School of Biomedical Sciences

# Integrative Physiology 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 Integrative Physiology.**

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# Integrative Physiology Discipline

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**Graduate Faculty:** Tune (Chair) J.; Cunningham M.; Cunningham R.; Cunningham T.; Dick G.; Farmer G.; Gregory P.; Hodge L.; Ma R.; Mallet R.; Rickards C.; Romero S.; Schreihofer A.; Smith M.; Yurvati A.

Physiology is an essential foundation for clinical and experimental medicine. The physiologist seeks an understanding of the physical and chemical mechanisms of biological processes. Integrative physiology is the study of the function of living organisms and their various components. It encompasses normal and abnormal function and ranges in scope from an understanding of basic molecular and cellular functions to a cognizance of biological control systems and of the integration of bodily functions among multiple organ systems.

The faculty maintain active and productive research programs. Research interests of the faculty include heart failure, cardiac resuscitation, coronary circulation, hypertension , adaptation to exercise and hypoxia, effects of aging and obesity, neurophysiology, renal physiology, diabetic kidney disease, reproductive physiology and preclamsia. Faculty programs are funded by extramural sources including the National Institutes of Health, the American Heart Association, Department of Defense, and Private Industry.

Students may enter the discipline after completing course work and laboratory rotations as required by the School of Biomedical Sciences. The discipline offers advanced courses designed to integrate the fundamental processes of molecular biology with organ system functions. Students participate in teaching and seminars and receive extensive training in techniques of contemporary physiological research. Doctor of Philosophy (Ph.D.) and Master of Science (M.S.) students perform original, publishable research, and present their research findings at national scientific meetings. One to two years are required to complete the M.S. degree requirements. Four to five years are required to complete the Ph.D. degree requirements.

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

*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.

# Integrative Physiology Graduate Faculty and Their Research

**Johnathan D. Tune, Ph.D.**
Chairman and Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/johnathan-tune*
Research in the Tune laboratory focuses on the regulation of myocardial oxygen delivery, contractile function and metabolism in health and disease. The primary goal centers on elucidating mechanisms of impaired coronary and cardiac function in the setting of obesity and diabetes. More specifically, experiments are designed to delineate putative mechanisms responsible for the regulation of coronary blood flow, identify factors that contribute to the initiation and progression of coronary vascular dysfunction and disease, and protecting the heart from irreversible ischemic damage. Studies routinely include a series of highly integrative experimental approaches which utilize both in vivo and in vitro approaches in large animal models of disease.

**J. Thomas Cunningham, Ph.D.**
Associate Vice President for Research and Regents Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/thomas-cunningham*
Our laboratory studies the role of the central nervous system in the regulation of the cardiovascular system and water and electrolyte balance. We study how the brain participates in the normal maintenance of blood pressure and fluid balance, a process called homeostasis. We also investigate how changes in these CNS processes contribute to water retention associated with heart or liver disease and chronic diseases such as hypertension. Our goal is to achieve a better understanding of how the CNS contributes to health and diseases though its interactions with the cardiovascular system.

**Mark Cunningham, Ph.D.**
Assistant Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/mark-cunningham-jr*
High blood pressure during pregnancy, known as preeclampsia (PE), produces harmful effects that can last well beyond the pregnancy for the mother and her offspring. The Cunningham Laboratory is focused on defining the mechanisms for mitochondrial dysfunction, dysfunction of blood vessels in the brain, cardiovascular disease (CVD), and high blood pressure in women with PE during and after pregnancy, and in their offspring. Mitochondrial dysfunction and several inflammatory molecules, such as IL-17, are known to be upregulated in PE and may contribute to the pathophysiology PE. Thus, the major goal of the Cunningham lab is to determine if improving mitochondrial function and/or blocking circulating factors associated with PE, improves maternal and fetal outcomes during pregnancy and later in life. The clinical implication of this work is to

provide insights for therapies and approaches to improve the lives of both mother and baby during pregnancy and in later life.

**Rebecca Cunningham, Ph.D.**
Associate Dean for Research and Professor, Department of Pharmaceutical Sciences
School of Pharmacy, Institute for Translational Research
SBS Faculty Membership Category: Full Member
Primary Discipline: Pharmaceutical Science and Pharmaceutical Therapy
Secondary Discipline: Integrative Physiology
*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 our research has been focused on androgen signaling mechanisms and defining the effects of androgens on central nervous system function. One of our 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. We use in vitro, in vivo, and clinical approaches to understand 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.

