School of Biomedical Sciences

PHARMACEUTICAL SCIENCES & PHARMACOTHERAPY DISCIPLINE HANDBOOK 2023-2024

Regardless of the discipline, each SBS student (MS or PhD) will receive the degree of Biomedical Sciences. The discipline is listed on the transcript as the Major.

The information provided in this document serves to supplement the requirements of the School of Biomedical Sciences detailed in the UNTHSC Catalog with requirements specific to the discipline of Pharmaceutical Sciences and Pharmacotherapy.

Table of Contents

Pharmaceutical Sciences & Pharmacotherapy (PSPT) Discipline

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Graduate Faculty: Cheng; Cunningham; Dong; Ellis; Emmitte; Inman; Karamichos; Kastellorizios; Liu; Rasu; Simecka; White; Wu; Yan; Kim; Suh

The Pharmaceutical Sciences and Pharmacotherapy Graduate Discipline is an interdisciplinary discipline that offers both Master of Science (MS) and Doctor of Philosophy (PhD) degrees. The goal of this discipline is to provide students with a rigorous education and training in biomedical sciences with a specialty in Pharmaceutical Sciences and Pharmacotherapy. Students receive training through original research, formal classroom education, problem-based learning, seminars, and journal clubs. The discipline includes faculty members engaged in various aspects of basic, clinical, and translational research in Pharmaceutical Sciences and Pharmacotherapy.

The specific research interests of faculty cover a wide range of subjects, including cancer stem cell biology, target identification, natural product discovery, design and synthesis of new drug molecules, mechanistic studies of drug action (pharmacology), drug analysis, drug formulation and drug delivery, drug metabolism, drug resistance, pharmacokinetics, pharmacodynamics, and pharmacogenomics, etc. The interdisciplinary research also includes investigation of the link between and among different categories of human diseases, such as cancer, aging and neurodegenerative diseases (e.g., Alzheimer's and Parkinson's diseases), HIV, psychiatric diseases, metabolic disorders, neurological disorders, and ocular diseases. The research projects employ state-of-the-art chemical, biochemical, molecular, cellular, immunological, *in vivo* and clinical, and health outcomes techniques that include computer-aided drug design, fermentation, chromatography, mass spectrometry, NMR, molecular cloning, gene targeting, FACS analysis, advanced fluorescence spectroscopy, optical imaging and advanced single cell technology, behavioral testing, cellular reprogramming, nanoparticle characterization, organoid modeling, and statistical methodology.

Students may enter the discipline after completing course work and laboratory rotations as required by the Graduate School of Biomedical Sciences. The discipline offers advance courses in all aspects of pharmaceutical sciences and pharmacotherapy. Students participate in seminars and discussion of current research and receive extensive laboratory training. Students perform original, publishable research, and present their research findings at regional and national scientific meetings. Approximately two years are required to complete the Master of Science degree, while the Doctor of Philosophy degree is completed in approximately five years.

Students who successfully complete a graduate degree in Pharmaceutical Sciences and Pharmacotherapy will be well prepared for careers in academic and government research laboratories, as well as in the pharmaceutical/ biotechnology industry.

Graduate Faculty and their Research

Graduate Faculty Membership Categories: Associate members of the Graduate Faculty are able to serve as members of thesis or dissertation advisory committees, as major professors or co-major professors on thesis advisory committees, and as co-major professor on dissertation advisory committees with a full member as the other co-major professor. Full members of the Graduate Faculty are able to serve as members of thesis or dissertation advisory committees, and as major professors or co-major professors on thesis or dissertation advisory committees.

Eric Y. Cheng, PhD

Professor, Department of Pharmaceutical Sciences

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/yiqiang-eric-cheng

The overall goal of my group research is to discover and develop bioactive natural products as drugs or drug leads for the treatment of cancer and infectious diseases. To this end, we have so far discovered a serial of potent histone deacetylase inhibitors, and a serial of potent pre-mRNA splicing inhibitors, among many other natural products from exotic bacterial species. We forged collaborations with cancer biologists to evaluate some of those small molecules in tumor xenograft models, including neuroendocrine cancer, breast cancer, colon cancer, prostate cancer, glaucoma, leukemia and neuroblastoma. Our research was supported by NIH grants (R03, R01, CTSA), a US Department of Defense BCRP Idea Award, a pilot grant from the Lynde and Harry Bradley Foundation, and supplemented with institutional funds. I have so far coauthored > 60 peer-reviewed publications and several book chapters. One of our publications was recognized as "The 2013 A. E. Schwarting Award for the *Journal of Natural Products* Best Paper of the Year". I am also an inventor in several issued US and international patents and pending patents. Students of my group will gain broad training in microbiology, molecular biology, biochemistry and natural product chemistry.

