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Graduate School of Biomedical Sciences

Pharmacology and Neuroscience Discipline Handbook 2021-2022

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

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

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Pharmacology & Neuroscience Discipline

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Graduate Faculty: Acharya, Barber, Borgmann, Clark, Cunningham R, Das, Dong, Forster, Gatch, Hall, Jin, Johnson, Liu, Luedtke, Mallet, Nejtek, Ortega, Park, Phillips, Prokai L, Prokai-Tatrai K, Roane, Salvatore, Schreihofer A., Schreihofer D, Shetty, Shi, Siderovski, Stankowska, Su, Sumien, Yang

Pharmacology is a discipline that bridges the basic and clinical sciences. Classically, pharmacologists sought to understand the pharmacological responses, mechanisms and clinical uses of drugs. In recent decades, the scope of pharmacology has expanded dramatically to include cutting edge research in signal transduction and cellular & molecular biology.

Neuroscience combines the fields of anatomy, physiology, molecular biology and cytology to study the function of the brain and nervous system. The goal of these studies is to gain a fundamental understanding of the biological basis of learning and memory, as well as the processes involved in neural development and neurodegeneration. The scope of neuroscience includes molecular and cellular studies of individual neurons to imaging the circuitry of sensory and motor tasks within the brain.

The Pharmacology & Neuroscience faculty maintain active research programs in the following areas: aging and Alzheimer's disease; drug discovery; glaucoma and ocular pharmacology; stroke; Parkinson's disease; learning and memory; neurobiology of drug and alcohol abuse; neuronal degeneration and protection; neuropsychopharmacology; pharmacogenetics; and receptors and ion channels.

Students in the Pharmacology & Neuroscience Discipline may choose from a number of advanced elective courses that are related to their individual research interests. Students are also required to participate in seminars, works in progress presentations and group discussions of current research topics, and will be trained in a number of techniques required to address existing research problems in the field. Both MS and PhD students will conduct original, publishable research and will be expected to present their results at national scientific conferences. Completion of the master's degree typically requires two years while the PhD degree is generally completed in four to five years.

Students who successfully complete a graduate degree in the Pharmacology & Neuroscience discipline will be well prepared for careers in academic or government research laboratories, as well as in the pharmaceutical/biotechnology industry.

Graduate Faculty and Their Research

To find out more specific information about faculty, please refer to: https://experts.unthsc.edu/en/

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 (chairs) or co-chairs on thesis advisory committees, and as co-chair on dissertation advisory committees with a full member as chair.

Full members of the Graduate Faculty are able to serve as members of thesis or dissertation advisory committees, and as major professors (chairs) or co-chairs on thesis or dissertation advisory committees.

Suchismita Acharya, Ph.D. Assistant Professor, Full Member

The Acharya laboratory's research is focused on expanding the chemical toolbox for neural signaling and anti-inflammation/anti-oxidant pathways to understand the mechanism of action of the disease pathology associated with glaucomatous optic neuropathy, Alzheimer Diseases, Ischemic stroke, substance abuse disorder as well as angiogenesis. The lab integrates medicinal chemistry, chemical biology, bio-engineering, and drug delivery via nanotechnology. We employ synthetic organic and organometallic chemistry to generate small molecule library for low throughput as well as high throughput screening (target based as well as phenotypic). The projects involve traditional medicinal chemistry SAR for property optimization to find hit to lead and structure, fragments or ligand-based drug design using structural biology, and computational chemistry tools. Fluorescent and ESR active probe design for signaling study as well chemoluminoscense assays are used. Pro-drug design to achieve chemical and metabolic stability, use of nanomeric materials and polymeric particles for drug delivery study is another core interest of Acharya lab.

Robert Barber, Ph.D. Professor, Full Member

Research in my group is focused on identifying genetic and epigenetic risk factors for neurodegeneration. Work in our group is collaborative and translational in nature. Ongoing projects include efforts to use patterns of DNA variation and differential methylation to predict the risk and progression rate of Alzheimer's disease. I am also interested in the biology of Alzheimer's among Mexican Americans and how disease etiology may differ between this underrepresented ethnic group and Caucasians. A second area of research interest is how individual gut bacteria profiles may impact risk for neurodegeneration and the age at onset of cognitive decline.
Collaborations are established with researchers at UNTHSC and other Texas institutions, as well as West Virginia University. Active projects are ongoing with Drs. O'Bryant, Allen, Planz, Cross, Hall, and Cunningham at UNTHSC; Chumley and Boehm at Texas Christian University; Royall and Palmer at UT Health Science Center at San Antonio and Wilhelmsen at West Virginia University School of Medicine.

