatics
Nita Patel, Preclinical Drug Development
Erick Peters, Psychiatric and Cancer Pharmacogenomics
Matthew Pletcher, Genetics, Pharmacogenomics
Shruti Raja, Neurology
Cosette Serabjit-Singh, Computational Approaches to Predicting ADME Parameters/Pharmacogenetics
Katharine Sheldon, Practice Advancement and Clinical Education
Richard Stanford, Health Outcomes Strategy and Research
Andrine Swenson, Development and Application of Epidemiological Methods
Russell Thomas, Genomic Biology and Bioinformatics
Andrew Z. Wang, Radiation Oncology, Nanomedicine
Jian Wang, Pharmacology, Regulatory Science, Pharmacometrics
David Wei, Pharmacy Outcomes and Evaluation
Adam Wolfe, Practice Advancement and Clinical Education
Kelee Wurst, Epidemiology
Macej Zamek-Gliszczynski, Preclinical Drug Development

Professors Emeriti
William Campbell
George H. Cocolas
Dale Christensen
Anthony Hickey
Khalid S. Ishaq
Rudolph Juliano
Tom S. Miya
G. Joseph Norwood

Subjects in this school include: Chemical Biology and Medicinal Chemistry (CBMC) (p. 6), Pharmacoeengineering and Molecular Pharmaeutics (DPMP) (p. 6), Pharmacotherapy and Experimental Therapeutics (DPET) (p. 7), Practice Advancement and Clinical Education (PACE) (p. 9), Pharmaceutical Outcomes and Policy (DPOP) (p. 10), Pharmaceutical Sciences (Non-Departmental) (PHCY (p. 11)), Pharmaceutical Sciences (PHRS) (p. 14), and Practice Advancement and Clinical Education (PACE). (p. 9)
Chemical Biology and Medicinal Chemistry (CBMC)

Graduate-level Courses

CBMC 804A. Biochemical Foundations of Chemical Biology. 3 Credits.
Permission of instructor for students lacking the prerequisites. This course is designed to emphasize the elements of biochemistry, bioorganic chemistry, and molecular biology required for the design and synthesis of biologically-active compounds.
Requisites: Prerequisites, CHEM 466, BIOC 505 or 601, and PHCO 643.
Grading status: Letter grade.

CBMC 804B. Biochemical Foundations of Chemical Biology Journal Club. 1 Credit.
Permission of the instructor for students lacking the co-requisite. This is a seminar based course that will run in concert with 804A. Students will present journal articles and interact with seminar speakers.
Requisites: Co-requisite, CBMC 804A;
Repeat rules: May be repeated for credit. 2 total credits. 2 total completions.
Grading status: Letter grade.

CBMC 805. Molecular Modeling. 3 Credits.
Introduction to computer-assisted molecular design, techniques, and theory with an emphasis on the practical use of molecular mechanics and quantum mechanics programs.
Requisites: Prerequisites, MATH 231, 232, and CHEM 481.
Grading status: Letter grade 
Same as: BIOC 805.

CBMC 807. Foundations of Chemical Biology I: Organic and Medicinal Chemistry. 3 Credits.
The elements of organic chemistry required for the design and synthesis of chemical probes and biologically active compounds.
Requisites: Prerequisite, CHEM 262.
Grading status: Letter grade

CBMC 833. Molecular Target-Based Drug Discovery. 3 Credits.
An integrated introduction to molecular target-based drug discovery including bioactive natural products, neuropharmacology, chemical biology, and recent advances and techniques in drug discovery.
Requisites: Prerequisite, CBMC 804A and 804B.
Grading status: Letter grade.

Medicinal Chemistry (MEDC)

Graduate-level Courses

MEDC 806. Macromolecular Modeling. 3 Credits.
Introduction to modeling and simulation techniques for biological macromolecules. Two lecture and three to four laboratory hours per week.
Requisites: Prerequisites, MATH 231, 232, and CHEM 430.
Grading status: Letter grade 
Same as: BIOC 806.

MEDC 821. Chemistry of Natural Products. 3 Credits.
An introduction to the isolation, structure determination, biosynthesis, and synthesis of bioactive natural products; emphasis on aspects relating to medicinal chemistry. Three hours a week.
Requisites: Prerequisite, CHEM 466; Permission of the instructor for students lacking the prerequisite.
Grading status: Letter grade.

MEDC 822. Selected Topics in Natural Products. 2 Credits.
Discussions of important recent developments in the chemistry of natural products of biomedical significance.
Requisites: Prerequisites, CHEM 466 and 468.
Grading status: Letter grade.

MEDC 836. Selected Topics in Synthetic Medicinal Chemistry. 2 Credits.
Discussions from current literature on the strategy and techniques involved in the synthesis of drug molecules. Two lecture hours a week.
Requisites: Prerequisite, CHEM 460.
Grading status: Letter grade.

MEDC 842. Therapeutic Proteins. 3 Credits.
This course covers applications of modern information theory and information technologies to biomolecular systems. The core of this course is an overview and practical applications of methods and techniques for the analysis of nucleic acid and protein sequences, sequence-structure, and sequence-function correlations.
Grading status: Letter grade.

MEDC 899. Seminar. 1 Credit.
Seminar consists of presentations on current research topics by the division’s graduate students, faculty, and invited speakers from industry, government, and other academic departments and institutions. Only four credits of MEDC 899 may count toward requirement for the Ph.D. degree (two credits for M.S.).
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

MEDC 900. Introduction to Research in Medicinal Chemistry. 1-3 Credits.
One conference and three or more laboratory hours a week.
Requisites: Prerequisites, CHEM 261 and 262; Permission of the instructor.
Grading status: Letter grade.

MEDC 991. Research in Medicinal Chemistry. 1-9 Credits.
One conference and nine laboratory hours a week per course.
Grading status: Letter grade.

MEDC 993. Master's Research and Thesis. 3 Credits.
After didactic course work is complete, master's students register for three credits of MEDC 993 during the fall and spring semesters.
Repeat rules: May be repeated for credit.

MEDC 994. Doctoral Research and Dissertation. 3 Credits.
Students register for dissertation credits after successfully completing all didactic course work. A minimum of six credit hours are required for graduation.
Repeat rules: May be repeated for credit.