Rebecca L. Cunningham, Ph.D.

Professor and Associate Dean of Research, Department of Pharmaceutical Sciences

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/rebecca-cunningham

Our laboratory studies the role of steroid hormones, specifically androgens, from prenatal development to aging. Most of her research has been focused on androgen signaling mechanisms and defining the effects of androgens on central nervous system function. One of Dr. Cunningham's long-term research goals is to determine how development and aging alters neuronal steroid hormonal responses in an oxidative stress environment, a key characteristic of aging, developmental disorders, and neurodegeneration. We have shown that androgens can either be neuroprotective or damaging, and these effects are dependent on the oxidative stress environment. Dr. Cunningham and team use in vitro, in vivo, and clinical approaches to understand the how androgens affect brain function and physiology. It is hoped that this research will expand the understanding of how steroid hormones impact the brain and body.

Xiaowei Dong, PhD

Associate Professor, Department of Pharmaceutical Sciences

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/xiaowei-dong

My research has focused on drug delivery and formulation development. Cancer definitely is one of my research areas. Finding novel delivery systems to efficiently deliver anti-cancer drugs to tumors is the goal for this research. The research on overcoming multidrug resistance in cancer, which was the area of my Ph.D. research, continues in my current lab. In addition, I obtained great experience on drug product development and manufacture. The projects I had worked on covered the development stages from pre-clinical to clinical Phase III. Thus, my research interests also include translating pharmaceutical research into commercial products. In this aspect, novel oral solid dosage forms are specially interested. In-vitro cell study and in-vivo animal study are essential, and the studies of the underlying mechanisms about why and how the novel delivery systems enhance therapeutic outcomes are emphasized in my lab. Moreover, I am actively looking for the collaboration opportunities with the groups working on drug discovery to provide the support on formulation development of novel compounds. The ultimate goal of my research is to provide more medication options for patient benefits and make best contribution on healthcare improvement.

Dorette Z. Ellis, PhD

Associate Professor, Department of Pharmaceutical Sciences, North Texas Eye Institute

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/dorette-ellis

I am interested in understanding how aqueous humor is regulated in normal and the diseased state, glaucoma. Specifically, I study signal transduction and the regulation of ion transport (sodium and potassium) in physiological and pathological states. High intraocular pressure is a risk factor for glaucoma. Intraocular pressure is regulated by the rate of secretion of aqueous humor in the ciliary processes and the rate of exit of aqueous humor through the trabecular meshwork and Schlemm's canal. The role of the trabecular meshwork and Schlemm's canal in intraocular pressure regulation is unknown. Therefore, the goals of my laboratory are to determine how aqueous humor production and outflow via the trabecular meshwork and Schlemm's canal are regulated. Additionally, we will identify the molecular and cellular mechanisms by which certain ocular hypotensives lower intraocular pressure. Identification of these target sites will allow for potential therapeutic strategies for the treatment of glaucoma and ocular hypertension. Another area of interest is retinal ganglion cell survival in glaucoma; specifically, the involvement of the sigma 1 receptor in neuroprotection and its modulation of ion transport (calcium) and mitochondrial function. The elucidation of mechanism (s) involved in retinal ganglion cell survival is of great importance, as this may lead to potential targets for therapeutic strategies for the treatment of glaucoma.

Kyle A. Emmitte, PhD

Professor & Chair, Departments of Pharmaceutical Sciences, Pharmacology & Neuroscience

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/kyle-emmitte

Dr. Emmitte's primary research interests include the design and optimization of biologically active small molecules to serve as *in vivo* probes and drug discovery leads. He has more than twenty years of experience in the fields of medicinal chemistry and drug discovery, having previously held positions in the pharmaceutical industry and academia. Dr. Emmitte's current research primarily focuses on the optimization of novel small molecule ion channel modulators for the treatment of childhood epilepsies and fragile X syndrome. He is also engaged in additional projects related to obesity, Alzheimer's disease, and corneal injury. Dr. Emmitte's research is collaborative by nature and engages the areas of medicinal chemistry, molecular pharmacology, *in vivo* biology, and DMPK. His laboratory employs both classical and state-of-the-art synthetic chemistry techniques such as microwave assisted organic synthesis and flow chemistry in pursuit of new chemical targets. Students in the Emmitte laboratory gain experience in synthetic organic chemistry, including compound purification and characterization, as well as strategies for SAR development and drug design. To date, he has authored 64 peer-reviewed publications and is an inventor on 20 issued U.S. patents.