Kathleen Borgmann, PhD Assistant Professor, Full Member

The overarching scientific goal of Dr. Borgmann's research is to explore 'The Funnel Hypothesis' – where insults to the brain enter the funnel from the periphery and trickle down the edges through complex pathways. These may include, but are not limited to, HIV-1 infection, drug exposure, cancer, microglial activation, excitotoxicity, mitochondrial dysfunction and calcium dysregulation. The resultant differential outcomes of acute and chronic inflammation converge in the brain at the astrocyte, which cares for and communicates directly with the neuron, ultimately leading to neurodegeneration. Dr. Borgmann's research program focuses on the role of glial inflammation in neurodegeneration, particularly in the context of HIV/AIDS, other dementias, drug abuse, aging and cancer. The burden of HIV infection on the world population is astounding. The evidence for astrocytes

playing an important role in neural health and disease conditions continues to grow. Our laboratory investigates two main themes that pertain to glial responses in disease. One line of investigation is focused on the alterations in protective functions of astrocytes, while the other investigates activation of pathways deleterious to neural health. We currently have several research projects related to these themes in primary human neural cell cultures and transgenic HIV animal models.

Abe Clark, Ph.D. Regents Professor, Full Member
Dr. Clark's major research focus is to discover the molecular mechanisms involved in ocular diseases, particularly glaucoma, in order to develop disease modifying therapies for better management of ocular diseases. Glaucoma is the leading cause of irreversible vision loss and blindness in the world and is also the leading neurodegenerative disease, affecting both the eye and brain. Dr. Clark's research includes molecular genetics, molecular biology, cell biology, physiology, pathology, and mouse models of glaucoma. A main goal in this lab is to perform translational research that eventually will help patients with glaucoma. In addition to research, he trains and mentors graduate students, postdoctoral fellows, and medical students. He also is very active in community-based vision screening events.

Rebecca Cunningham, Ph.D. Associate Professor, Full Member
Through her lab work, Dr. Rebecca Cunningham studies the role of steroid hormones, specifically androgens, during aging. Most of the team's 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 steroid hormonal responses in the central nervous system. In pursuing this goal, Dr. Cunningham and team use in vitro, in vivo, and clinical approaches to understand the how androgens affect brain function. It is hoped that this research will expand the understanding of how steroid hormones in the brain participate in aging. At the same time, she is expecting new insights that can lead to a better understanding of the role of gender in central nervous system disorders.

Hriday Das, Ph.D. Professor, Full Member
Currently there are no clinically-effective treatments or prophylactic-preventative agents for Alzheimer's disease (AD). My current research involves identification of molecular mechanisms of neuronal cell death in AD and develop cost-effective clinically-useful drug therapies for prevention of neuronal cell death and the treatment of AD. We are testing the effects of drugs that prevent neuronal cell death and improve memory in the genetically engineered mouse model of AD. The identification of novel pathways that these potential drugs regulate for neuroprotection in these genetically engineered mice, could provide new therapeutic avenues for AD. The anticipated outcomes of our mouse studies are likely to provide strong justification for the continued development and future clinical trials of these drugs for the treatment of AD.

Xiaowei Dong, Ph.D. Assistant Professor, Full Member
Dr. Xiaowei Dong received a BS in Industrial Analysis and a MS in Applied Chemistry from the universities in China, and a PhD in Pharmaceutical Sciences from the University of Kentucky. Dr. Dong was selected as one of six students nationwide to participate in the 2008 AAPS Graduate Student Symposium in Drug Delivery and Pharmaceutical Technology. She has worked as a lead formulator for drug development at Novartis Pharmaceutical Corporation for four years. In 2013, she joined UNT Health Science Center as an assistant professor in the Department of Pharmaceutical Sciences at the College of Pharmacy. Dr. Dong's research has focused on drug delivery and formulation development.

Michael Forster, Ph.D. Regents Professor, Full Member
The goal of research in our lab is to understand the biology that makes us slow down and become more vulnerable to disease and injury as we grow older. We know that it is possible to combat aging biology, because some people achieve advanced age in truly great condition. Studies of the habits and biology of such individuals during their lives are underway, but it may take several human lifetimes for them to be completed. Lower organisms grow old more rapidly and, like humans, show great differences among individuals in terms of how long they remain robust and resist disease and injury. By studying lower organisms, our laboratory is focused on the promise that we can rapidly discover ways to combat deleterious aging conditions, study how they work, and design trials in humans. Understanding the biology of aging will help us treat all aging-related diseases (i.e., Alzheimer's disease, diabetes, etc).

Michael Gatch, Ph.D. Professor, Full Member
The focus of our research is on two broad aims. One aim is to screen compounds that will attenuate the subjective and reinforcing effects of abused drugs as part of a NIDA-funded contract searching for effective treatment drugs for addiction to cocaine, methamphetamine, nicotine and marijuana. Another aim is to evaluate the potential abuse liability of novel designer drugs that are increasingly available as "legal" alternatives to controlled substances. We use drug discrimination procedures which assess the subjective effects of common drugs of abuse such as cocaine, methamphetamine, nicotine and marijuana, with designer drugs like MDMA (Ecstasy), with opioids like morphine, or with hallucinogens such as LSD. We also test the reinforcing/rewarding effects of drugs using the conditioned place preference and self-administration assays.

