Contact Information
UNC Eshelman School of Pharmacy
http://pharmacy.unc.edu

Robert A. Blouin, Dean

The UNC Eshelman School of Pharmacy offers graduate curricula leading to the master of science in pharmaceutical sciences with a specialization in health-system pharmacy administration and the doctor of philosophy in pharmaceutical sciences with concentrations in one of four research areas: chemical biology and medicinal chemistry; pharmacoengineering and molecular pharmaceutics; pharmacotherapy and experimental therapeutics; or pharmaceutical outcomes and policy.

Instruction emphasizes contemporary research methods, study design, and results and is delivered in the form of small group lectures/discussions, group activities and recitations, and seminars combined with intensive laboratory-based research. The excellent rapport that exists between schools, departments, institutes, and centers within the University facilitates interdisciplinary collaborative research by graduate students and faculty. The graduate degree programs also benefit from faculty affiliations with GlaxoSmithKline, Inc., the Research Triangle Institute, the Hamner Institutes for Health Sciences, Duke University, the Wake Forest University School of Medicine, and many other organizations in the Research Triangle Park area. The UNC Eshelman School of Pharmacy is housed in Beard Hall, Kerr Hall, Marsico Hall, and the Genetic Medicine Building, which are located on the health sciences campus together with the Schools of Dentistry, Medicine, and Nursing and the Gillings School of Global Public Health. The Health Sciences Library has an outstanding collection of books and journals as well as computer and support services. Library and laboratory resources residing in other University departments are also available for use by students and faculty.

Requirements for Admission to the Ph.D. Program

Applicants who have completed a standard collegiate curriculum in pharmacy, chemistry, biochemistry, biology, engineering, or in an allied field in the University, or in other universities or colleges having curricula acceptable to UNC–Chapel Hill’s Graduate School, are eligible for admission to the graduate program in pharmaceutical sciences. Applications for admission must be supported by scores on the Graduate Record Examination, letters of recommendation, official transcripts, and a statement of personal goals as they relate to graduate study at the UNC Eshelman School of Pharmacy.

The Graduate School online application is the standard means of applying for admission. Inquiries concerning admission to programs in the pharmaceutical sciences may be directed to the Office of Curricular and Student Affairs, CB# 7566, 109 Beard Hall, Chapel Hill, NC 27599-7566.

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, glycochemistry, 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, pharmacoeconomic 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, 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 systems 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.

Professors
Jeffery Aube, Synthetic Organic/Medicinal Chemistry, Neuroscience, Infectious Disease, Cytochrome P450 Biochemistry
J. Herbert Patterson (47), Individualized Pharmacotherapy of Heart Failure
Susan J. Blaock (115), Risk Communication, Behavior Change, and Psychosocial Aspects of Chronic Illness
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
Joel Farley, (124), Pharmaceutical Policy, Pharmaceutical Outcomes Research, Comparative Effectiveness Research, Medication Adherence, Continuity of Care, Multiple Chronic Conditions
Stephen Frye, Drug Design and Discovery, Chemical Biology of Chromatin Regulation
Leaf Huang (121), Gene Therapy, Targeted Gene/Drug Delivery in Tumor Microenvironment
Michael Jay (137), Pharmaceutical Formulation Development, Nuclear Sciences
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 Analogos including Antitumor, Anti-Aids, Antimalarial, Antineoplastic, 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
Xiao Xiao (126), Gene Therapy for Muscular Dystrophy and Other Genetic Diseases