Denise Inman, PhD

Associate Professor, Department of Pharmaceutical Science, North Texas Eye Institute

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/denise-inman

The Inman laboratory investigates how energy generation and utilization in the central nervous system is impacted by chronic diseases such as glaucoma. Our work has shown that the visual system undergoes metabolic decline during glaucoma development. That decline occurs in mitochondria, but also in the various transporters that supply substrate to the mitochondria or glycolysis for energy production. We have been able to limit the metabolic decline and halt glaucomatous progression by increasing a transporter that moves pyruvate and lactate into the retinal ganglion cells and their axons, suggesting that improving cells' metabolic choices can prevent degeneration. We are also interested in the interaction of neurons and glia in the retina and optic nerve, two structures impacted by glaucoma, because of the metabolic coupling that exists between these cell types, and the implications those interactions have for disease. The lab uses in vitro and in vivo approaches to investigate these mechanisms. Ongoing studies include proteomics of retinal cells subjected to glaucoma, transgenic approaches to knockdown or knockout of various proteins to test their role in metabolic adaptation, and bioenergetic analysis of mitochondrial function and quality control.

Dimitrios Karamichos, PhD

Professor, Department of Pharmaceutical Sciences

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/dimitrios-karamichos

The Karamichos laboratory investigates novel therapies for the treatment of corneal trauma and diseases. More specifically, we are working on the following research topics: 1) Keratoconus: A corneal disorder affecting 1:400 people worldwide characterized by progressive thinning and steepening of the cornea. The pathobiology and treatment of this disorder remains elusive. The lab is working with clinicians, on pre-clinical studies, as well as in vitro models in order to delineate the mechanisms that drive Keratoconus. 2) Diabetic Keratopathy: Corneal complications due to diabetes include corneal erosions, corneal scarring, endothelium shape abnormalities, and decreased epithelial barrier function. The lab is utilizing both in vitro and in vivo models in order to develop novel, non-invasive treatments for the disease. 3) Corneal trauma: Physical, chemical, or any injury to the human cornea can be a serious threat to vision. The gold standard treatment, to-date, is corneal transplantation. While corneal transplantation is a safe procedure, it comes with numerous limitations and side effects including bleeding, infections, swelling, clouding of lens and/or cataracts, glaucoma, and lifetime of steroids treatment. The lab, using both in vivo and in vitro models, and novel molecules, seeks to develop novel drugs and/or therapeutic modalities for the treatment of corneal trauma. 4) 3D bioprinting: The lab, in collaboration with industry partners, are developing novel fabrication methods of a living cornea.

Michail Kastellorizios, PhD

Assistant Professor, Department of Pharmaceutical Sciences

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/michail-kastellorizios

Dr. Kastellorizios' research focuses on drug delivery technologies including nanomedicine, medical devices, and regulatory science.

Our primary research focus is the translation of anticancer medicines from preclinical development to the clinic. We are developing novel nanoparticle characterization methods designed to be of clinical relevance by testing them against solid tumor biopsies. In particular, we are developing a method for personalized treatment of metastatic breast cancer, and we are studying breast cancer health disparities in African American women as they apply to nanotherapy outcomes.

Our work on regulatory science includes the development of novel quality assurance testing methods for nanoparticle drug products. We apply the principles of Physical Pharmacy and Physical Chemistry to characterize nanoparticle formulations based on their unique interfacial properties. In addition, we provide formulation development and characterization expertise to other researchers that work on new drug candidates, generic drug formulations, and medical devices. These smaller projects are utilized to train Dr. Kastellorizios' lab members in the science of and application of Pharmaceutical Technology.

Jin Liu, PhD

Associate Professor, Department of Pharmaceutical Sciences

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/jin-liu

Dr. Liu is broadly interested in the development and application of computational methods to solve problems in pharmaceutical sciences. Her lab integrates pharmaceutical sciences with computer sciences, chemistry, biology, and physics to develop new biotechnologies, understand molecular mechanisms underlying diseases, and design new drugs. Specifically, Dr. Liu's lab is interested in protein allostery study, computer-aided drug design, CRISPR-Cas9 technology improvement, artificial intelligence (AI) for drug discovery, and big data analysis of health disparity diseases. Her lab extensively engages in dynamic collaborations with various experimental labs with a goal to bridge the interface of computational, experimental, and clinical research.

Rafia S. Rasu, PhD

Professor, Departments of Pharmacotherapy and Health Behavior & Health Systems, Senior Fellow of *SaferCare* Texas Institute of Patient Safety

Graduate Faculty Full Member
https://experts.unthsc.edu/en/persons/rafia-rasu

Dr Rafia Rasu is a health services outcomes researcher. She analyzed numerous population health level national level datasets, EMR, and hospital quality/safety dataset to evaluate effectiveness and safety of care. Her academic and research objectives are focused on pharmacoepidemiology and economic evaluation of health care interventions. Her wide-range of background in pharmacy, epidemiology, economics, finance, and public health allowed her to collaborate with many multidisciplinary professionals. She applied risk adjustment techniques with real-world evidence to make informed health care decisions. She published close to 50 peer reviewed articles and 2 book chapters. Currently serving as an NIH grant reviewer and editorial board member of Journal of Managed Care and Specialty Pharmacy.