Jim Hall, Ph.D. Professor, Full Member
The focus of my research over the past few years has been on Alzheimer's disease and the identification of blood-based biomarkers that can be used in the early diagnosis of the disease. I have focused on investigating risk factors for cognitive decline and dementia in the Mexican-American elderly. I have also investigated the occurrence and identification of factors leading to neuropsychiatric symptoms of Alzheimer's such as depression, anxiety, and inappropriate behavior. Alzheimer's is a major public health concern, and developing accessible means to predict the disease and potentially allow for intervention to prevent or slow the disease is of upmost importance. Additionally, being able to identify those with the disease who are most likely to develop neuropsychiatric symptoms (the primary cause of caregiver stress and nursing home placement) can lead to early intervention and provide the groundwork for understanding the pathophysiology of neuropsychiatric symptoms of dementia. Developing treatment approaches for the pre-clinical stage of Alzheimer's disease to reduce the risk of developing neurodegenerative diseases is crucial to our aging population.

Kunlin Jin, M.D., Ph.D. Professor, Full Member
Stroke remains a leading cause of disability in the world. Despite progress in understanding molecular mechanisms of neuronal cell death in these diseases, widely effective treatment remains elusive. For many stroke survivors, the best hope is a lengthy program of rehabilitation, followed by a lifelong process of clinical support. However, even with rehabilitation therapy, 50% to 95% of stroke survivors remain impaired. We have documented that endogenous neural stem cells (NSCs) can proliferate, migrate and differentiate into functional neurons to replace or repair damaged neurons after acute ischemic stroke. Conditional depletion of neurogenesis inhibits functional recovery after ischemic stroke either in young adult or aged animals. Yet, patients who survive an acute stroke are typically left with fixed anatomical damage, which eventually transforms a brain cavity and results in permanent neurological deficits. Therefore, NSCs may not be able to reconstitute the lost neural tissue and restore the functional circuitry at chronic stage of stroke due to the brain cavity. To help

elucidate the potential of cell replacement therapy in stroke, we found that transplantation of human ESC-derived NSCs with Matrigel scaffolding resulted in improved histologic and behavioral outcome in animal model of stroke. However, many issues remain to be addressed before clinical application of this strategy becomes feasible. Matrigel is a gelatinous protein mixture extracted from EHS mouse sarcoma cells. Therefore, there is almost no chance that this mouse sarcoma derived gelatin would be approved for use as a scaffold for grafting cells into the human stroke. To address this issue, we generated gel-like scaffold from serum with ideal properties, and treated patients with ischemic stroke using autogenous stem cells and serum-derived scaffold. We found that the motor deficits and tissue damage post-stroke were significantly improved after transplantation, suggesting that stem cells-based tissue engineering may be a clinically effective therapeutic strategy for repairing the damaged brain tissue in the chronic phase after stroke.

Leigh Johnson, Ph.D. Associate Professor, Associate Member
My area of expertise is in translational aging research. I am the Co-I of Health & Aging Brain among Latino Elders (HABLE) study (R01AG054073), and the Director of the Clinical and Outreach cores for this study. I have spent a great deal of time studying factors related to cognitive loss among Mexican Americans with specific emphasis on the link between depression and cognition. I have developed and cross-validated a depressive endophenotype (DepE) of cognitive aging across multiple national and international cohorts. This work has been translated into a proof of concept clinical trial (The DEMO trial).

Ran Liu, M.D. Research Assistant Professor, Associate Member
The principal goals of my research are focused on translational stroke research. Although rtPA is the sole FDA approved treatment for ischemic stroke, very few patients have been benefited from rtPA treatment because of its limited therapeutic window and the increased risk of hemorrhage transformation due to blood-brain barrier breakdown. We are among the first to explore the combined therapy to extend rtPA's therapeutic window in ischemic stroke models. We have demonstrated that estrogens could extend the therapeutic window of rtPA for the treatment of ischemic stroke. In addition, our research has provided insight to target ischemic penumbra and beyond for the treatment of ischemic stroke.
Currently we repurpose a century-old drug, methylene blue, for the treatment of ischemic stroke. Our study demonstrates that large MCA territory infarct may induce long-lasting elevated GABAergic tonic inhibition in the hippocampus and, thus, contributes to cognitive impairment after ischemic stroke. All these results have led us to explore the role of GABAA receptor mediated neurotransmission in the cognitive impairment after large MCA territory infarct and to determine the effect of methylene blue on cognitive impairment after ischemic stroke.

Yang Liu, Ph.D. Research Assistant Professor, Associate Member
Our laboratory is interested in retinal neurodengeneration and potential therapeutics.

Robert Luedtke, Ph.D. Professor, Full Member
Our laboratory is interested in development and pharmacological characterization of dopamine receptor subtype selective drugs for the treatment of individuals afflicted with Parkinson's Disease or Alzheimer's Disease. We have also worked to develop D3 vs. D2 dopamine receptor subtype selective drugs that can be used to assist in the rehabilitation of individuals who abuse psychostimulants, such as cocaine. We are also working on the development of sigma-1 receptor selective compounds as therapeutics for the prevention of neurodegenerative disorders including traumatic brain injury and dementia. These studies have provided insights into the function of D2-like dopamine and sigma-1 receptors in the brain.

