UNT HEALTH SCIENCE CENTER

GRADUATE SCHOOL OF BIOMEDICAL SCIENCES

VISUAL SCIENCES
STUDENT HANDBOOK
2018-2019

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 Visual Sciences.

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Visual Sciences Discipline

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Graduate Faculty:
- Suchismita Acharya
- Sai Chavala
- Abbot Clark
- Adnan Dibas
- Dorette Ellis
- Raghu Krishnamoorthy
- Cameron Millar
- Iok-Hou Pang
- Hongli (Catherine) Wu
- Thomas Yorio
- Gulab Zode
- Yang Liu
- Tara Tovar-Vidales
- Shaoqing He
- Dorota Stankowska
- Aiguo Ni

Description of the Visual Sciences Discipline:

Vision is one of the most important sensations of the human body. Although our knowledge of eye diseases has greatly advanced, the leading causes of vision loss and blindness, such as age-related macular degeneration, glaucoma, cataract and diabetic retinopathy still affect hundreds of millions of people. Therefore, prevention and treatment of these eye diseases are of tremendous importance, the success of which depends on the elucidation of disease mechanisms.

Vision science is the study of the physiology and pathology of the visual system, which includes the eye, its appendages, as well as the visual cortex of the brain. This delicate system is extremely sensitive to aging, genetic disorders, infection, and injuries. Vision scientists combine cell biology, molecular biology, biochemistry, and electrophysiology techniques with ocular cell, tissue and animal models to study the visual system under normal or disease conditions.

The research of our current faculty focuses on eye diseases including glaucoma, retinal degeneration, and diabetic retinopathy. Their research areas cover trabecular meshwork pathology, aqueous humor dynamics, retinal ganglion protection and regeneration, ocular responses to steroids, ocular genetic diseases, retinal pigment cell protection, oxidative stress and gene therapy. Faculty research is funded by extramural sources including the National Eye Institute, U.S. Department of

Defense, The Bright Focus Foundation, Glaucoma Research Foundation, The Knights Templar Eye Foundation, Fight for Sight, as well as pharmaceutical companies.

Students may enter the discipline with a variety of academic backgrounds, providing that they have fulfilled prerequisite courses. The graduate training program involves basic courses in cell biology, immunology, molecular biology, biochemistry, physiology, immunology and pharmacology, as well as advanced courses in specific vision science topics. Besides lectures, students have the opportunity to participate in seminars, journal clubs and clinical shadowing in techniques of contemporary vision research as well as clinical diagnosis and treatment. Students perform original publishable research, and present their research findings at local, national, and/or international scientific conferences. In addition, students present their research at the annual UNTHSC Research Appreciation Day (RAD) and during the weekly institutional Works in Progress (WIPs). About two years are required to complete the Master of Science degree. Approximately four to five years are required to complete the Doctor of Philosophy degree. However, the actual time required for graduation depends on students' academic performance, which is determined by the major professor and the master's/doctoral advisory committee.

Students who are interested in joining the Visual Sciences discipline should have identified their major professor (see Graduate Faculty on the previous page) by the end of their 1st semester of study. Before choosing his/her major professor, the student is required to consult the Graduate Advisor.

Graduates with advanced degrees find employment in higher education, industry and government agencies.

2. Graduate Faculty and Specific Research Programs

More information is available at https://www.unthsc.edu/health-institutes/north-texas-eye-research-institute/north-texas-eye-research-institute-faculty-and-staff/

Abbot (Abe) Clark, Ph.D.
Regents Professor of Department of Pharmacology and Neuroscience
Executive Director, NTERI
Category III

Dr. Clark's research interests are focused on understanding the biochemical, cellular and molecular mechanisms involved in the pathobiology of glaucoma and other ocular diseases. Dr. Clark is discovering the molecular pathogenesis of glaucoma in the trabecular meshwork, retinal ganglion cells, optic nerve head, optic nerve and visual centers of the brain in order to design disease-modifying therapies. His laboratory uses molecular genetics, molecular biology, cell biology, and physiological techniques to not only discovery of novel pathogenic pathways, but also to identify new therapeutic approaches. He collaborates with laboratories throughout the US as well as internationally.