Annesha White, PharmD, PhD

Associate Professor and Assistant Dean for Assessment, Department of Pharmacotherapy

Graduate Faculty Associate Member
https://experts.unthsc.edu/en/persons/annesha-white

Dr. White's primary research interests include the design of studies to address issues in the health services research arena. Areas of focus include Medicare, Managed Care, Pharmacoeconomics, Comparative Effectiveness and Outcomes Research. Her research over the years has included a focus on a variety of disease states, such as heart disease, asthma, hypertension, and diabetes with the goal of providing care that is balanced in quality and cost. Dr. White's recent research has focused on accountable care organizations and health system mergers to improve patient care coordination. She also works on projects to improve care for chronic kidney disease patients, specifically targeting novel therapies to treat hyperphosphatemia. Dr. White's research involves a team approach to care examining the various aspects of the health care system and how entities can join together to enhance efforts. She has published several peer-reviewed articles, a textbook entitled Introduction to the Pharmacy Profession and serves as a referee for journals such as Medical Care and the Journal of Managed Care Pharmacy.

Hongli Wu, PhD

Associate Professor, Department of Pharmaceutical Sciences, Pharmacology & Neuroscience

Graduate Faculty Full Member
https://experts.unthsc.edu/en/persons/hongli-catherine-wu

The central theme of my research is to understand the role of protein repair enzymes and evaluate their therapeutic potentials for the treatment of eye diseases and cancer. Of primary interest is the age-related macular degeneration (AMD), the most common retinal disorder that affects 25 million people worldwide, yet its pathogenesis remains poorly understood. My lab uses gene knockout and transgenic animals, and primary retinal cells as models to elucidate how altered redox signaling and disrupted redox homeostasis contribute to the pathogenesis of AMD. My research emphasizes the effects of oxidative damage and its repair on retinal proteins, in particular the thiol (SH)-containing proteins/enzymes. We also identify new therapeutic agents from natural products for AMD treatment and cancer prevention.

Liang-Jun Yan, PhD

Professor, Department of Pharmaceutical Sciences, Pharmacology & Neuroscience

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/liang-jun-yan

We are interested in understanding the molecular mechanisms of adaptive mitochondrial oxidative stress response in aging-related metabolic disorders. The lab's current projects focus on kidney disease encompassing ischemia- and drug-induced acute kidney injury and diabetic kidney disease. The objective of these projects is to understand the molecular basis of oxidative stress and redox dysregulation in these kidney diseases and identify novel targets for developing potential therapeutic approaches.

Jerry Simecka, Ph.D.

Professor, Executive Director of Preclinical Services
Department of Pharmaceutical Sciences
Graduate Faculty Full Member
https://experts.unthsc.edu/en/persons/jerry-simecka

Dr. Simecka's lab founded the Pre-Clinical Services group at the University of North Texas Health Science Center in 2008. We conduct studies utilizing established models of both acute and chronic bacterial and fungal infections in several different animal species to help researchers evaluate and develop need antimicrobial therapies. Animal models established include septicemia, lung, intestinal, urinary tract, gastric, biofilm, abscess, and skin infections from a broad range of pathogens. We also work with sponsors to develop and establish new animal models to meet their needs. In addition, pharmacokinetic studies with accompanied bioanalytical LCMS or HPLC analysis are performed in-house for submitted compounds. Overall, we support and guide the drug discovery process of the sponsor, through protocol design, implementation and analysis for compound lead selection. Importantly, there are 7 drugs/therapies that we tested and are currently used clinically, and others will be added to this list soon.

Jayoung Kim, PhD

Assistant Professor, Department of Pharmaceutical Sciences

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/jayoung-kim

Major limitations of gene therapy are ***safety and precision***. Off-target transgene expression not only reduces on-target efficacy hence therapeutic function, but also increases the possibility of severe toxicity due to chromosomal integration or prolonged expression. Despite decades of effort on developing efficient gene delivery vectors, design and synthesis of novel vectors alone have fallen short of claiming clinical success. To achieve precision and personalization, my research aims to optimize formulation of existing vectors through 1) application-specific modular functionalization, 2) hierarchical targeting (physical, chemical, and biological modifications), and 3) deep learning-assisted prediction of target-specific transgene expression.