Robert Mallet, Ph.D. Regents Professor, Full Member
Dr. Robert Mallet's research focuses on developing treatments to protect the heart and brain from heart attack, stroke, and cardiac arrest. These three diseases, which result from interruptions in the blood flow to the heart and/or brain, are among the leading causes of death and disability in the United States. Dr. Mallet's team has discovered that breathing air containing reduced amounts of oxygen, for a few daily exposures lasting a few minutes each, causes adaptations in the heart and brain that make these organs much more resistant to interruptions in their blood flow. As a result, the damage to the heart and brain inflicted by temporary loss of blood flow is greatly decreased, enabling these vital organs to recover and resume their normal function.
Current work in the Mallet laboratory is studying the favorable changes in the brain's and heart's biochemical makeup which underlie the adaptations to low oxygen, so that these adaptations can be safely harnessed to help human patients survive and recover from strokes, heart attacks, and cardiac arrest.

Vicki Nejtek, Ph.D. Associate Professor, Full Member
The Nejtek lab currently examines biomarkers and cognitive functioning outcomes to predict risks for Parkinson's disease (PD) in veterans with and without mild traumatic brain injury (mTBI). We have successfully used BDNF, cortisol, and interleukin to identify treatment response, and have used cognitive functioning tests to predict mood state, and drug relapse. We have also used MRI with and without diffusion tensor imaging (DTI) to identify brain anomalies in patients with bipolar disorder with cocaine dependence in comparison to healthy controls. In a recent collaboration with Dr. Michael Salvatore, the Nejtek lab has received funding to conduct cross-species translational studies in parallel with our veterans with and without mTBI using a Parkinson's genetic PINK1 rat model compared to wild type.

Sterling Ortega, Ph.D. Assistant Professor, Full Member
The overarching theme of my research program is to discover novel therapeutics that can reverse immune-mediated neurological dysfunction. In line with this focus, my lab studies two debilitating neurological diseases.
Stroke, which is caused by the loss of blood flow to the brain, results in neurological injury and inflammation. Our previous studies have revealed a dynamic interaction between the adaptive immune system and the injured ischemic brain. This project will characterize the adaptive immune response (specifically CD8 T-cells) and determine if they can indeed modulate neuropathology and neurorecovery. Our preliminary data shows autoreactive CD8 T-cell responses to a subunit of the NMDA receptor as early as four days after stroke induction in two different murine strains. These neuronal GluN2A-reactive CD8 T-cells produce both interferon-gamma and tumor necrosis factor-beta, both highly inflammatory cytokines. The immuno-biology of CD8 T-cells makes them perfect harbingers of neuropathology. In my lab, we will use advanced immunological and neuroscientific assays to test our hypotheses. Our translational studies will determine if these cells are present and functional in post-stroke patients.
In addition, my lab also studies the role of neuroprotective myelin-specific CD8 T-cells in a mouse model of Multiple Sclerosis (MS). Multiple sclerosis is a disease whereby the myelin sheath around nerve axons is lost, disrupting communication between the brain and the body. Our preliminary data show that myelin-reactive CD8 T-cells expeditiously (2–6 days) and robustly reverse disease, access the brain during disease amelioration, and produce interferon-gamma. This cytokine has been shown to exhibit neuro-reparative properties. Taken together, we believe that myelin-reactive CD8 T-cells employ "neuro-reparative" mechanisms that we will evaluate. In summary, using in vitro and in vivo approaches, we will delineate mechanisms involved in the cerebral functional recovery

that myelin-reactive CD8 T-cells possess. Investigating the immune mechanisms that potentiate direct activation of brain reparative processes is a novel approach that directly addresses the goal of understanding how we can restore function in MS patients. Our translational studies will determine the role of these cells in MS patients.

InWoo Park, Ph.D. Associate Professor, Full Member
The first is HIV-1-mediated aggravation of liver disease in HCV virus co-infectees. Due to the shared routes of infection, HIV-1/HCV co-infection is common, with 15~30% of all HIV-1-infected persons estimated to be co-infected with HCV. In the co-infected patients, HIV-1 is known to accelerate every stage of HCV-mediated liver disease progression. However, the molecular details regarding how co-infection of HIV-1 and HCV brings about a more severe deterioration of the liver than a single infection of HCV are unknown at present.
Second, HIV-1 viral proteins are generated in a stage-specific manner; that is, regulatory proteins, such as Tat, Rev, and Nef, are expressed at the early stage, while structural proteins, such as Gag, Pol, and Env, are produced at the late stage of virus infection. Molecular regulation of viral gene expression in protein production has been studied comprehensively, whereas the elimination processes using the ubiquitin proteasome system for the synthesized proteins after completion of their duties in the infected cells are generally unknown, representing a current gap in understanding the smooth stage-specific transitioning through the HIV-1 life cycle, crucial to viral pathogenicity.

Nicole Phillips, Ph.D. Assistant Professor, Full Member
Our laboratory has a several areas of interest: 1) studies of mitochondrial DNA and mitochondrial function, in the context of various disease states such as Alzheimer's disease, type 2 diabetes and preeclampsia (in collaboration with Dr. Stella Goulopoulou); 2) genetic aspects of pain and pain management, as the Director for Genomic Research for PRECISION Texas; 3) genetic risk for age-related disease and comorbidity patterns, via genome-wide genotyping, methylation profiling, and data mining.