Sai Chavala, M.D.
Professor of Department of Pharmacology and Neuroscience
Director of Translational Research, NTERI
Category III

Dr. Chavala's laboratory focuses understanding the molecular underpinnings of acquired and inherited retinal degenerations. Our goal is to develop novel therapies and restore vision for patients suffering from vision impairment secondary to retinal disease. Currently, our lab focuses on stem cell-like regenerative approaches to replace damaged or lost retinal cells.

Adnan Dibas, Ph.D.
Research Assistant Professor of Department of Pharmacology and Neuroscience
NTERI
Category II

Glaucoma is the second leading cause of blindness in the US. The prescription of millions of steroids for many diseases has unfortunate effects that include steroid-induced glaucoma. In collaboration with colleagues at NTERI, we are trying to understand mechanisms involved in steroid-induced IOP elevation that are mediated by the translocation of GRalpha to the nucleus. The second project in my lab focuses on neuroprotection. While current glaucoma drugs lower intraocular pressure in patients, retinal ganglion cells continue to die leading ultimately to blindness. We have discovered a protein channel known as ASIC (Acid-sensing ion channel) that appears involved in retinal cell death. We are currently testing selective blockers against ASIC to assess neuroprotection.

Dorette Ellis, Ph.D.
Associate Professor, Pharmaceutical Sciences & NTERI
Category III

Our laboratory utilizes a multidisciplinary approach (animal models, cell culture, biochemistry, pharmacology and molecular tools) to promote neuroprotection of retinal ganglion cells during glaucomatous insults. We believe that the sigma 1-receptor protects the retinal ganglion cells by its ability to restore proper functioning of the mitochondria, thus maintaining retinal ganglion cell survival.

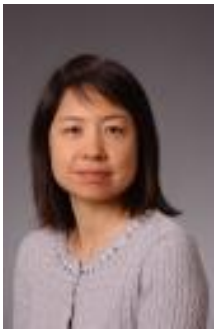
Shaoqing He, Ph.D.
Research Assistant Professor of Department of Pharmacology and Neuroscience
NTERI
Category I

My research interest focuses on the pathological mechanisms of glaucoma. The characteristic events occurring during progression of glaucoma are the death of nerve cells in the eye (retinal ganglion cells) and damage to the optic nerve. We are testing the hypothesis that transcription factors, the proteins controlling gene expression, and astrocytes, one type of supporting cells in the nervous system, play a crucial role in both events. Therefore, my efforts are dedicated to understand the interaction of nerve cells and astrocytes, and to reveal the roles of transcription factors in neuronal cell death, particularly through the activation of astrocytes.

Raghu Krishnamoorthy, Ph.D.
Associate Professor of Department of Pharmacology and Neuroscience
NTERI
Category III

Endothelin B (ET_B) receptor belonging to the rhodopsin superfamily of G protein coupled receptors plays a causative role in optic nerve damage and retinal ganglion cell death in a rat model of glaucoma. Our work is aimed at developing endothelin receptor antagonists as neuroprotective agents in glaucoma.

Yang Liu, Ph.D.
Research Assistant Professor of Department of Pharmacology and Neuroscience
NTERI
Category I



Dr. Liu's research interests focus on understanding the mechanisms related to glaucoma neurodegeneration and developing effective neuroprotective strategies. Current studies include phosphoproteomics changes in the retina following optic nerve injury, establishing conditionally immortalized retinal cell lines.