Associate Professors
Kristy Ainslie, Formulation of Vaccines and Drug Delivery Treatments for Immune Modulation to Treat and Prevent Infectious and Other Diseases
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-Organoic 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
Yanguang Cao, Pharmacokinetics, Pharmacodynamics, and Quantitative Pharmacology
Daniel James Crona, Pharmacokinetics and Pharmacodynamics of Therapeutic Treatments in Oncology
Stacy Bailey (81), Health Literacy, Health Disparities, Medication Understanding and Use
Albert Bowers, Drug Discovery, Natural Products and Synthetic Biology
Delesha Carpenter (88), Chronic Disease Self-Management, Medication Adherence, Patient-Provider Communication, mHealth, eHealth, Rural Health, Measurement, Asthma
Stacie Dusetzina (89), Pharmacoepidemiology/Drug Utilization Research, Pharmaceutical and FDA Policies, Treatment of Multiple Chronic Conditions, Cancer Treatment, Mental Illness Treatment
Julie Dumond, Pharmacometrics, Clinical Pharmacokinetics
Gang Fang (84), Pharmacoepidemiology, Medication Adherence, Evaluation of Treatment Utilization and Outcomes in Populations, Comparative Treatment Effects Research, Patient-Centered Outcomes, Health Disparities
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 via Bispecific Fusion Proteins, Clinical Education Computational Modeling
Robert McGinty, Structural Biology, Protein Chemistry, Epigenetics
Christine Omwasionwu (87), HIV/AIDS Health Disparities and Health Outcomes, Medication Use in Minority, Underserved, and International Populations
Gauri Rao, Quantitative Systems Pharmacology, Pharmacometrics, Pharmacokinetic and Pharmacodynamic Modeling

Research Professors
Dmitri Kireev, Computational Biophysics, Computer-Aided Drug Design, Drug Discovery Informatics
Feng Liu, Gene and Drug Delivery
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 Polyepitides 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
Elias P. Rosen, HIV, Infectious Diseases
Juan Li, Gene Therapy
Alexander Golbraikh, Chemical Biology and Medicinal Chemistry, Informatics
Chris Luft, Polymeric Particles for Drug Delivery
Chunping Qiao, Gene Therapy
Susan Morris-Natschke (102), Design, Synthesis, and Structural Optimization of Antiviral Phospholipids
Chunping Qiao, Gene Therapy
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 Bachelder, Treatment of Autoimmune Diseases through Modulation of Immune Responses with Microparticles
Rahima Benhabbour, Organic/Polymer Chemistry and Drug Delivery
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/Medical 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
Xin Ming, Targeted Delivery of Antisense and siRNA
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
Ruhang Tang, Molecular Pharmaceutics
Qunzhao Wang, Biochemistry
Xiang Wang, Molecular Modeling
Zhuo Wang, Drug Metabolism and Pharmacokinetics
Kuo Yang, Pharmacometrics
Hao Zhu, Molecular Modeling

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

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
Adam M. Persky, Pharmacy Education, Pharmacokinetics and Pharmacodynamics of Dietary Supplements
Jo Ellen Rodgers, Clinical and Translational Research in Heart Failure

Clinical Assistant Professors
Amber Frick, Clinical Pharmacology and Pharmacogenomics
Roy Hawke (118), Clinical Pharmacology of Natural Products and Their Mechanisms of Action and Disposition in Liver Disease
Nicole Pinelli, Practice Advancement and Clinical Education
Amber Proctor, Thoracic Oncology, Hematology
David Steeb, Practice Advancement and Clinical Education
Stephanie Kiser, Practice Advancement and Clinical Education