Laszlo Prokai, Ph.D. Professor, Full Member
Dr. Prokai is the first Chair in Biochemistry endowed by the Houston-based Welch Foundation, one of the United States' oldest and largest private funding sources for basic research, at the UNT Health Science Center. He is affiliated with the UNTHSC's Department of Pharmacology and Neuroscience, and is an Associate Member of the Graduate Faculty at the Department of Chemistry and Biochemistry of the Texas Christian University. His interests focus on chemistry-driven multidisciplinary research and include the discovery, chemical biology, bioorganic and medicinal chemistry of central nervous system agents, as well as neuropeptides, proteomics and mass spectrometry. Dr. Prokai has maintained an actively funded research program from grant support by the National Institutes of Health (NIH) as well as through collaborations with pharmaceutical and chemical companies, and was the recipient of the 2017 Wilfred T. Doherty Award of the Dallas/Fort Worth Section of the American Chemical Society (ACS) and the 2017 Southwest ACS Regional Award.

Katalin Prokai-Tatrai Ph.D. Professor, Full Member
The research in our laboratory is directed at medicinal chemistry-based drug design and delivery into the central nervous system with translational medicine in mind. We focus on agents (neuropeptides and estrogens) that are beneficial for brain and retinal health. Our projects involve pharmacokinetics, metabolism and drug distribution studies in early-phase drug discovery and the aging/diseased brain and retina. The current federally funded main project in our lab is entitled "A Novel Neuroprotective Approach for Glaucoma."

Brandy Roane, Ph.D. Associate Professor, Full Member
Sleep is both a biological need and a choice, making the study of sleep both fascinating and complex. Insufficient sleep and poor quality sleep adversely impact health and wellness. Yet, 70% of Americans across all age groups experience one or both. The Sleep Research Lab, directed by Dr. Brandy M. Roane, examines the combined influence of physiological, behavioral, and social factors on health with a specific focus on: (a) exploring links between sleep and subsequent psychopathology and chronic medical conditions, and (b) developing effective prevention and intervention treatments.
Research projects include clinical, laboratory, and public health studies such as experimentally manipulating sleep parameters and examining how these changes impact obesity-related behaviors such as physical activity and eating. The overarching goal of all work conducted in the Sleep Research Lab is to better understand how sleep may act as an environmental variable altering the trajectory of chronic medical conditions and psychopathology. Understanding how sleep influences these conditions would contribute greatly to health and wellness, as sleep is a targetable behavior.

Michael Salvatore, Ph.D. Professor, Full Member
Our lab goal is to understand the molecular basis for locomotor impairment in aging and Parkinson's disease. Once we have identified differences in specific dopamine or glutamate-regulating proteins that are associated with locomotor impairment, we can use approaches that target these proteins and determine if experimental changes in protein expression or function can improve locomotor function. Therefore, our immediate and long-term goals are to delineate optimal molecular, pharmacological, and non-invasive (exercise, calorie restriction) approaches that can target proteins associated with motor impairment. Once we have gained such results in rat models, we aim to translate these findings into the human condition. Ultimately, we use our results toward the goal of reducing or eliminating locomotor impairment associated with aging and Parkinson’s disease. Dr. Salvatore has obtained funding from the National Institute on Aging and Department of Defense to maintain this research program and has served as a reviewer for multiple funding mechanisms for the Parkinson’s Foundation.

Ann Schreihofer, Ph.D. Professor, Full Member
My goal is to better understand how the brain controls blood pressure, both under normal conditions and in the presence of disorders that raise blood pressure. Currently, my laboratory focuses on two conditions that lead to high blood pressure: obesity and sleep apnea. Both of these conditions change how the brain controls blood pressure, but the mechanisms are not well understood. Although, ideally, obesity and sleep apnea can be managed, many find it difficult to control body weight in the long term and not may tolerate current treatments for sleep apnea. As these conditions continue to become more prevalent, the cardiovascular disease that accompanies them also becomes a major health issue nationwide. The current treatments for high blood pressure are numerous, and many medications act within the brain to control blood pressure.
Our work examines which treatments are ideal for management of cardiovascular disease with these conditions by determining how the brain changes with obesity and sleep apnea and whether current medications can reverse these changes. Because high blood pressure has many causes, treatments should be individually optimized to best manage control of blood pressure in the context of the conditions that accompany it.

Derek Schreihofer, Ph.D. Associate Professor, Full Member
My laboratory is interested in the prevention and treatment neurodegeneration. Using cell and animal models of stroke, traumatic brain injury, and metabolic syndrome, we examine the factors that reduce injury and prevent or delay the onset of motor and cognitive disfunction. Ongoing projects

1) examine how steroid hormones like estrogen, testosterone, and natural estrogens from plants regulate brain function in injury and aging and the underlying mechanisms of steroid action; 2) determine the role of sport-related head injury in aging-induced neurodegeneration and Alzheimer's disease; 3) determine precursors of cognitive decline associated with metabolic syndrome; and 4) identify new drugs for treating stroke injury. Our goal is to determine the conditions in which these compounds can be safely and effectively used to provide ongoing brain health and treat brain injury and disease. My lab uses rodent injury models to study behavior, gene expression, cell signaling, and pharmacological interventions. In vitro, we make use of cell lines, primary cell cultures, and organotypic brain slice cultures with fluorescent markers and live cell imaging.