Pharmacoeengineering and Molecular Pharmaceutics (DPMP)

Graduate-level Courses

MOPH 738. Nanomedicine. 3 Credits.
Offers an introduction to the interdisciplinary field of nanomedicine for students with physical, chemical, or biological sciences background. It will emphasize emerging nanotechnologies and biomedical application.
Grading status: Letter grade.

MOPH 810. Drug Metabolism. 3 Credits.
Permission of the instructor. Introduction to the use of concepts, chemistry, enzymology, and techniques in drug metabolism for the design and development of safe and effective therapeutic agents.
Grading status: Letter grade.
MOPH 840. Introduction to Research. 1-3 Credits.
Permission of the instructor. Students participate in research projects designed to introduce them to research opportunities in the pharmaceutical sciences.
Grading status: Letter grade.

MOPH 850. Pharmaceutical Analysis. 1 Credit.
Permission of the instructor. Introduction to quantitative instrumental analysis in pharmaceutics. One lecture hour a week.
Grading status: Letter grade.

MOPH 862. Advanced Physical Pharmacy. 3 Credits.
Discuss industrial approaches to pharmaceutical formulation development.
Grading status: Letter grade.

MOPH 864. Advances in Drug Delivery. 3 Credits.
Requisites: Prerequisites, PHCY 410 and 411; permission of the instructor for students lacking the prerequisites.
Grading status: Letter grade.

MOPH 865. Trends in Molecular Pharmaceutics Research. 3 Credits.
An interactive course in which students actively participate by critical evaluation and discussion of current literature in the field of drug delivery.
Requisites: Prerequisite, MOPH 864.
Grading status: Letter grade.

MOPH 866. Advances in Drug Delivery and Nanomedicine. 6 Credits.
Discuss basic physicochemical and transport properties of the drug with emphasis in macromolecular drugs and nano drug carriers.
Requisites: Prerequisite, CHEM 430.
Grading status: Letter grade.

MOPH 890. Special Topics in Advanced Pharmaceutics. 1-12 Credits.
Permission of the instructor. A lecture and/or laboratory course designed to present new concepts and innovations in the area of drug delivery and disposition.
Grading status: Letter grade.

MOPH 899. Seminar. 1 Credit.
Seminar consists of presentations on current research topics by the division's graduate students, faculty, and invited speakers from industry, government, and other academic departments and institutions. Only four credits of MOPH 899 may count toward requirement for the Ph.D. degree (two credits for M.S.).
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

MOPH 900. Introduction to Research in MOPH. 2-3 Credits.
This course provides students the opportunity to work with a faculty mentor on a research project.
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

MOPH 991. Research. 1-12 Credits.
Graduate course consisting of laboratory-based research, conferences with the major professor, and library investigations relating to research. One conference and nine laboratory hours a week per course.
Grading status: Letter grade.

MOPH 993. Master's Research and Thesis. 3 Credits.
After didactic course work is complete, master's students register for three credits of MOPH 993 during the fall and spring semesters.
Repeat rules: May be repeated for credit.

MOPH 994. Doctoral Research and Dissertation. 3 Credits.
Students register for dissertation credits after successfully completing all didactic course work. A minimum of six credit hours are required for graduation.
Repeat rules: May be repeated for credit.

Pharmacotherapy and Experimental Therapeutics (DPET)
Graduate-level Courses

DPET 800. PHAR PRAC GER PAT. 3 Credits.

DPET 801. Introduction to Hospital Pharmacy. 3 Credits.

DPET 802. TOP ACUTE CARE PHPR. 3 Credits.

DPET 803. AMB CARE PHAR PRAC. 3 Credits.

DPET 804. Pediatric Pharmacotherapy. 3 Credits.

DPET 805. Rural Health. 2-3 Credits.

DPET 806. INTRO RES PHAR PRAC. 1-3 Credits.

DPET 807. ID ELECTIVE-THERAPY. 2 Credits.

DPET 808. Critical Care. 3 Credits.

DPET 809. Hubbard Program. 3 Credits.
This interdisciplinary course for health professions students trains students to practice collaboratively in the care of their older patients.
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

DPET 810. THERAP HIV INFEC. 2 Credits.

DPET 811. Infectious Disease. 2 Credits.
Course consists of infectious disease case presentations by small groups of students. Discussion of a specific infectious disease, its drug therapy, and specific antibiotics are evaluated extensively at each session.
Requisites: Prerequisite, PHCY 449.
Grading status: Letter grade.

DPET 814. ENTREPRENEUR PHAR. 3 Credits.

DPET 815. Interdisciplinary Teamwork in Geriatrics. 3 Credits.
Course emphasizes the acquisition of skills and competencies necessary to provide effective interdisciplinary geriatrics care and leadership in a variety of settings, including rural and/or underserved communities.
Grading status: Letter grade.

DPET 817. THERAP HIV INFEC. 2 Credits.

DPET 818. Foundations in Exercise Prescription. 2 Credits.
This course is designed to introduce basic concepts and selected therapeutic applications of exercise testing and prescription.
Grading status: Letter grade.

DPET 819. The Package Insert: Drug Development for Clinicians. 2 Credits.
This course reviews the components of the package insert, provides an understanding of the key studies required to support each component, and provides insight into the strategic thinking required for planning these studies. Students will learn the drug development process and ways in which clinicians scientifically contribute to this effort.
Grading status: Letter grade.
DPET 820. MAN THE PRACT PHARM. 3 Credits.

DPET 821. Principles of Pharmacy Practice. 3 Credits.
Students discuss the modern role of the hospital pharmacist and how the role integrates progressive management with innovative services. The problems with implementing these programs are evaluated. Three lecture hours a week.
Requisites: Prerequisite, PHPR 249.
Grading status: Letter grade.

DPET 822. Advanced Clinical Pharmacy. 3 Credits.
Discussions, workshops, and lectures to develop the student’s skills and abilities to make therapeutic recommendations, utilize drug literature, educate patients and health professionals, and record observations, plans, and actions in a problem-oriented record.
Grading status: Letter grade.