Cameron Millar, Ph.D.
Research Assistant Professor of Department of Pharmacology and Neuroscience
NTERI
Category II

In recent years I have focused on the mouse as a model for the study of Primary Open-Angle Glaucoma (POAG). My current interests include (in the mouse): measurement of intraocular pressure (IOP); the study of aqueous humor dynamics, and creation of induced models of POAG via over-expression of POAG-associated transgenes using viral vectors; creation of induced models of POAG via daily topical treatment with dexamethasone; creation of transgenic (Tg) models of POAG; models of retinal ganglion cell (RGC) degeneration achieved via retinal ischemia/reperfusion (I/R) and optic nerve crush (ONC); imaging of retinal tissues via Spectral Domain-Ocular Coherence Tomography (SD-OCT); assessment of visual acuity via assessment of the optomotor response, and assessment of the electroretinogram (ERG); and ocular examination (slit lamp examination, direct ophthalmoscopy, gonioscopy).

Iok-Hou Pang, Ph.D.
Professor, Pharmaceutical Science & NTERI
Category III

Dr. Pang's research interests mainly focus on the understanding of glaucoma etiology, pathology, and pharmacology, especially on glaucoma neuroprotection. He is working to delineate essential molecular and cellular mechanisms, as well as characterize receptors and signal transduction pathways related to the abnormal changes in glaucoma. His laboratory is using rodents and primary cultures of retinal cells as study models to clarify biological events leading to glaucomatous retinopathy and its protection.

Dorota Stankowska, Ph.D.
Research Assistant Professor of Department of Pharmacology and Neuroscience
NTERI
Category III

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.
Stankowska's 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 as well as 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.

Tara Tovar-Vidales, Ph.D.
Research Assistant Professor of Department of Pharmacology and Neuroscience
NTERI
Category II

Dr. Tovar-Vidales research goal is to understand the pathology of the trabecular meshwork (TM) and the optic nerve head (ONH) in glaucoma. The TM is the main dynamic resistor that regulates the aqueous humor outflow and causes elevated intraocular pressure in the anterior chamber of the eye. This elevated pressure is transduced towards the back of the eye and results in a remodeling of the ONH. The ONH is the resident of two types of cells, ONH astrocytes and lamina cribrosa cells (LC). ONA and LC cells have been implicated in the pathophysiology of glaucoma. I focus primarily on growth factors and their signaling pathways to determine if they alter mRNA and protein expression of the TM and the ONH cells. I wish to understand the roles of these growth factors in normal tissue and in the glaucoma pathophysiology.

Hongli Wu, Ph.D.
Assistant Professor, Pharmaceutical Science & NTERI
Category III

The central theme of my research is to understand the role of oxidative stress defense agents/enzymes and their functional targets and potential therapies in eye diseases. Of primary interest is 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 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 natural product-derived antioxidants for AMD treatment.

Thomas Yorio, Ph.D.
Professor of Pharmacology & Neuroscience
NTERI
Category III

Dr. Yorio's laboratory focuses on glaucoma. Areas of interest include aqueous humor dynamics, endothelin pharmacology in glaucoma, identifying potential targets for neuroprotection and in the area of glucocorticoid pharmacology and ocular hypertension, specifically on understanding the role of glucocorticoid receptor (GR) beta in dampening the ocular hypertensive response of glucocorticoids.

Gulab Zode, Ph.D.
Assistant Professor of Department of Pharmacology and Neuroscience
NTERI
Category III

My research focus is to understand the pathological molecular mechanisms of glaucoma, a leading cause of irreversible blindness worldwide and to develop therapeutic targets based on the understanding of these mechanisms. Using mouse models of glaucoma, we have recently demonstrated the role of endoplasmic reticulum (ER) stress in ocular hypertension. I am interested in understanding this pathological role of ER stress in glaucoma and developing the targeted therapy to treat glaucoma.