Ritu Shetty, PhD., R. Ph. Research Assistant Professor, Associate Member
Long-lasting drug related memories can play an important role in addiction cycle and relapse. I am interested in understanding the mechanisms behind formation and consolidation of memories; predominantly drug-related memories. The main focus of my research is to understand the acquisition and development of drug-seeking behavior using various rodent models, and also identify molecular targets in different brain regions involved in expression of such behaviors.

Xiangrong Shi, PhD Associate Professor, Full Member
Dr. Shi lab focuses on clinical research and application. Research interests include to apply physical exercise training as prophylactic measure for counteracting human cardiorespiratory and neurovascular aging based on testing cerebral blood flow and autonomic nervous function under physical and mental challenges; and to apply intermittent hypoxia preconditioning as novel therapeutic and rehabilitative intervention for improving neurovascular and neurocognitive functions in elderly with ischemic stroke and Alzheimer disease/dementia.

David Siderovski, Ph.D. Professor & Chair, Full Member
G protein-coupled receptors (GPCRs) remain the single largest group of "druggable" proteins that continue to find tremendous utility in drug discovery programs. In 1994, Siderovski was the first to report the sequencing of a "Regulator of G protein Signaling" (RGS protein): 'G0/G1-switch gene-8' or G0S8 (subsequently renamed RGS2). What Siderovski originally identified as the G0S8-homology ("GH") domain in proteins from several eukaryotic genomes (human, *Drosophila melanogaster*, *Caenorhabditis elegans*, *Saccharomyces cerevisiae*) is now known as the "RGS domain", a 130 amino-acid domain that contacts G-alpha switch regions to stabilize the transition state, thus accelerating GTP hydrolysis. Discovery of this superfamily of proteins that negatively regulate G-alpha-dependent signaling resolved a prior paradox that GPCR-stimulated signals are seen to terminate much faster in vivo than predicted from the slow GTP hydrolysis rates exhibited by purified G-alpha subunits in vitro. RGS proteins are now considered key desensitizers of heterotrimeric G protein signaling and, as such, as new drug discovery targets. The lab is currently pursuing RGS protein inhibitors as potential agents against cocaine and opioid abuse.

Dorota Stankowska, Ph.D. Assistant Professor, Full Member
Glaucoma is an eye disease commonly associated with an increase in intraocular pressure, afflicting nearly 3 million Americans and 70 million people world-wide. Current therapies are aimed at lowering intraocular pressure, however, damage to the optic nerve continues to occur despite these treatments. There is a pressing need for adjunct therapies aimed at protecting the optic nerve from further damage.
My laboratory research focuses on the development of strategies for neuroprotection in glaucoma. Specifically, we are testing various small molecules and adeno-associated viral gene therapies for their ability to attenuate neurodegeneration in animal models of glaucoma. We also aim to unravel

cellular and molecular mechanisms underlying the pathophysiology of glaucoma.
Concepts/techniques: We carry out these studies using in vitro rat primary retinal ganglion cell cultures, ex vivo adult rat retinal explants, and various in vivo rodent models of glaucoma. We use visual function tests including pattern ERG and optomotor test to determine the efficacy of clinically relevant experimental pharmacotherapies.
Our ongoing studies have the potential to develop novel therapeutic agents for neuroprotection in glaucoma.

Dong-Ming Su, Ph.D. Professor, Full Member
The strength of our research projects is using and generating genetically-engineered animal models in understanding genetic and epigenetic regulation of the T-cell immune system and its microenvironment during aging. Our aim is to determine mechanistic insights into poor (immunosenescence) and harmful (autoimmune) T-cell immunity in the elderly for developing rejuvenation strategies to combat age-related chronic inflammatory diseases and cancer recurrence.
Our current NIH- & AAI-funded and potentially NIH-funded projects include: "Balance of thymic negative selection vs. Treg cell generation in the elderly (NIH-funded R01)"; "Biased Treg TCR specificity and its impact on immunity in the elderly (Potential NIH R01)"; and "Role of the central immune organ in cancer chemoimmunotherapy (AAI-funded fellowship).

Nathalie Sumien, Ph.D. Associate Professor, Full Member
My scientific interests lies with the study of interventions to alleviate the effects of aging and age-related diseases on motor, cognitive and affective function and the role oxidative stress and inflammation may play in the success of these interventions. Currently, we have three on-going studies: (1) hyperbaric oxygen therapy as a novel intervention for Alzheimer's Disease, (2) developing a model of childhood leukemia "chemobrain" to study interventions, and (3) long-term consequences of psychostimulants on brain function. All our studies are done in rodents and include male and females to determine the impact of sex differences on interventions.

Shaohua Yang, M.D., Ph.D. Regents Professor, Full Member
In biology, energy is an attribute of all living organism from bacterial to human being. The conversion between mass and energy are fundamental to our understanding of the biological processes defined as metabolism by which living organisms cycle energy through different mechanisms to produce the necessary molecules and perform the necessary functions of life. As the metabolism goes on, the life goes on. Dr. Yang's laboratory is interested in understanding the mechanism and discovery of interventions for brain aging and aging-related neurological disorders, including ischemic stroke, vascular dementia, and Alzheimer's dementia. His research has been focusing on the brain metabolism and using cell culture and rodent models of ischemic stroke and neurodegenerative diseases to address these issues.