DPET 831. Quantitative Methods in Clinical Research. 3 Credits.
Required preparation, introductory biostatistics or general statistics. Graduate standing or permission of the instructor. This course reviews statistical concepts and discusses the most commonly used statistical methods for analysis of data from clinical studies or research experiments. Students will analyze problem datasets using SAS.
Grading status: Letter grade.

DPET 832. Pharmacogenomics. 2 Credits.
DPET 833. Experimental Design Considerations in Clinical Research. 2 Credits.
Course provides an overview of clinical trials methodology, focusing primarily on designs of (and common flaws in) clinical drug trials and nonclinical research experiments intended to answer clinical questions.
Grading status: Letter grade.

DPET 834. Methods in Quantitative Systems Pharmacology. 3 Credits.
Open to graduate student and PY3 students. This course utilizes hands on experiences to introduce the student to the principles and practices of contemporary quantitative systems pharmacology.
Requisites: Prerequisites, DPET 855 and 856.
Grading status: Letter grade.

DPET 836. Elements of Scientific Writing and Communication. 2 Credits.
This course is designed to help students develop strategies for presenting research ideas and results in written and oral form and for participating effectively in the peer review process.
Grading status: Letter grade.

DPET 838. Methods in Pharmacogenomics. 2 Credits.
The goals of this course are to provide graduate students with an understanding of major genomic discovery methodologies and their application for solving translational research problems.
Requisites: Prerequisite, DPET 832; Permission of the instructor for student lacking the prerequisite.
Grading status: Letter grade.

DPET 840. Advanced Pharmacotherapy. 3 Credits.
A modular approach to advanced level pharmacotherapy. Coursework using the Pharmacotherapy Self Assessment Program (PSAP) aimed at improving clinical skills and reviewing standards of practice.
Grading status: Letter grade.

DPET 841. Science and Methods in Drug Development. 2 Credits.
Provides working knowledge of commonly-used processes, techniques, and methods involved in drug development processes, emphasizing preclinical aspects. Lectures and in-class case-based interactive discussion. Students will develop problem-solving skills, writing and presentation skills, and will be exposed to analytical and pharmaceutical methods and gain experience interpreting data for regulatory approval.
Grading status: Letter grade.

DPET 853. PK Module 1: Pharmacokinetic Concepts and Applications. 1.75 Credit.
Required preparation, elementary calculus; students without prior coursework in pharmacology/pharmacokinetics are encouraged to discuss their backgrounds with the module coordinator for recommendations of introductory work. Module is an introduction to pharmacokinetic theory, mathematical model development, and data analysis. Assumes basic knowledge of human physiology, drug administration and action, and calculus.
Grading status: Letter grade.

Prerequisite/Corequisite: DPET 853. This course is an introduction to pharmacodynamics from a modeling and simulation perspective. Students will build upon the material introduced in Module 1 and apply data analysis techniques to dynamics data.
Grading status: Letter grade.

DPET 856. Advanced Pharmacokinetics and Pharmacodynamics. 4 Credits.
Advanced treatment of contemporary pharmacokinetic theory and application, with emphasis on model development, analytical approaches to parameter estimation, and experimental design/data analysis.
Requisites: Prerequisite, MOPH 855; Permission of the instructor.
Grading status: Letter grade.

DPET 857. PK Module 3: Population PK/PD Analysis. 2 Credits.
This course is an introduction to population pharmacokinetic and pharmacodynamic modeling techniques, including theory and application.
Requisites: Prerequisite, DPET 854.
Grading status: Letter grade.

DPET 858. PK Module 4: Advanced PK/PD Modeling. 2 Credits.
This course covers a series of advanced pharmacokinetics/pharmacodynamics (PK/PD) modeling concepts and techniques, fundamental elements towards systems pharmacology, and methodology of developing mechanism-based PK/PD models in drug development.
Requisites: Pre- or corequisite, DPET 857.
Grading status: Letter grade.

DPET 873. Precision Therapeutics Through Genomics. 3 Credits.
Evidence-based medicine and the use of clinical practice guidelines is evolving to include application of genomic information to target drug therapies for patients. This course reviews the principles and applications of genomics to therapeutics and studies examples where this field is impacting therapeutic decisions in a variety of disease states.
Grading status: Letter grade.
**Graduate-level Courses**

**PACE 700. Community Outreach and Service Learning. 0 Credits.**
This course provides service learning opportunities to apply pharmacy practice within the context of interprofessional care for vulnerable populations through participation with local clinic programs. Enrollment is required for participation in any aspect of clinic programs. Enrollment is restricted to Pharmacy students.

Requisite: Prerequisite, completion of first year in Doctor of Pharmacy program.

Grading status: Letter grade.

**PACE 801. Inter-Professional Team Work and Communication: Keys to Patient Safety. 3 Credits.**
This inter-professional course focuses on understanding roles, teamwork, and communication to improve patient safety within the health care environment. National standards and initiatives will be foundational to the course.

Requisite: Prerequisite, PHCY 442, 443, 444, 445, and 446.

Grading status: Letter grade.

**PACE 803. Ambulatory Care. 3 Credits.**
Provides comprehensive immunization education, discusses strategies to develop, implement, and maintain pharmacy-based immunization services, and provides opportunities to practice administration of subcutaneous and intramuscular injections.

Requisites: Prerequisites, PHCY 442, 443, 444, 445, and 446.

Grading status: Letter grade.

**PACE 804. Teaching and Learning Concepts of Pharmacy Practice. 3 Credits.**
This course introduces pharmacy students to teaching and learning theories and concepts that may be used during future teaching opportunities and assist in the development of lifelong learning techniques.

Requisites: Prerequisites, PHCY 401 and 402.

Grading status: Letter grade.

**PACE 805. Medication Therapy Management. 2 Credits.**
This course examines the expanded role of pharmacists in the community setting with the focus on integrating their pharmacotherapy knowledge into the Medication Therapy Management role.

Requisites: Prerequisites, PHCY 442, 443, 444, 445, and 446.

Grading status: Letter grade.

**PACE 814. Disaster Preparedness and Emergency Care. 1.5 Credit.**
Students will learn about different types of disasters and the treatment of common disaster related injuries. They will also learn about strategies for health care delivery during disasters.

Requisites: Prerequisite, PY2 standing.