Professor of the Practice
Jerry Heneghan, 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
Daniel K. Benjamin Jr., Children's Health
M. Alan Brookhart, Epidemiology
Patricia J. Bush, Asthma
Paul Bush, Practice Advancement and Clinical Education
William Campbell, Pharmaceutical Policy
Michael Crimmins, New Methodology and Synthesis of Natural Products
Skip Cummings, Primary Care, Obesity and Diabetes
Patricia Deverka, Senior Research Director, Center for Medical Technology Policy
Joseph Desimone, Polymer Synthesis, Liquid and Supercritical CO2 Processing, Gene Therapy and Drug Delivery
Nikolay Dokholyan, Computation/Experimental Biology and Structural Biology
Robert Gomeni, Pharmakinetics, Clinical Development
Eric C. Faulkner, Senior Director, RTI Health Solutions
Jean Paul Gagnon, Pharmaceutical Outcomes Research and the Pharmaceutical Industry
John Grabenstien, U.S. Pharmacopeia and Vaccination
Klaus Hahn, Molecular Imaging Tools, Signaling Dynamics in Motility and Blood Cells
Allison Harrill, Research Investigator, the Hamner Institutes for Health
Alan Higgins, Vice President, Viamed Pharmaceuticals
William Janzen, Assay Development and Compound Profiling
Clark D. Jeffries, Chemical Biology and Medicinal Chemistry
Kazunori Kataoka, Biomaterials
John Kessler, Practice Advancement and Clinical Education
Natalia Klyachko, Biochemistry, Catalysis, Nanotechnology
Robert Konrad
Lawrence Lesko, Clinical Pharmacology and Drug Development
Qi Lu, Antisense Therapy for Muscular Dystrophy
Matthew Maciejewski, Pharmacoeconomics
Elaine Mardis, Characterization of Cancer Genomes, Genome Sequencing Technologies
Lesley Marson, Histology, Human Biology, Neuroscience
Howard Mcleod, Pharmacogenomics and Individualized Therapy
Gerald Miwa, Drug Metabolism and Drug Development
Alison Motsinger, Associate Professor, NC State Department of Statistics
Michael Murphy, Pharmaceutical Research in Molecular Genotyping
Kouros Owzar, Professor of Biostatistics and Bioinformatics, Duke University School of Medicine
Jai Patel, Levine Cancer Institute
Nita Patel, Senior Vice President, Operations, Artisan Pharma Inc.
Gary Pollack, Pharmacokinetics, Pharmacodynamics
Joseph Polli, Dmpk and Drug Transporters, GlaxoSmithKline
John Robert Powell, Clinical Pharmacology and Drug Development
D.K. Theo Raynor, Medication Risk Communication
Jack Reynolds, Toxicity and Drug Development
Bryan Roth, GPCR Structure
Virginia Schmith, GlaxoSmithKline
Cosette Serabjit-Singh, Pharmaceutical Scientist
Mannohaman Singh
Til Sturmer, Epidemiology
Russell Thomas, Director, Center for Genomic Biology, Epidemiologic Methods and Bioinformatics Clinical Epidemiology
Robert Voyksner, Mass Spectrometry
Amelia Warner
Morris Weinberger, Health Policy and Clinical Trials
Macej Zamek-Gliszczynski, Senior Research Scientist, Eli Lilly
Daryl C. Zeldin, Respiratory Biology, Exposure Assessment and Prevention of Asthma, Eicosanoid Metabolism
Zhao Zhiang

Adjunct Associate Professors
Elizabeth Andrews, Drug Safety and Compliance
Ronald Brashear, Chemical Heritage Foundation
Andrea K. Biddle, Health Economics and Public Policy Analysis
Kenneth Brouwer, Biotechnology
William Brock, Toxicology, Pharmacology
David M. Cocchetto, Clinical Pharmacology, Antiviral/Antibacterial Regulatory Affairs
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
Eric Faulkner, Personalized Medicine Development
John Edgar French, Toxicology
Felix Frueh, Pharmacogenomics and Clinical Pharmacology
Alex Z. Fu, Cost Effectiveness and Pharmacoeconomics
Ramprakash 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

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 Wascevich, Pharmacy Leadership and Hospital Pharmacy Management

Russell Thomas, Genomic Biology and Bioinformatics

Amelia Warner, Pharmacogenomics

Dan Weiner, Pharmaceutometrics, 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

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-Wolkoweiz, Pediatrics

Austin Combust, 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

Eric Faulkner, Personalized Medicine Development

Mona Fiuzat, Heart Failure Drug Development and Pharmacogenomics

Justin Lee Geurink, Experimental Education

Giulia Ghidellini, Pharmacokinetics, Clinical Pharmacology

Alicia Gilsonan, Pharmacoepidemiology 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

Adam Orsborn, Practice Advancement and Clinical Education

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

Keele Wurst, Epidemiology

Maceij Zamek-Gliszczynski, Preclinical Drug Development

Distinguished Professors

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

Kim L.R. Brouwer (62), Hepatobiliary Drug Disposition, Drug Transport, Prediction of Drug Interactions and Hepatotoxicity, Clinical Pharmacokinetics and Quantitative Systems Pharmacology

Wei Li, 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)

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 Pharmaceutics (DFPM) (p. 6), Pharmacotherapy and Experimental Therapeutics (DPET) (p. 7), Practice Advancement and Clinical Education (PACE) (p. 8), Pharmaceutical Outcomes and Policy (DPOP) (p. 10), Pharmaceutical Sciences (Non-Departmental) (PHCY) (p. 11), Pharmaceutical Sciences (PHRS) (p. 12), and Pharmacy Practice and Experiential Education (DPPE) (p. 13).
**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, BIOLC 505 or 601, and PHCO 643.

**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.

**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.
Same as: BIOLC 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.