Requirements

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

Grades

For either the MS or PhD program, it is required that a student maintain a GPA of 3.0. In addition, each student must make a grade of at least B in all Pharmacology & Neuroscience courses.
PhD students who fail to make a B in required courses (PHRM 6400 and PHRM 6410) will be required to retake these courses or other courses with contents covering OQE topics and will have to delay their oral qualifying exams.

Discipline-Specific Required Courses

For MS and PhD Program

- Pharmacology & Neuroscience Seminar (PHRM 5140)-1 SCH (***required registration for at least one semester, but attendance mandatory throughout degree)***
- Pharmacology & Neuroscience Journal Club (PHRM 6140) - 1 SCH (***attendance required for Spring Year 1, required registration for Fall/Spring Year 2***)
- Pharmacology & Neuroscience Work in Progress (PHRM 5150)- 1 SCH (***required registration for every long semester throughout degree * potential exception for last semester***)

For PhD Program*

- Functional Neuroscience (PHRM 6400) - 4 SCH
- Basic and Clinical Pharmacology (PHRM 6410) - 4 SCH

**Master's Degree students are encouraged, but not required to take these 2 courses*

Discipline-Specific Required Elective Courses

Must include at least 2 SCH in PHRM courses, excluding Special Problems courses

Elective courses offered by other departments can also be taken, provided that the required electives in Pharmacology and Neuroscience are completed. The student is referred to the Graduate Catalog for course offerings in other departments.

Offered every semester:
Techniques in Biomedical Sciences: Multifactor Experiments (BMSC 5170.400) - 1 SCH
Drug Discovery and Design (PHRM 6270) - 2 SCH
Current Strategies and Challenges in Drug Discovery (PHRM 6280) – 2 SCH

Offered every year:
Mitochondria and Complex Diseases (PHRM 6200) - 2 SCH (Spring)
Methods in Molecular Biology (PHRM 6440) – 4 SCH (Summer)
Grant Writing (BMSC 6102)- 1 SCH (Fall)

Offered in "even" fall semesters:
Receptors and Drug Action (PHRM 6480) - 4 SCH

Offered in "even" spring semesters:
Neurobiology of Aging (PHRM 5300) - 3 SCH

Offered in "odd" fall semesters:
Neuropharmacology (PHRM 5470) - 4 SCH
Receptors and Second Messenger Signaling (MIMG 6435) - 2 SCH
Kinases and Phosphatases (MIMG 6436) – 2 SCH

Offered in "odd" spring semesters:
Biomedical Mass Spectrometry (PHRM 6361) - 1-2 SCH

Required Activities

Journal Club: Students are required to register for Journal Club for Year 2, but will be required to attend and participate during Spring Year 1

Seminars: Student are required to register for Seminar course, but will be required to attend and participate throughout their degree. Course can be taken more than once for credit.

Work in Progress: Starting in Year 2, the students will be required to register and participate in this course every long semester. The semester they defend they may choose to not register after discussion with graduate advisor and mentor.

Others activities: It is required of all students to attend as many research proposal defense, thesis and dissertation defense as possible, to support fellow students and to remain engaged within the program.

Sample Degree Plan

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 to be Completed***
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	Diversity, Equity and Inclusion in Biomedical Sciences: Fundamental Concepts	1	Spring Year 1
BMSC	5998	Individual Research	0-6	Spring Year 1
PHRM	5140	Pharm & Neuro Seminar	1	Spring Year 1
PHRM	6140	Pharm and Neuro Journal Club	1	Spring Year 1
		Advanced Courses	0-6	Spring Year 1
		Subtotal	***12***	
Milestones to be completed: Designation of Advisory Committee, Degree Plan. The Research Proposal must be filed prior to enrollment in Thesis (BMSC 5395).				
BMSC	5108	Transferable Skills	1	Summer Year 1
BMSC	5395	Thesis	0-5	Summer Year 1
		Advanced Courses	0-5	Summer Year 1
		Subtotal	***6***	
		Total for Degree	***30***	

Note: Year 2 on, PHRM 5150 will be required (Pharm & Neuro Work in Progress).

Doctor of Philosophy Degree Plan - The sample below does not imply that all requirements for graduation will be met with 93 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 four-to-five years.

Dept	***Course Number***	***Title***	***SCH***	***Semester to be completed***
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	Diversity, Equity and Inclusion in Biomedical Sciences: Fundamental Concepts	1	Spring Year 1
PHRM	6400	Functional Neuroscience	4	Spring Year 1
PHRM	6410	Basic and Clinical Pharmacology	4	Spring Year 1
		Subtotal	***12***	
Milestones to be completed: Designation of Advisory Committee, Degree Plan				
BMSC	5108	Transferable Skills	1	Summer Year 1
BMSC	6998	Individual Research	0-5	Summer Year 1
		Advanced Courses	0-5	Summer Year 1
		Subtotal	***6***	
Milestone to be completed: Oral Qualifying Examination				
PHRM	5140	Pharm & Neuro Seminar	1	Fall Year 2
PHRM	6140	Pharm & Neuro Journal Club	1	Fall Year 2
PHRM	5150	Pharm & Neuro Work in Progress	1	Fall Year 2
BMSC	6998	Individual Research	0-9	Fall Year 2
		Advanced Courses	0-9	
		Subtotal	***12***	
PHRM	6140	Pharm & Neuro Journal Club	1	Spring Year 2