**PACE 815. Evaluation Research and Project Design. 3 Credits.**
This course provides formal instruction on critical components of evaluation research, study design, and data analyses that a Master in Pharmaceutical Sciences with a specialization in health system pharmacy administration graduate will need in the workplace.

Grading status: Letter grade.

**PACE 820. Health-System Pharmacy Leadership. 2 Credits.**
Graduate student status in the MS in Pharmaceutical Sciences (Health-System Pharmacy Administration subplan) program required. This course focuses on principles of leadership and strategies used by leaders, with an emphasis in health-system pharmacy. Active learning strategies are used to examine and model leadership principles.

Grading status: Letter grade.

**PACE 821. Rural Pharmacy Health 1: Introduction to Rural Pharmacy Practice. 1 Credit.**
This seminar course is the first in a four-semester course sequence intended to facilitate skill development in rural pharmacy practice as part of the Rural Pharmacy Health Certificate Program. Enrollment is reserved for Rural Pharmacy Health Scholars only.

Grading status: Letter grade.

**PACE 822. Rural Pharmacy Health 2: Cultural Competence and Physical Assessment in Rural Pharmacy Health. 1 Credit.**
This seminar course is the second in a four-semester course sequence intended to facilitate skill development in rural pharmacy practice as part of the Rural Pharmacy Health Certificate Program. Enrollment is reserved for Rural Pharmacy Health Scholars only.

Requisites: Prerequisite, PACE 821.

Grading status: Letter grade.

**PACE 823. Rural Pharmacy Health 3: Interprofessional Practice. 1 Credit.**
This seminar course is the third in a four-semester course sequence intended to facilitate skill development in rural pharmacy practice as part of the Rural Pharmacy Health Certificate Program. Enrollment is reserved for Rural Pharmacy Health Scholars only.

Requisites: Prerequisite, PACE 821, PACE 822.

Grading status: Letter grade.

**PACE 824. Rural Pharmacy Health 4: Population Health Management. 1 Credit.**
This seminar course is the fourth in a four-semester course sequence intended to facilitate skill development in rural pharmacy practice as part of the Rural Pharmacy Health Certificate Program. Enrollment is reserved for Rural Pharmacy Health Scholars only.

Requisites: Prerequisites, PACE 821, PACE 822, PACE 823.

Grading status: Letter grade.

**PACE 825. Foundational Practices of a Successful Health-System Department of Pharmacy. 4 Credits.**
MS in Pharmaceutical Sciences students with a specialization in Health-System Pharmacy Administration. This course will focus on the Foundational Practices of a Successful Health-System Department of Pharmacy. Topics covered include medication safety, pharmacy informatics, and human resources management.

Grading status: Letter grade.
PACE 830. The Leadership Challenge. 2 Credits.
Introducing students to the principles of leadership and strategies used by leaders, regardless of position or pharmacy practice setting, and helps prepare student pharmacists to meet the leadership challenge. Active learning strategies are used to examine and model leadership principles. Instructors will lead discussions on various topics pertaining to leadership.
Grading status: Letter grade.

PACE 832. Financial Management of Health-system Pharmacy. 3 Credits.
MS in Pharmaceutical Sciences students only. This course provides an overview of the current financial environment in the health care industry and is intended to familiarize students with general accounting principles and financial management skills required to lead and manage pharmacy services in a health care organization.
Grading status: Letter grade.

PACE 833. Overview of Health Systems. 3 Credits.
MS in Pharmaceutical Sciences students with a specialization in Health-System Pharmacy Administration. This course is designed to expose participants to real world issues facing health system pharmacy leaders and to teach participants to work through concepts, processes, and challenges that are and will be faced.
Grading status: Letter grade.

PACE 860. Advanced Hospital Pharmacy Operations. 3 Credits.
This course is intended to build on the basic principles of pharmacy operations learned through coursework and experience as professional students as well as work experience.
Grading status: Letter grade.

PACE 896. Independent Study in PACE. 1-8 Credits.
Independent Study in the Division of Practice Advancement and Clinical Education.
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

Pharmaceutical Outcomes and Policy (DPOP)

Graduate-level Courses

DPOP 801. Economics and Behavior of the International Pharmaceutical Industry. 3 Credits.
This course focuses on the empirical investigation of the economic and health impact of major pharmaceutical policies, regulations, market conditions, prescription drug use, and pharmaceutical care.
Grading status: Letter grade.

DPOP 803. Social and Behavioral Aspects of Pharmaceutical Use. 3 Credits.
This course will draw upon medical sociology and health psychology to familiarize students with core theories, research, measures, and design issues relevant to conducting social/behavioral research in pharmaceutical use.
Grading status: Letter grade.

DPOP 804. Introduction to Healthcare Database Research. 3 Credits.
Course will provide foundational knowledge for using administrative health care claims and other relational data for health services research. Students will learn to: manage large databases in SAS, identify key variables in administrative data, and design and implement a study protocol.
Grading status: Letter grade
Same as: HPM 804.

DPOP 805. Patient-Reported Outcomes: Theory, Methods, and Applications. 3 Credits.
Course examines theoretical and methodological issues related to the assessment of patient reported outcomes, including health-related quality-of-life, in pharmaceutical research. Current and potential applications are highlighted.
Grading status: Letter grade.

DPOP 806. Pharmaceutical Policy. 3 Credits.
Course examines policies that influence pharmacy. Structured methods of policy analysis are examined and used to assess theoretic and analytic applications for evaluating pharmaceutical policy.
Grading status: Letter grade.

DPOP 870. Pharmaceutical Outcomes Research. 3 Credits.
Required preparation, introductory statistics and research methods coursework. Permission of the instructor for students lacking the required preparation. This is an intermediate-to-advanced-level applied and contemporary research methods class for students to build methodological and analytical knowledge to conduct high quality studies in evaluating pharmaceutical treatment utilization and outcomes.
Grading status: Letter grade.

DPOP 872. Proposal Writing in DPOP. 3 Credits.
How to write research proposals, including dissertation grants.
Grading status: Letter grade.

DPOP 899. Seminar. 1 Credit.
Forum for scholarly discussion of policy issues, research ideas and methods, campus and industry research resources, and the presentation of ongoing research. In addition to presentations by DPOP faculty and students, seminar will include presentations from invited researchers from industry, managed care, foundations, health care organizations, clinicians, and other departments.
Grading status: Letter grade.