Eul Suh, PhD

Assistant Professor, Department of Pharmaceutical Sciences

Graduate Faculty Full Member

https://experts.unthsc.edu/en/persons/eul-hyun-suh

The Suh laboratory is interested in applying novel molecular imaging tools to elucidate and visualize metabolic changes associated with diseases. The Suh laboratory research focuses on two main biomedical imaging technique for *in vivo* metabolism studies: 1) lanthanide-based responsive Magnetic Resonance Imaging (MRI) agents to detect Zn^{2+} secretion from the pancreas for *in vivo* β -cell function imaging, and enantiomeric detection of lactate in neurodegenerative disease. 2) to develop chemical probes labeled with ^{13}C and ^{15}N stable isotopes that could image metabolic processes *in vivo* in real-time using dynamic nuclear polarization (DNP) techniques. DNP hyperpolarization coupled with MR imaging is a rapidly growing metabolic imaging methodology that significantly increases the sensitivity of MR compared to conventional MRI, enabling biological studies that are typically challenging. DNP improves the NMR sensitivity of the ^{13}C nucleus by more than 10,000-fold, allowing for the real-time imaging of enzyme-catalyzed reactions in a single or multiple pathways *in vivo*. The current focus of the Suh laboratory research is the development of chemical probes to sense the tissue pH and bio-metal, as well as to understand real-time metabolic flux in various areas such as cancer, host-gut microbiota metabolic interactions, and glia-neuron energy metabolism. Furthermore, to measure flux through complex metabolic pathways, the Suh laboratory will be integrating mass spectrometry (MS) technology into the NMR-based ^{13}C isotopomer methods.

Requirements

The requirements below are in addition to the SBS requirements listed in the SBS Degree Programs chapter of the UNTHSC Catalog.

A student who receives a single "C" in BMSC 6201, BMSC 6202, BMSC 6203, or BMSC 6204, but maintains an overall GPA of 3.0 or better after the first semester will be allowed to enter the Pharmaceutical Sciences & Pharmacotherapy Discipline and enroll in PSPT 6100 and PSPT 6400.

I. REQUIRED COURSES

For Master and Doctoral Degrees

Responsible Conduct of Research (BMSC 6101) - 1 SCH (Summer)
Grant Writing (BMSC 6102) - 1 SCH (Fall)*
Values-Based Considerations in Biomedical Sciences (BMSC 5109) - 1 SCH (Spring)
Transferable Skills (BMSC 5108) – 1 SCH (Summer)

* *Master's degree students are encouraged but not required to take BMSC 6102.*

PhD Required Courses*

Principles of Drug Discovery and Development (PSPT 6400) – 4 SCH

A PhD student who receives a "C" or "F" in the required course will not be allowed to take the oral qualifying exam in the summer of year 1 or the fall of year 2. Successful completion of PSPT 6400 is required to take the oral qualifying exam.

* *Master's degree students are encouraged but not required to take PSPT 6400*

II. SEMINAR COURSES, JOURNAL CLUB COURSES, AND WIPs

Journal Club in Pharmaceutical Sciences

PSPT 6100 – 1 SCH

- Offered in the Spring of Year 1
- Minimum of 2 SCH required
    - Once MS students register for Thesis (BMSC 5395) or PhD students register for Doctoral Dissertation (BMSC 6395), they are no longer required to register for a journal club course.

Works in Progress

- All students are required to present their research in Works in Progress or the System College of Pharmacy (SCP) Seminar Series once per year beginning in their second year
- Comparable courses may be substituted
    - Works in Progress (PHAN 6385) -1 SCH

Seminars - SCP Research Seminar Series

- All MS and PhD students in PSPT are required to attend all SCP's Research Seminar Series.

III. PhD ELECTIVE (ADVANCED AND TECHNIQUE) COURSES

PhD students are required to take at least two advanced courses in addition to PSPT 6400. Students are free to take advanced courses from other disciplines to complete their advanced course requirements. Advanced courses should be selected in consultation with the student's major professor and PSPT Graduate Advisor.

Advanced Course Examples (there are other SBS courses you could choose):

School of Pharmacy*:
PHAR 7313: Pharmaceutics I
PHAR 7323: Pharmaceutics II
PHAR 7232: Principles of Medicinal Chemistry & Pharmacology
PHAR 7322: Pharmacogenetics, Genomics, & Personalized Medicine
* These courses require written permission from course director for enrollment. Under the guidance of SBS, these courses will be covered under the Special Problems course number for registration.