Adjunct Faculty:
Terry Braun, PhD
University of Iowa
Associate Professor

Michelle Butler, MD
Glaucoma Associates of Texas
Assistant Professor

Jennifer Deakins, OD
Community Eye Clinic of Fort Worth
Assistant Professor

Jaime Dickerson, PhD
Smith & Nephew
Associate Professor

Matthew Emanuel, MD
Glaucoma Associates of Texas
Assistant Professor

Ronald Fellman, MD
Glaucoma Associates of Texas
Professor

David Godfrey, MD
Glaucoma Associates of Texas
Associate Professor

Davinger Grover, MD, MPH
Glaucoma Associates of Texas
Assistant Professor

Colleen McDowell, Ph.D.
University of Wisconsin-Madison
Associate Professor

Brett Mueller, D.O., Ph.D.
Texas Vision and Laser Center
McKinney, TX

Michael Simpson, PhD
Optics R & D
Assistant Professor

Oluwatosin Smith, MD
Glaucoma Associates of Texas
Assistant Professor

Jenny Terrell, OD
Community Eye Clinic of Fort Worth
Assistant Professor

Requirements

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

GPA requirements:
For graduate core courses:
All students are required to maintain a GPA of 3.0 (equivalent to "B") or higher in every graduate course. A student who receives a single "C" in BMSC 6201, 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 Visual Sciences Discipline and enroll in PHRM 6401, PHRM 6402, and PHRM 6440. For these courses, the student is not required to retake the course after making a C grade, if an overall GPA of 3.0 is maintained. The student's major professor is expected to work with the students to improve his/her knowledge in related area during the student's graduate study.

If a student's overall core GPA is 3.0 or higher but has earned a "C" in BMSC 6202, the student shall retake the course and will be on probation until a grade of "B" or better is achieved. The student who does not receive a "B" or better in a repeated course will be immediately dropped to the master's program.

I. REQUIRED COURSES

Visual Sciences I (PHRM 6401) – 4 SCH
Visual Sciences II (PHRM 6402) – 4 SCH
Methods in Molecular Biology (PHRM 6440) – 4 SCH

An MS or PhD student who receives a "C" or "F" in one of these required courses (PHRM 6401, PHRM 6402 or PHRM 6440) will be allowed to self-remediate the course and the PhD student will still be allowed to take the oral qualifying exam in the summer of year 1 or the fall of year 2. An MS or PhD student who receives two or more "C's" or "F's" in the discipline-specific required courses must retake those courses in their entirety the following year. If the PhD student receives "A's" and/or "B's" upon retaking the courses, they will be allowed to take the oral qualifying exam.

II. SEMINAR COURSES, JOURNAL CLUB COURSES, AND WIPs

Current Topics in Visual Sciences (PHRM 5220) – 1 SCH
Seminars in Visual Sciences (PHRM 5120) – 1 SCH

All Visual Sciences students are required to register for a journal club course (PHRM 5220) during every long semester beginning in the spring of year 1. 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. All MS and PhD students are required to present their research in Seminar in Visual Sciences (PHRM 5120), also known as "Works in Progress or WIPs," once per year beginning in their second year.

Course Offerings

The following are typical degree plans for students in the M.S. or Ph.D. programs in the Visual Sciences discipline. Also, students are expected to complete the core curriculum required by GSBS.

In both programs, students are required to take the Core Courses (Fundamentals of BMSCs) in the Fall semester, and Advanced Courses (Visual Science courses) in the Spring and Summer semester of their first year of study. By the end of the Fall semester of their first year of study, they should have identified their Major Professor and applied for change of discipline. They should have formed an advisory committee (Major professor, at least two (MS)/three (PhD) additional graduate faculty members, and a University member), and should have filed a degree plan with the graduate school by the end of the Spring semester of their first year of study. In general, M.S. students could complete their programs in 2 years, while Ph.D. students could graduate after four to five years, if they are able to satisfy the requirements on time. **For Ph.D. students, one accepted peer-reviewed 1st author research (not review) manuscript and one submitted 1st author research manuscript are required to obtain their Ph.D. degree.**