DPOP 900. Introduction to Research in DPOP. 2-3 Credits.
This course offers students the opportunity to work with a faculty mentor on a research project.
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

DPOP 901. Selected Topics in Pharmaceutical Outcomes and Policy. 1-3 Credits.
A reading and/or special projects course for both undergraduate and graduate students interested in pursuing additional work in the administrative and social sciences as they pertain to pharmacy practice. One to three hours a week.
Grading status: Letter grade.

DPOP 902. Methods in Pharmaceutical Outcomes Research. 3 Credits.
Includes formulating a research question, stating aims and hypothesis. Students are introduced to formulating a research strategy to write the background of the protocol, developing a research methodology, addressing measurement issues, selecting an appropriate design, and performing statistical analysis and power calculations. Three lecture hours a week.
Grading status: Letter grade.

DPOP 991. Research in Pharmaceutical Outcomes and Policy. 1-6 Credits.
Consists of laboratory work, conferences with the major professor, and library investigations relating to research.
Grading status: Letter grade.
DPOP 993. Master’s Research and Thesis. 3 Credits.
A minimum of six hours of thesis credit must be taken in order to complete the requirements for the master's degree.
Repeat rules: May be repeated for credit.

DPOP 994. Doctoral Research and Dissertation. 3 Credits.
There is no limit to the number of dissertation hours that can be taken; however, no more than six hours may be applied to the minimum of 45 hours needed to satisfy graduation requirements.
Repeat rules: May be repeated for credit.

Pharmaceutical Sciences (Non-Departmental) (PHCY)

Advanced Undergraduate and Graduate-level Courses

PHCY 504. Evidence-Based Practice. 3 Credits.
The course teaches students to identify, critically evaluate, and interpret scientific literature to support the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. Skills developed include experimental design, identifying gaps in knowledge, asking relevant questions, and drawing appropriate conclusions.

PHCY 519. Self-Care and Non-Prescription Medications. 1.5 Credit.
Pharmacists are often the first health care professional patients turn to when seeking guidance to treat common ailments. This course focuses on quickly and accurately assessing patients to determine candidacy for self-care therapy, including nonprescription selections. Establishing a process to triage patients regarding self-care management is emphasized.
Requisites: Prerequisite, PY1 standing.

PHCY 529. Pharmacotherapy: Foundations. 3 Credits.
This course serves as a transition from foundational coursework to direct patient care and coordinates learning activities with concurrent term courses. Students will learn how to approach patient scenarios and formulate pharmacotherapy recommendations. In-class discussion involves the application of pharmacotherapy principles to patient cases.
Requisites: Prerequisites, PHCY 502, 503, and 516.

PHCY 610. Horizons: Changing the Landscape of Health Care. 1 Credit.
This seminar series is designed to expose students to luminaries who are extending the boundaries of what is possible in healthcare and to thought leaders who will engage students in conversation around emerging topics of critical importance in healthcare.
Grading status: Pass/Fail.

PHCY 611. Applied Clinical Pharmacology. 3 Credits.
This course applies foundational elements of clinical pharmacology and problem-solving skills to individual patient and population-based clinical scenarios. Emphasis placed on dosing and monitoring pharmacotherapy regimens that maximize desired effects and minimize adverse effects to reinforce content covered in concurrent courses.
Requisites: Prerequisites, PHCY 510, 511, and 512.

PHCY 621. Pharmacy Innovation and Problem Solving. 3 Credits.
This course is designed to foster the habits of mind of scholarly and entrepreneurial practitioners. This course is designed for students to develop innovative problem-solving skills through case studies; and for student teams to apply innovative problem solving in proposing a solution to a real-world problem.
Requisites: Prerequisite, PHCY 520.

PHCY 624. Research and Scholarship in Pharmacy I. 1.5 Credit.
This course is part of a three-course sequence built around a mentored, in-depth, scholarly project. Students will frame an answerable question with a faculty mentor, generate and interpret relevant data, and communicate their findings in an oral and written forum.
Requisites: Prerequisites, PHCY 504 and 621.

PHCY 630. Foundations of Pharmacotherapy. 4 Credits.
Restricted to students with PY2 standing. This course transitions students from foundational coursework to the patient-care setting. By integrating knowledge gained from prerequisite courses with principles of pharmacotherapy, students will be able to formulate pharmacotherapy recommendations for patient scenarios. Organ systems covered: immune, cardiovascular, respiratory, gastrointestinal, neurologic, endocrine, and infectious disease.

PHCY 631. Integrative Pharmacotherapy I. 5 Credits.
This course builds off of PHCY 630 in which students will engage in pharmacotherapeutic decision making that integrates advanced clinical pharmacology and pharmacokinetics.
Requisites: Prerequisite, PHCY 630.

PHCY 636. Leadership and Professional Development I. 1 Credit.
This course focuses on leading self before leading others. Students will be guided through the development of a keen sense of self through self-awareness and self-reflection in order to begin developing the "leader within" to lead with and through others.
Requisites: Prerequisite, PHCY 501.

PHCY 639. Immersion Experience 2. 8 Credits.
This course is designed to allow student pharmacists to provide patient-centered collaborative care that will optimally prepare students for the Advanced Pharmacy Practice Experiences in the fourth professional year.
Requisites: Prerequisites, PHCY 504, 591, 601, 611, and 630.
Grading status: Pass/Fail.

Graduate-level Courses

PHCY 718. The Patient Care Experience II. 2 Credits.
This course prepares students to fully engage in patient interactions in a wide variety of pharmacy practice settings. Emphasis is placed on pharmacy ethics and patients experiencing mental health crises. Through reflective activities, students identify strengths and opportunities for growth.
Requisites: Prerequisite, PHCY 617.

PHCY 722. Pharmacy Law: Regulation of Pharmacy Practice. 3 Credits.
This course surveys the legal and regulatory frameworks that govern pharmacy practice. It begins with a review of the United States legal system. Next, it focuses on federal and state statutes and regulations. It concludes by examining common-law malpractice principles and their application to pharmacy practice.
Requisites: Prerequisite, PY3 standing.