Integrative Physiology:
PHAN 5300: Cardiovascular Physiology
PHAN 6380: Neurohumoral Control of Autonomic Function
PHAN 6400: Physiology of Health & Disease

Pharmacology & Neuroscience; Visual Sciences:
PHRM 5300: Neurobiology of Aging
PHRM 5470: Neuropharmacology
PHRM 6400: Functional Neuroscience
PHRM 6410: Basic & Clinical Pharmacology
PHRM 5200: Introduction to Bioinformatics
PHRM 6440: Methods in Molecular Biology
PHRM 6402: Visual Sciences

Biochemistry and Cancer Biology:
MIMG 6250: Molecular and Cell Biology of Cancer
MIMG 6435: Receptors and Second Messenger Signaling
MIMG 6436: Kinases and Phosphates
MIMG 5202: Introduction to Confocal Microscopy
MIMG 6220: Cellular & Molecular Fluorescence
MIMG 5150: Introduction to Flow Cytometry

Cell Biology, Immunology & Microbiology; Genetics:
MIMG 6200: Mitochondria and Complex Diseases
MIMG 6205: Fundamentals of Virology
MIMG 6207: Animal Models of Immunological Diseases
MIMG 6210: Practical Fluorescence for Biomedical Science

BMSC:
BMSC 5165: Industry Practice (Biotech and Pharmaceutical Industry, Bench to Bedside, Professional Development)
BMSC 5180: Introduction to Entrepreneurship

Special Problems Course Options: Under each PI name

4. SAMPLE DEGREE PLANS

I. **Master of Science Degree Plan** - The sample below does not imply that all requirements for graduation will be met with 30 SCH of course work. While it is possible to complete the requirements in this time frame, most research projects require additional semesters to complete. The typical time-to-degree for MS students is two years.

Dept	***Course Number***	***Title***	***SCH***	***Semester***
BMSC	5150	Lab Rotations	2	Fall year 1
BMSC	6200	Intro to Experimental Design & Biostatistical Methods	2	Fall year 1
BMSC	6201	Fundamentals of Biomedical Science I	2	Fall year 1
BMSC	6202	Fundamentals of Biomedical Science II	2	Fall year 1
BMSC	6203	Fundamentals of Biomedical Science III	2	Fall year 1
BMSC	6204	Fundamentals of Biomedical Science IV	2	Fall year 1
		Subtotal	***12***	
Milestones to be completed: Selection of Major Professor, Change of Discipline				
BMSC	5160	Biomedical Ethics	1	Spring year 1
BMSC	5315	Principles of Scientific Communication	2	Spring year 1
BMSC	5109	Values-Based Considerations in Biomedical Sciences	1	Spring year 1
BMSC	5998	Individual Research	0-6	Spring year 1
PSPT	6100	Journal Club	1	Spring year 1
		Advanced Course/Electives	0-6	Spring year 1
		Subtotal	***12***	
Milestones to be completed: Designation of Advisory Committee, Degree Plan.				
BMSC	5395	Thesis	0-6	Summer year 1
BMSC	5998	Individual Research	0-6	Summer year 1
BMSC	5108	Transferable Skills	1	Summer year 1
BMSC	6101	Responsible Conduct of Research	1	Summer year 1
		Advanced Courses	0-3	Summer year 1
		Subtotal	*6*	
Milestones to be completed: Research Summary (annual committee meeting), Research proposal (advancement to candidacy). The Research Proposal must be filed prior to enrollment in BMSC 5395. 30 SCH are accumulated at this point. If degree requirements are not met, student continues to register for BMSC 5998.				
BMSC	5998	Individual Research	1-12	Fall year 2
BMSC	5395	Thesis	1-12	Fall year 2
		Advanced Courses/ WiPs	0-3	Fall year 2
		Subtotal	***12***	
Once a student completes the research proposal, SCH can be reduced to 6 SCH.				
BMSC	5395	Thesis	1-6	Spring year 2
PSPT	6100	Journal Club		Spring year 2
		Subtotal	***12***	
		Minimum Total for Degree	***30***	

II. **Doctor of Philosophy Degree Plan** - The sample below does not imply that all requirements for graduation will be met with 90 SCH of course work. While it is possible to complete the requirements in this time frame, most research projects require additional semesters to complete. The typical time-to-degree for PhD students is approximately four-five years.