MS Degree Plan for Visual Sciences

Year 1: Fall		
BMSC 6201	Fundamentals of BMSC I	2 SCH
BMSC 6202	Fundamentals of BMSC II	2 SCH
BMSC 6203	Fundamentals of BMSC III	2 SCH
BMSC 6204	Fundamentals of BMSC IV	2 SCH
BMSC 5150	Lab rotations	1 SCH
BMSC 5150	Lab rotations	1 SCH
BMSC 6200	Experimental Design and Biostatistics	2 SCH
	Milestones to be completed*: Selection of Major Professor, Change of Discipline*	12 SCH
Year 1: Spring		
BMSC 5160	Biomedical Ethics	1 SCH
BMSC 5315	Principles of Scientific Communications	2 SCH
PHRM 5220	Current Topics in Visual Sciences	1 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
BMSC 5998	Individual Research	3 SCH
PHRM 6401	Visual Sciences I	4 SCH
	Milestones to be completed*: Selection of Advisory Committee, and Degree Plan,*	12 SCH
Year 1: Summer		
PHRM 6440	Methods in Molecular Biology	4 SCH
BMSC 5998	Individual Research	2 SCH
	Milestones*: Research Progress Summary, and Research Proposal*	6 SCH
Year 2: Fall		
PHRM 6402	Visual Sciences II	4 SCH
PHRM 5220	Current Topics in Visual Sciences	1 SCH
BMSC 5395	Thesis	3 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
		9 SCH
Year 2: Spring		
PHRM 5220	Current Topics in Visual Sciences	1 SCH
BMSC 5395	Thesis	5 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
BMSC 5250	Laboratory management	2 SCH
		9 SCH
TOTAL		**48 SCH**

PhD Degree Plan for Visual Sciences

Year 1: Fall		
BMSC 6201	Fundamentals of BMSC I	2 SCH
BMSC 6202	Fundamentals of BMSC II	2 SCH
BMSC 6203	Fundamentals of BMSC III	2 SCH
BMSC 6204	Fundamentals of BMSC IV	2 SCH
BMSC 5150	Lab rotations	1 SCH
BMSC 5150	Lab rotations	1 SCH
BMSC 6200	Experimental Design and Biostatistics	2 SCH
	Milestones: *Selection of Major Professor, Change of Discipline*	**12 SCH**
Year 1: Spring		
BMSC 5160	Biomedical Ethics	1 SCH
BMSC 5315	Principles of Scientific Communications	2 SCH
PHRM 5220	Current Topics in Visual Sciences	1 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
BMSC 6998	Individual Research	3 SCH
PHRM 6401	Visual Sciences I	4 SCH
	Milestones*: Selection of Advisory Committee, Degree Plan*	**12 SCH**
Year 1: Summer		
PHRM 6440	Methods in Molecular Biology	4 SCH
BMSC 6998	Individual Research	2 SCH
	Milestones*: Research Progress Summary (annual committee meeting)*	**6 SCH**
Year 2: Fall		
PHRM 5120	Visual Sciences Seminar	1 SCH
BMSC 6998	Individual Research	6 SCH
PHRM 5220	Current Topics in Visual Sciences	1 SCH
PHRM 6402	Visual Sciences II	4 SCH
	Milestone: Oral Qualifying Exam	**12 SCH**
Year 2: Spring		
BMSC 5165	Introduction to Industry Practice	2 SCH
PHRM 5220	Current Topics in Vision Research	1 SCH
BMSC 6998	Individual Research	8 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
		12 SCH
Year 2: Summer		
BMSC 6100	Scientific Communication Competencies	1 SCH
BMSC 6998	Individual Research	5 SCH
	Milestones*: Research Progress Summary (annual committee meeting), approved Research Proposal, and advancement to PhD candidacy.*	**6 SCH**