PHCY 725. Research and Scholarship in Pharmacy II. 1.5 Credit.
Research and Scholarship in Pharmacy 2 is the second course in a 3-course sequence that is built around a mentored, in-depth, scholarly project. Students will frame an answerable question with a faculty mentor, generate and interpret relevant data, and communicate findings in an oral and written forum.
Requisites: Prerequisite, PHCY 624.
PHCY 726. Research and Scholarship in Pharmacy. III. 3 Credits.
This is the third course in a 3-course sequence that is built around a mentored, in-depth, scholarly project. Students will (1) frame an answerable question with a faculty mentor, (2) generate and interpret relevant data, and (3) communicate their findings in an oral and written forum.
Requisites: Prerequisite, PHCY 725.

PHCY 732. Integrative Pharmacotherapy II. 5 Credits.
Integrative Pharmacotherapy II is the second in a series of three case-based courses. It builds upon the clinical decision-making process and knowledge base introduced in PHCY 631, further developing students’ capacity to research, analyze and solve complex patient medication problems in holistic, evidence-based ways.
Requisites: Prerequisite, PHCY 630 and PHCY 631.

PHCY 733. Integrative Pharmacotherapy III. 5 Credits.
The last of a three case-based course sequence, PHCY 733 deepens the clinical decision-making process and knowledge base introduced in the preceding courses. Students will further develop their capacities to effectively and efficiently research, analyze and solve complex patient medication problems in a holistic, evidence-based, professional manner.
Requisites: Prerequisite, PHCY 732.

PHCY 737. Leadership and Professional Development II. 1 Credit.
Leadership and Professional Development II focuses on leaving a leadership legacy. Collaboration, teamwork, and the ability to exercise professionalism in crucial conversations are key to achieving success as a leader. Students will develop their leadership identity within teams, while learning effective strategies to maximize team members’ strengths.
Requisites: Prerequisite, PHCY 732.

PHCY 791. Immersion Experience III. 8 Credits.
This course is designed to allow student pharmacists to provide patient-centered collaborative care that will optimally prepare students for the Advanced Pharmacy Practice Experiences in the fourth professional year.
Requisites: Prerequisites, PHCY 631, 691.

PHCY 800. Geriatric Pharmacy Practice. 3 Credits.
This course is designed to provide opportunities to enhance knowledge and skills in geriatric pharmacotherapy and other health disciplines involved in the care of seniors. This course will challenge students to identify and resolve health and medication use problems they may encounter while caring for older patients.
Requisites: Prerequisite, PY3 Standing.

PHCY 801. Radiopharmacy I: Introduction to Radiopharmacy. 1 Credit.
Radiopharmacy I introduces students to the use of radioactivity in medicine science, the practice of compounding, medical imaging, and the role of pharmacists in molecular imaging. This is the first course in the pathway for completing the didactic requirements of an Authorized Nuclear Pharmacist.
Requisites: Prerequisite, PY2 Standing.

PHCY 802. Radiopharmacy 2 - The Drugs of Nuclear Medicine. 2 Credits.
Radiopharmacy II is the second course in the series of radiopharmacy curriculum. While fundamental concepts were established in MOPH/PHCY 801, this course will delve into the instrumentation used in radiopharmacy as well as the biological effects of radiation.
Requisites: Prerequisite, Completion of Radiopharmacy I (MOPH 801) with a grade of C or better.

PHCY 803. Radiopharmacy 3. 3 Credits.
This is the final course in the series of radiopharmacy curriculum. This course will focus sharply on the radiopharmaceuticals and ancillary drugs used in nuclear medicine. Time will also be devoted to ensure the student’s understanding of the use of radiopharmaceuticals in drug development and clinical research.
Requisites: Prerequisite, PHCY 802.

PHCY 804. Travel Medicine Care. 1.5 Credit.
This course prepares students to deliver comprehensive travel medicine care to international travelers. Through readings, lectures, and case discussions, students learn key concepts of travel medications, vaccines, risk assessment and education. This knowledge is applied in a practice experience with a travel vaccine expert.
Requisites: Prerequisite, PY2 or PY3 standing.

PHCY 805. Independent Study and Research in Pharmacy. 1-6 Credits.
Required preparation, arranged with the faculty member in each individual case. Contract with a faculty member required. Permission of the instructor. Provides opportunities for professional (doctor of pharmacy) students to conduct independent study or participate in research projects designed to introduce them to a specialized area of practice or research.

PHCY 806. Contemporary Topics in Pharmacy. 1-3 Credits.
Experimental course, for professional (doctor of pharmacy) students, to determine the need and demand of courses in new content areas. Topics will be chosen by faculty based on current issues.
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

PHCY 807. Veterinary Pharmacotherapy. 3 Credits.
PY3 PharmD students. An introductory course providing students with the knowledge and skills required to provide effective pharmaceutical care and compounds to non-human patients.

PHCY 808. Critical Care. 3 Credits.
The course is designed to develop knowledge in common acute diseases encountered in the ICU by utilizing patient cases. Classes will focus on choice and rationale for therapy, dosing guidelines, and monitoring parameters. Two visits to the ICUs at UNC-CH are required.
Requisites: Prerequisite, PY3 Standing.

PHCY 809. Effective Teaching Strategies for Health Sciences Education. 1.5 Credit.
This course prepares professional students in pharmacy and other health professions to adapt and apply effective, research-based strategies and skills to design, promote, and assess learning in a variety of settings, including: large- and small group teaching, precepting, continuing professional education, and/or patient and community health education.
Requisites: Prerequisite, PY2 standing.

PHCY 810. The Science of Pharmaceutical Compounding. 1 Credit.
This course immerses students in the exploration of science utilized in contemporary pharmaceutical compounding. Students will investigate relationships between physiochemical principles and compounded preparatories, and develop strategies for preparing and assessing correctly and incorrectly compounded preparations.
Requisites: Prerequisite, PHCY 513.
PHCY 811. Infectious Diseases. 1.5 Credit.
This course expands student knowledge of the pharmacotherapy of bacterial, fungal, and viral infections. It also builds upon topics covered in the required PharmD curriculum, and introduces several new disease states. Presentations and course activities include case and evidence-based discussions led by infectious diseases faculty and practitioners.
Requisites: Prerequisite, PY3 standing.