Dept	***Course Number***	***Title***	***SCH***	***Semester***
BMSC	6150	Lab Rotations	2	Fall year 1
BMSC	6200	Intro to Experimental Design & Biostatistical Methods	2	Fall year 1
BMSC	6201	Fundamentals of Biomedical Science I	2	Fall year 1
BMSC	6202	Fundamentals of Biomedical Science II	2	Fall year 1
BMSC	6203	Fundamentals of Biomedical Science III	2	Fall year 1
BMSC	6204	Fundamentals of Biomedical Science IV	2	Fall year 1
		Subtotal	***12***	
Milestones to be completed: Selection of Major Professor, Change of Discipline				
BMSC	5160	Biomedical Ethics	1	Spring year 1
BMSC	5315	Principles of Scientific Communication	2	Spring year 1
BMSC	5998	Individual Research	1-3	Spring year 1
BMSC	5109	Values-Based Considerations in Biomedical Sciences	1	Spring year 1
PSPT	6100	Journal Club	1	Spring year 1
PSPT	6400	Principles of Drug Discovery and Development	4	Spring year 1
		Subtotal	***12***	
Milestones to be completed: Designation of Advisory Committee, Degree Plan				
BMSC	6998	Individual Research	1-6	Summer year 1
BMSC	5108	Transferable Skills	1	Summer year 1
BMSC	6101	Responsible Conduct of Research	1	Summer year 1
		Advanced Courses	0-4	Summer year 1
		Subtotal	***6***	
Milestone to be completed: Oral Qualifying Examination, Research Summary (annual committee meeting).				
BMSC	6998	Individual Research	1-10	Fall year 2
BMSC	6102	Grant Writing	1	Fall year 2
		Advanced Courses/ Electives	1-4	Fall year 2
		Works in Progress	0-1	Fall year 2
		Subtotal	***12***	
BMSC	6998	Individual Research	1-11	Spring year 2
PSPT	6100	Journal Club	1	Spring year 2
		Advanced Courses/ Electives	0-11	Spring year 2
		Subtotal	***12***	

BMSC	6998	Individual Research	1-6	Summer year 2
BMSC	6101	Responsible Conduct of Research	1	Summer year 2
		Advanced Courses/Electives	0-4	Summer year 2
		Subtotal	***6***	
Milestone to be completed: A Research Progress Summary (annual committee meeting) and approved Research Proposal (subsequently advancement to candidacy) must be on file prior to enrollment in Doctoral Dissertation (BMSC 6395). Once a PhD student has advanced to candidacy (completed the oral qualifying exam and research proposal milestones), they are able to enroll in a total of 6 SCH per semester. Two of the 6 SCH must be in BMSC 6395 (Doctoral Dissertation).				
BMSC	6395	Doctoral Dissertation	2	Fall year 3
BMSC	6998	Individual Research	1-9	Fall year 3
		Works in Progress	0-1	Fall year 3
		Advanced Courses	0-8	Fall year 3
		Subtotal	***6-12***	
BMSC	6998	Individual Research	1-11	Spring year 3
BMSC	6395	Doctoral Dissertation	6-9	Spring year 3
PSPT	6100	Journal Club	1	Spring year 3
		Advanced Courses/Electives	0-8	Spring year 3
		Subtotal	***6-12***	
BMSC	6998	Individual Research	0-6	Summer year 3
BMSC	6395	Doctoral Dissertation	2-6	Summer year 3
		Advanced Courses	0-5	Summer year 3
		Subtotal	***6***	
BMSC	6998	Individual Research	0-9	Fall year 4
BMSC	6395	Doctoral Dissertation	6-9	Fall year 4
		Subtotal	***6-12***	
BMSC	6395	Doctoral Dissertation	6	Final Semester
		Total for Degree (Minimum)	***90***	
** Once a PhD candidate submits the "Declaration of Intent to Graduate" Form, they can enroll in a total of 3 SCH of Doctoral Dissertation (BMSC 6395) in the semester in which they will defend their dissertation (the final semester of enrollment).* ** 130 SCH is the maximum hours for in-state tuition. 6-20 SCH of BMSC 6998 (Individual Research) can be applied to the 90 SCH degree total. 6-30 SCH of BMSC 6395 (Doctoral Dissertation) can be applied to the 90 SCH degree total. In all cases, the degree plan must be approved by the student's advisory committee and the Dean of the SBS.*				

For additional information regarding Academic Procedures, please refer to the Graduate School of Biomedical Sciences Catalog at: Academic Procedures (SBS)

ADVANCEMENT TO CANDIDACY

I. Master of Science

Advancement to master's Candidacy is achieved after successful completion of a research proposal.

Each student will be required to submit a research proposal to his/her advisory committee. The student and their mentor will decide upon the format of the research proposal: 1) traditional proposal with no page limits, 2) NIH style grant including all its limitations (F31, R21), or foundation style grant with associated page limitations (e.g., AHA predoctoral grant). Traditional proposal format is as follows: Abstract (1pg), Specific Aims (1pg), Background and Pilot Studies (3-5pgs), Experimental Design and Methods including an anticipated results section (4-5pgs), References (unlimited). For NIH-style grant format, refer to the National Institutes of Health website for current information. For foundation grants, please refer to their website for information. A pre-proposal meeting is required for approval of research proposal format and submission of Research Proposal Forms SBS Forms and Guidelines website.