**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 804.

**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.
Same as: BIOLC 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.

**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.

**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.

**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.

**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.

**MEDC 900. Introduction to Research in Medicinal Chemistry. 1-3 Credits.**
One conference and three or more laboratory hours per week.

Requisites: Prerequisites, CHEM 261 and 262; Permission of the instructor.

**MEDC 991. Research in Medicinal Chemistry. 1-9 Credits.**
One conference and nine laboratory hours a week per course.

**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.

**MOPH 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.

**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.

**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.

**MOPH 850. Pharmaceutical Analysis. 1 Credit.**
Permission of the instructor. Introduction to quantitative instrumental analysis in pharmaceutics. One lecture hour a week.

**MOPH 862. Advanced Physical Pharmacy. 3 Credits.**
Discuss industrial approaches to pharmaceutical formulation development.
MOPH 864. Advances in Drug Delivery. 3 Credits.
Requisites: Prerequisites, PHCY 410 and 411; permission of the instructor for students lacking the prerequisites.

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.

MOPH 868. 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.

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.

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.

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.

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.

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.
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.
DPET 812. ADV HEM/ONC. 3 Credits.
DPET 813. Cardiovascular Pharmacy. 3 Credits.
Provides an in-depth discussion of the pharmacotherapy of major cardiovascular diseases such as hypolipidemia, hypertension, ischemic heart disease, heart failure, and arrhythmias.
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.
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, PY2 standing.
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.
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.
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.

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.

DPET 823. International Clinical Classroom Case Discussion. 2 Credits.
Prerequisite: PY2 or PY3 PharmD students. 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.

DPET 830. Clinical Investigation of Drugs. 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.

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.

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.

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.

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.

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.

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.

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.

DPET 853. PK Module 1: Pharmacokinetic Concepts and Applications. 1.25 Credit.
Required preparation, introductory 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.

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.

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.

DPET 900. Introduction to DPET Research: Translational Science Journal Club. 1 Credit.
This one credit hour course is offered jointly with the Universities of Minnesota and Pittsburgh. Students participate in journal club discussions by video teleconferencing on articles emphasizing methods which allow the translation from preclinical to clinical investigation in different therapeutic areas with emphasis on pharmacometrics, pharmacogenomics, and biomarker validation.
Repeat rules: May be repeated for credit.

Practice Advancement and Clinical Education (PACE)
Advanced Undergraduate and Graduate-level Courses
PACE 607I. 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.
Requisites: Prerequisite, completion of first year in Doctor of Pharmacy program.
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.
Requisites: Prerequisite, PHCY 513.
Repeat rules: May be repeated for credit. 0 total credits. 16 total completions.
PACE 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, PHCY 446.
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.
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.
PACE 806. 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.
PACE 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.
PACE 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.
PACE 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.
PACE 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.
PACE 811. Contemporary and Applied Communincations 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.
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.
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.
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.
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.
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.
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.
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.
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.

PACE 832. Financial Management of Health-system Pharmacy. 3 Credits.
MS in Pharmaceutical Sciences students only. This course provides an overview of 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.

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.

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.

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.

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.

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.

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. 
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.

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.

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.

DPOP 872. Proposal Writing in DPOP. 3 Credits.
How to write research proposals, including dissertation grants.

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.

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.

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.

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.

DPOP 901. Research in Pharmaceutical Outcomes and Policy. 1-6 Credits.
Consists of laboratory work, conferences with the major professor, and library investigations relating to research.

DPOP 991. Research in Pharmaceutical Outcomes and Policy. 1-6 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 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.

**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. 4 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 691. 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.

**Graduate-level Courses**

**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 732. Integrative Pharmacotherapy II. 5 Credits.**
Integrative Pharmacotherapy II is the second in a series of 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 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 636.

**PHCY 791. Immersion Experience 3. 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. Applied Pharmaceutical Statistics. 3 Credits.**
Application of statistical analysis concepts and tools including probability, statistical inference, and regression analysis. Experimental design and statistical modeling approaches appropriate to common pharmaceutical research scenarios.

**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 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.
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, PHCY 504, PHCY 516, PHCY 601, PHCY 630, PHCY 631.

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.

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.

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.

PHRS 900. 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.

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.

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.

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

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

DPPE 899. Seminar in DPPE. 1 Credit.
Seminar in DPPE.

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.