PHCY 812. Pediatric Pharmacotherapy. 1.5 Credit.
A comprehensive overview of developmental pharmacology and pharmaceutical management of various disease states in pediatric patients. Emphasis will be placed on nutrition management and pharmacokinetic recommendations for pediatric patients.
Requisites: Prerequisite, PY3 standing.

PHCY 813. Clinical Toxicology. 1.5 Credit.
This course explores the clinical toxicology of drugs and chemicals and provides an overview of the clinical manifestations, assessment and treatment of poisonings with common drug, chemical and biological agents.
Requisites: Prerequisite, PHCY 631.

PHCY 816. Integrative Medicine. 1.5 Credit.
This is a survey course intended to introduce students to various complementary and alternative medicine practices, and their integration into traditional medicine. It will utilize active learning strategies to enhance student involvement.
Requisites: Prerequisite, PY3 standing.

This course examines the drug development process and its connections to clinical research and healthcare outcomes through independent student exploration of on-line content followed by group activities and facilitated classroom discussion on important issues related to each state of the drug development process.
Requisites: Prerequisite, PY3 standing.

PHCY 821. Contemporary and Applied Communications in Healthcare. 1.5 Credit.
This course is designed to prepare students who are interested in developing and enhancing their health communication skills across a broader range of constituents in the field of healthcare.
Requisites: Prerequisite, PY2 standing.

PHCY 822. Hematology/Oncology Pharmacotherapy. 3 Credits.
Prerequisite: PY3 standing. This course explores non-pharmacologic treatment modalities, complications of cancer and treatment, supportive care issues and subspecialties and reviews current cancer screening and prevention guidelines and cancer research.

PHCY 823. International Clinical Classroom Case Discussion. 2 Credits.
Permission of the instructor. An elective offering interactions with pharmacy students from other countries, facilitated through the discussion and critical evaluation of relevant clinical cases highlighting pharmacotherapy issues.
Requisites: Prerequisite, PY2 or PY3 standing.

PHCY 830. Introduction to Drug Development. 2 Credits.
Includes preclinical drug safety evaluation, preclinical pharmacology, design of protocols for Phases I-IV, FDA guidelines for clinical study, preparation of study plan, statistics in clinical trials, data analyzing, and FDA interactions with industry.

PHCY 831. Applied Self-Care Therapeutics. 1.5 Credit.
This course utilizes a systematic process to quickly and accurately assess patients for self-care treatment. Team-based learning will engage students in discussion on the appropriate use of nonprescription medications, dietary supplements, and herbal products. Students will apply skills in literature evaluation and practice communicating recommendations to patients and healthcare providers.
Requisites: Prerequisites, PHCY 504, PHCY 516, PHCY 601, PHCY 630, PHCY 631.

PHCY 833. Advanced Cardiovascular Pharmacy. 3 Credits.
Prerequisite: PY3 Standing. Provides an in-depth discussion of the pharmacotherapy of major cardiovascular diseases such as hypolipidemia, hypertension, ischemic heart disease, heart failure, and arrhythmias.

PHCY 834. 21st Century Independent Pharmacy Ownership. 3 Credits.
Independent community pharmacy is a rapidly changing healthcare industry. In this course, we will explore topics relevant to a career in independent pharmacy including: healthcare policy; supply chain; business and reimbursement models and evolving practice models.
Requisites: Prerequisite, PY3 standing.

PHCY 836. Prevention, Treatment, and Recovery of Substance Use Disorders. 1.5 Credit.
There is a crippling opioid epidemic in the US stemming from decades of misguided approaches to addiction. This course addresses prevention, treatment, and recovery of substance use/misuse disorders, exploring addiction as a chronic brain disease with societal and economic factors contributing to development and progression.
Requisites: Prerequisite, PY3 standing.

PHCY 837. Pharmacogenetics. 1.5 Credit.
Pharmacogenetics covers the generation of pharmacogenetics data, the analysis of that data, and the development the reporting structure of gene/drug interactions. Students will investigate data analysis tools for pharmacogenetics, and review clinical outcomes data and clinical case studies.
Requisites: Prerequisite, PY3 standing.

PHCY 838. Global and Rural Health: Maximizing Interprofessional Teams to Impact Patient Outcomes. 1 Credit.
Global and rural health share public health approaches when identifying and implementing healthcare solutions. This course explores approaches, while engaging students in interprofessional, project-based learning. Students across multi-healthcare disciplines will explore cross-cultural communication, the social determinants of health, and service delivery in low resource settings.
Requisites: Prerequisite, PY2 or PY3 standing.

PHCY 886. Advanced Immersion Experience: Patient Care Elective I. 4 Credits.
Prerequisite: PY4 Standing. The patient-focused elective provides students experience in a unique patient care practice environment. Students will utilize abilities learned previously in the curriculum in order to collect patient-specific information, evaluate and monitor drug therapy, educate patients and caregivers, respond to drug information inquiries and to meet site-specific objectives.
PHCY 887. Advanced Immersion Experience: Patient Care Elective II. 4 Credits.
Prerequisite: PY4 Standing. The patient-focused elective provides students experience in a unique patient care practice environment. Students will utilize abilities learned previously in the curriculum in order to collect patient-specific information, evaluate and monitor drug therapy, educate patients and caregivers, respond to drug information inquiries and to meet site-specific objectives.

PHCY 888. Advanced Immersion Experience: Non-Patient Care Elective I. 4 Credits.
The non-patient focused elective provides students experience in unique pharmacy practice environments such as health care related professional societies, pharmaceutical industry corporate headquarters or manufacturing facilities, the FDA, etc. Students will utilize abilities learned previously in the curriculum to meet general course and site specific objectives.
Requisites: Prerequisite, PY4 Standing.

PHCY 889. Advanced Immersion Experience: Non-Patient Care Elective II. 4 Credits.
The non-patient focused elective provides students experience in unique pharmacy practice environments such as health care related professional societies, pharmaceutical industry corporate headquarters or manufacturing facilities, the FDA, etc. Students will utilize abilities learned previously in the curriculum to meet general course and site specific objectives.
Requisites: Prerequisite, PY4 Standing.