After student meets with their advisory committee, the student will setup a meeting with their advisory committee to present and defend the proposal. Once a date has been finalized, a Proposal Seminar and Defense form needs to be submitted to SBS no less than 30 days prior to the event date.

The research proposal should be provided to the advisory committee no later than 14 days prior to the defense. The formal public presentation will be followed by a private defense of the research proposal to the members of the student's advisory committee. The research proposal must be approved by the advisory committee and the Dean prior to registering for Thesis (BMSC 5395). It is expected that M.S. students will complete their Research Proposal in the Fall of year 2.

Research Proposal Guidelines and the Research Proposal approval forms are available on the SBS Forms and Guidelines website.

Once a master's student has successfully advanced to candidacy, they may use "MS Candidate" as a title on any general business correspondence such as business cards, e-mail messages, etc.

II. Doctor of Philosophy

Advancement to Doctoral Candidacy is a two-step process. The first step of this process is successful completion of the Oral Qualifying Examination, a common milestone in most doctoral programs regardless of the field of study. The second step of this process is the preparation and defense of a research proposal. Below are details of the Pharmaceutical Sciences & Pharmacotherapy Discipline for advancing to candidacy.

A. Oral Qualifying Examination

The qualifying examination ensures that the doctoral student has mastered information needed to succeed as a PhD in the fields of Pharmaceutical Sciences & Pharmacotherapy. The graduate advisor will distribute a list of key topics to the student at least 1 month prior to the qualifying examination. The student is expected to become knowledgeable in each of these topics through their previous course work, reading of textbooks and scientific literature, and discussion with faculty members.

The qualifying examination is administered by a committee comprised of members of the Pharmaceutical Sciences & Pharmacotherapy graduate faculty and the student's university member. The committee is established by the Pharmaceutical Sciences & Pharmacotherapy Graduate Advisor. The Graduate Advisor will chair the committee, unless they are the major professor for the student taking the oral qualifying exam. In such a case, an alternate chair will be appointed by the graduate advisor. The qualifying examination will be administered in the summer of the first year. The student will be given a list of questions covering topics from core and required advanced courses. The student will be given 1 hour of preparation time to review the questions and select a specified number of questions upon which they will be examined. The student will address the selected topics as well as any questions from the committee that may arise from the question and answer session.

Successful completion of the oral qualifying exam will be determined by the committee. If unsuccessful on the first attempt, a student may be allowed to retake the examination. The second examination should be completed by the end of the following semester. If unsuccessful on the second attempt, the student may be allowed to transfer to the MS degree program to complete the requirements for the MS degree.

It is the responsibility of the chair of the oral qualifying examination committee to obtain signatures from the examination committee, university member, graduate advisor, and department chair upon completion of the exam. The appropriate form may be obtained from the SBS Forms and Guidelines website.

B. Research Proposal

Each student will be required to submit a research proposal to their advisory committee. The student and their mentor will decide upon the format of the research proposal: 1) traditional proposal with no page limits, 2) NIH style grant including all its limitations (F31, R21), or foundation style grant with associated page limitations (e.g., AHA predoctoral grant). Traditional proposal format is as follows: Abstract (1pg), Specific Aims (1pg), Background and Pilot Studies (3-5pgs), Experimental Design and Methods including an anticipated results section (4-5pgs), References (unlimited). For NIH-style grant format, refer to the National Institutes of Health website for current information. For foundation grants, please refer to their website for information. A pre-proposal meeting is required for approval of research proposal format and submission of Research Proposal Forms SBS Forms and Guidelines website.

After meeting with their advisory committee, the student will setup a meeting with the committee to present and defend the proposal. Once a date has been finalized, a Proposal Seminar and Defense form needs to be submitted to SBS no less than 30 days prior to the event date.

The research proposal should be provided to the advisory committee no later than 14 days prior to the defense. The formal public presentation will be followed by a private defense of the research proposal to the members of the student's advisory committee. The research proposal must be approved by the advisory committee and the Dean prior to registering for Thesis (BMSC 6395). It is expected that PhD. students will complete their Research Proposal no later than the summer of year 2.

Research Proposal Guidelines and the Research Proposal approval forms are available on the SBS Forms and Guidelines website.

Once a doctoral student has successfully advanced to candidacy, they may use "PhD Candidate" or "Doctoral Candidate" as a title on any general business correspondence such as business cards, e-mail messages, etc. In addition, the minimum number of credit hours required for full-time enrollment drops from 12 SCH to 6 SCH. Two of the 6 SCH must be BMSC 6395 (Doctoral Dissertation).