Dept	*Course Number*	*Title*	*SCH*	*Semester to be completed*
PHRM	5150	Pharm & Neuro Work in Progress	1	Spring Year 2
BMSC	6998	Individual Research	0-10	Spring Year 2
		Advanced Courses	0-10	Spring Year 2
		Subtotal	***12***	
BMSC	6998	Individual Research	0-5	Summer Year 2
BMSC	6101	Responsible Conduct of Research	1	Summer Year 2
		Advanced Courses	0-5	Summer Year 2
		Subtotal	***6***	
Milestone to be completed: A Research Proposal must be on file prior to enrollment in Doctoral Dissertation (BMSC 6395)				
PHRM	5150	Pharm & Neuro Work in Progress	1	Fall Year 3
BMSC	6998	Individual Research	0-8	Fall Year 3
BMSC	6395	Doctoral Dissertation	0-8	Fall Year 3
		Advanced Courses	0-8	Fall Year 3
		Subtotal	***9***	
PHRM	5150	Pharm & Neuro Work in Progress	1	Spring Year 3
BMSC	6998	Individual Research	0-8	Spring Year 3
BMSC	6395	Doctoral Dissertation	0-8	Spring Year 3
		Advanced Courses	0-8	Spring Year 3
		Subtotal	***9***	
BMSC	6998	Individual Research	0-6	Summer Year 3
		Advanced Courses	0-6	Summer Year 3
		Subtotal	***6***	
BMSC	6998	Individual Research	0-9	Fall Year 4
BMSC	6395	Doctoral Dissertation	0-6	Fall Year 4
		Advanced Courses	0-9	Fall Year 4
		Subtotal	***9***	

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

Advancement to Candidacy

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 his/her mentor will decide upon the format of the research proposal: 1) traditional proposal with no page limits, or 2) NIH style grant including all its limitations (F31, R21)). 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.

Proposal Seminar and Defense, including securing a room reservation and committee signatures. The form must be submitted to GSBS no less than 30 days prior to the event date.

The research proposal should be provided to all committee members at least 14 days prior to the presentation to the advisory committee. The student will then conduct a public seminar of the research proposal, followed by a private discussion with the committee.

The advisory committee will determine if the proposal is satisfactory. The proposal must be approved by the advisory committee and submitted to the GSBS during the semester prior to the student's final semester, at the latest. Submission of an approved research proposal is prerequisite for registration in Thesis (BMSC 5395)

Research Proposal Guidelines and the Research Proposal approval forms are available on the GSBS 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.

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 Pharmacology and Neuroscience specifications for advancing to candidacy.

Oral Qualifying Examination

The doctoral student will successfully defend his/her general knowledge of pharmacology and neuroscience in an Oral Qualifying Examination (OQE) before an examination committee comprised of 3-5 members of the Pharmacology & Neuroscience graduate faculty and the student's university member. The graduate advisor will chair these examinations (another faculty will be asked to chair if the student taking their OQE is mentored by the graduate advisor). The committee will be appointed by the department chair and graduate advisor early Spring semester. This examination will be held during the Summer semester of Year 1 (typically June/July).

The student will be given a list of questions covering topics from core and required advanced courses early Spring semester. The student will be given one 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 this requirement will be determined by the OQE committee. If unsuccessful on the first attempt, a student may be allowed to retake the examination. The second examination should be completed within twelve weeks of the original examination, unless otherwise specified by the examination committee. If unsuccessful on the second attempt, the students may be allowed to transfer to the MS degree program to complete the requirements for the MS degree.

The chair of the committee will obtain the signatures from the examination committee members, university member, graduate advisor, and department chair upon completion of the exam. The appropriate form may be obtained from the GSBS Forms and Guidelines website.

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, or 2) NIH style grant including all its limitations (F31, R21)). 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.

The committee must approve of the format and topic, a decision that can be made via email or meeting. Once a date and time have been determined, the student must prepare a Notice of Research Proposal Seminar and Defense, including securing a room reservation and committee signatures. The form must be submitted to GSBS no less than 30 days prior to the event date.

The research proposal should be provided to all committee members at least 14 days prior to the presentation to the advisory committee. The student will then conduct a public seminar of the research proposal, followed by a private discussion with the committee.

For PhD students, the proposal should be completed within a year of having passed the OQE. The proposal must be approved by the advisory committee and submitted to the GSBS during the semester prior to the student's final semester, at the latest. Submission of an approved research proposal is prerequisite for registration in Doctoral Dissertation (BMSC 6395)

Research Proposal Guidelines and the Research Proposal approval forms are available on the GSBS 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 9 SCH in long semesters.

Additional Information

The following topics can be found in the GSBS catalog at **UNTHSC Catalog.**

Leave of Absence
Enrollment Requirements
Annual Progress Reports
Graduate Teaching Assistant