PHCY 891. Advanced Immersion Experience: Community. 4 Credits.
This course builds on foundational knowledge and skills gained during previous Immersion Experiences. Students will engage in a systems-based approach to quality improvement processes, develop practice management skills related to the medication use process, and refine skills in applying a consistent approach to patient care.
Requisites: Prerequisite, PY4 Standing.

PHCY 892. Advanced Immersion Experience: Health Systems. 4 Credits.
This course builds on foundational knowledge and skills gained during previous Immersion Experiences. Students will engage in a systems-based approach to quality improvement processes, develop practice management skills related to the medication use process, and develop skills in pharmacy practice in a value-based health care system.
Requisites: Prerequisite, PY4 Standing.

PHCY 893. Advanced Immersion Experience: Ambulatory Care. 4 Credits.
This course builds on foundational knowledge and skills gained during previous Immersion Experiences. Students will refine skills in applying a consistent approach to patient care, as exemplified in the Pharmacists’ Patient Care Process, by considering management of the entire patient focusing on a single medical condition.
Requisites: Prerequisite, PY4 Standing.

PHCY 894. Advanced Immersion Experience: General Medicine. 4 Credits.
This course builds on foundational knowledge and skills gained during previous Immersion Experiences. Students will refine skills in applying a consistent approach to patient care, as exemplified in the Pharmacists’ Patient Care Process, by considering management of the entire patient in an inpatient setting.
Requisites: Prerequisite, PY4 Standing.

PHCY 895. Advanced Immersion Experience: Clinical I. 4 Credits.
This course builds on foundational knowledge/skills gained during previous Immersion Experiences. Students will apply a consistent approach to patient care, as exemplified in the Pharmacists’ Patient Care Process, by considering management of the entire patient or focusing on a single medical condition (inpatient or outpatient setting).
Requisites: Prerequisite, PY4 Standing.

PHCY 896. Advanced Immersion Experience: Clinical II. 4 Credits.
This course builds on foundational knowledge/skills gained during previous Immersion Experiences. Students will apply a consistent approach to patient care, as exemplified in the Pharmacists’ Patient Care Process, by considering management of the entire patient or focusing on a single medical condition (inpatient or outpatient setting).
Requisites: Prerequisite, PY4 Standing.

PHCY 897. Advanced Immersion Experience: Clinical III. 4 Credits.
This course builds on foundational knowledge/skills gained during previous Immersion Experiences. Students will apply a consistent approach to patient care, as exemplified in the Pharmacists’ Patient Care Process, by considering management of the entire patient or focusing on a single medical condition (inpatient or outpatient setting).
Requisites: Prerequisite, PY4 Standing.

**Pharmaceutical Sciences (PHRS)**

**Graduate-level Courses**

This is a required course for first year pharmaceutical sciences graduate students. Students participate on cross-discipline teams to discuss topics in three foundational areas essential to their development as pharmaceutical scientists: research ethics which meets RCR training requirements; leading research articles within five areas of pharmaceutical sciences; and professional development.
Grading status: Letter grade.

PHRS 899. Seminar in Pharmaceutical Sciences. 1 Credit.
This course is required for all Pharmaceutical Sciences graduate students. Other students must obtain permission from the divisional course director. Class format consists of seminar presentations by students and/or faculty or invited speakers. Students are expected to actively engage in seminar activities and discussions.
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

PHRS 990. Practicum in Pharmaceutical Sciences. 1-9 Credits.
Enrollment in this variable credit course requires a signed agreement between the Chair of the student's academic division and a representative of the institutional sponsor providing the research practicum. Teaching/learning methods consist of a pharmaceutical sciences-based research training experience at the participating institution involving independent work and written and oral reports.
Repeat rules: May be repeated for credit.
Grading status: Letter grade.

PHRS 991. Research in Pharmaceutical Sciences. 1-9 Credits.
This is a variable credit course required for all Pharmaceutical Sciences graduate students by their second semester. Teaching/learning methods consist of a pharmaceutical sciences-based mentored research training experience involving independent work and research reports that must be filed at the end of the semester.
Repeat rules: May be repeated for credit.
Grading status: Letter grade.
PHRS 992. Master's (Non-Thesis). 3 Credits.
Students register for thesis substitute credits after successfully passing their comprehensive written examinations. A minimum of 3 credit hours of thesis substitute research and writing is required for Pharmaceutical Sciences graduate students.
Requisites: Prerequisite, PHRS 991 or equivalent.
Repeat rules: May be repeated for credit.

PHRS 993. Master's Research and Thesis. 3 Credits.
Students register for thesis credits after successfully passing their comprehensive written examination. A minimum of 3 credit hours of thesis research and writing is required for Pharmaceutical Sciences graduate students.
Requisites: Prerequisite, PHRS 991 or equivalent.
Repeat rules: May be repeated for credit.

PHRS 994. Doctoral Research and Dissertation. 3 Credits.
Students register for dissertation credits after successfully passing their qualifying preliminary and oral examinations. A minimum of 6 credit hours of dissertation research and writing is required for Pharmaceutical Sciences graduate students.
Requisites: Prerequisite, PHRS 991 or equivalent.
Repeat rules: May be repeated for credit.

Pharmacy Practice and Experiential Education (DPPE)

Graduate-level Courses

DPPE 801. Perspectives in Public Health. 3 Credits.
Examines the scope and implications of current public health concerns at the community, state and national level. Includes practical approaches to the integration of public health activities into the community.
Grading status: Letter grade.

DPPE 807. Pharmaceutical Approaches to ID Therapy. 2 Credits.
Same course as DPET 807. Instructor moved to different division in Eshelman School of Pharmacy
Grading status: Letter grade.

DPPE 810. Institutional Pharmacy. 3 Credits.
Same course as DPET 801. Instructor moved to different division in Eshelman School of Pharmacy
Grading status: Letter grade.

DPPE 899. Seminar in DPPE. 1 Credit.
Seminar in DPPE
Grading status: Letter grade.

DPPE 991. Research in DPPE. 1-9 Credits.
DPPE research is aimed at helping students develop necessary research skills, while exposing students to relevant issues, processes, investigations, and unanswered questions in pharmacy practice.
Grading status: Letter grade.