Year 3: Fall		
BMSC 6395	Doctoral Dissertation	7 SCH
PHRM 5220	Current Topics in Visual Sciences	1 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
		9 SCH
Year 3: Spring		
PHRM 5220	Current Topics in Visual Sciences	1 SCH
BMSC 6395	Doctoral Dissertation	7 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
		9 SCH
Year 3: Summer		
BMSC 6395	Doctoral Dissertation	**6 SCH**
	Milestones: Research Progress Summary (annual committee meeting)	
Year 4: Fall		
PHRM 5220	Current Topics in Visual Sciences	1 SCH
BMSC 6395	Doctoral Dissertation	7 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
		9 SCH
Year 4: Spring		
PHRM 5220	Current Topics in Visual Sciences	1 SCH
BMSC 6395	Doctoral Dissertation	7 SCH
PHRM 5120	Visual Sciences Seminar	1 SCH
		9 SCH
TOTAL		**102 SCH**

Advancement to Doctoral Candidacy

Qualifying Examination

Students are required to take the oral qualifying examination by the end of the summer semester of the first year or fall semester of their second year of study. The main goal of the examination is to ensure that each doctoral student has a broad knowledge base and has mastered the fundamental principles of biomedical sciences and visual sciences. The oral qualifying examination will be directed mainly towards the didactic coursework of the student but understanding of general research techniques in biomedical research and visual sciences will be included. The student is expected to become knowledgeable in these areas via individual reading of textbooks and scientific literature, coursework, seminar attendance, and/or journal club discussions. During the first month of the semester in which the examination is to be taken, the student will submit a written request and meet with the graduate advisor for Visual Sciences to discuss the format of the examination. The qualifying examination will be administered by an Examination Committee (EC) appointed by the graduate advisor. The student may meet with members of EC prior to the examination to discuss the topics and the examination schedule. The student's major professor may be present during the oral examination and participate in the examination. However, the major professor may not vote on the outcome. A university committee member must be in attendance for the oral examination. A student who fails the exam will be required to retake. Two attempts to pass the qualifying examination will be allowed. Failure to pass the qualifying examination after 2 attempts will result in dismissal from the doctoral program. In this case, a student may be allowed to complete the requirements for a Master of Science degree.

Defense of Research Proposal

Students are expected to successfully defend their research proposal by the end of the Summer semester of their second year of study, but no later than the end of their third year of study. Students are required to develop their research proposal, and the topics will be based on their graduate study. The Advisory committee and mentor should participate in the development of the proposal.

The student is required to (a) prepare an NIH-style R21 research proposal, (b) present the proposal in a public seminar, and (c) orally defend the proposal before the student's doctoral advisory committee. The proposal should be based on an original hypothesis and should describe specific experimental approaches to address the hypothesis. The graduate advisor will appoint a chair from the student's advisory committee to coordinate the process. The student will meet with the committee at least 2 times during the semester to review drafts of the proposal. The final written proposal must be prepared in NIH format and presented to the committee at least one week prior to the public seminar and oral defense. The grant proposal and the student's oral presentation and defense will be evaluated on the basis of originality and ability to synthesize and communicate the proposal content. The student's major professor may be present and may vote on the outcome. The student's university member must be present for the public seminar and oral defense of the proposal. Upon successful defense of the student’s research proposal, the student is advanced to doctoral candidacy. Two attempts will be allowed. Failure in the defense of research proposal will result in dismissal from the doctoral program in Visual Sciences. In this case, a student may be allowed to complete the requirements for a Master of Science degree.

Upon successful defense of their research proposal, the student is advanced to candidacy and must enroll in Doctoral Dissertation (BMSC 6395) in the first long semester immediately following their defense.

Expectations

Graduate students in the Visual Sciences Discipline are expected to meet frequently with their Major Professor to monitor research and academic progress. Students will also meet at least once per year with their thesis/dissertation graduate committee to update the committee on research progress. All students are required to attend the weekly Visual Sciences journal club as well as attend all Visual Sciences Seminars. Students also will be required to attend and present at Department of Pharmacology and Neuroscience Works in Progress Seminars (WIPS).