**Gregory Dick, Ph.D.**
Research Associate Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/gregory-dick*
Our research seeks to determine how the potassium channels of coronary artery smooth muscle control blood flow to the heart muscle. Evidence supports the idea that multiple signaling pathways converge on smooth muscle potassium channels to modulate coronary vascular tone. Although many types of potassium channels are expressed in coronary vascular smooth muscle, voltage-dependent channels appear to play a predominant role, as inhibition of these channels reduces coronary blood flow and inhibits vasodilation in response to metabolism and ischemia. We use an integrative approach to study these voltage-dependent potassium channels. This approach includes sensitive measurements of the opening and closing of single potassium channels in isolated smooth muscle cells all the way up to measurement of coronary blood flow in the beating heart.

**George Farmer, Ph.D.**
Research Assistant Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Associate Member
Primary Discipline: Integrative Physiology
*https://www.unthsc.ed/school-of-biomedical-sciences/physiology-and-anatomy/faculty/george-gef-farmer-ph-d*
Our research interests involve the study of the brain renin-angiotensin system and the role it plays in neural plasticity. Currently, our work focuses on understanding the mechanisms that regulate the synthesis and release of angiotensin II within the brain in response to chronic intermittent

hypoxia, an animal model that simulates the hypoxemia associated with sleep apnea. Furthermore, we investigate how dysregulation of angiotensin signaling can contribute to pathogenesis such as the development of hypertension commonly associated with sleep apnea. We have developed the use of sniffer cell line to detect the spontaneous and evoked release of angiotensin II in an in vitro preparation. Additionally, our research group has shown that angiotensin II signaling can influence the excitability of neurons in the median preoptic nucleus, an integrative brain structure that contributes to the sustained hypertension associated with sleep apnea, through the regulation of potassium-chloride co-transporters.

**Paula Gregory, Ph.D.**
Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/paula-gregory*
My research expertise is in the area of hereditary cancer predisposition. I have worked in the area of cancer genetics my entire career. For nearly 30 years I have been involved in training and education programs directed at high school students and teachers, undergraduate and medical student research experiences and junior faculty career development.
At the NHGRI I was the first Director of the Genetics Education Office and oversaw a variety of training programs there, including the Summer Internship Program for the NHGRI Intramural labs. That program received well over 2,000 application/year. After my move to the Ohio State University, I was awarded an R25 from the NCI that funded summer cancer research experiences for medical students. As the PI, I was responsible for recruitment, placement of students and coordination of all programmatic aspects of the program. Another R25 from the NCI supported a high school cancer education program.
I have been Co-Director of the Tulane MSCR program for over ten years and am the Co-Director of the LACaTS Professional Development Core. Based on my expertise, I was named the first Assistant Dean for Medical Student Research. I have been awarded NIH T35 funding from NHLBI, NIDDK and NIAAA to support medical student summer research internships; these students are placed with junior faculty mentors and assist them in their research. Our NCI P20 award created a Cancer Research Education Program for summer internships focused on URM undergraduate and medical students at LSUHSC. With 30 years of experience establishing, coordinating and evaluating research training programs, I am uniquely qualified to work on this mentored research training project. I will be conducting preliminary research on ethical issues in research in order to apply for an R03 ELSI grant.

**Lisa Hodge, Ph.D.**
Assistant Dean for Specialized MS Program, Director of the Masters in Medical Sciences Program, SBS, and Associate Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/lisa-hodge*

My training is in microbiology and immunology, with an emphasis on the lymphatic system and mucosal immunity. In 2005 I began studying the role of osteopathic manual medicine treatments (OMT) on the lymphatic and immune systems. My lab discovered that OMT enhances lymphatic flow, releases immune cells and inflammatory mediators into circulation, and protects against certain diseases in animal models. My research effort going forward is in best practices in higher education and I am also available for consulting and/or collaborating with labs in areas of osteopathic manipulative medicine, lymphatics, and immunity.

**Rong Ma, M.D., Ph.D.**
Graduate Advisor and Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/rong-ma*
We study renal physiology and pathology using both *in vitro* (cell culture) and *in vivo* (animal models) approaches. Our research focuses on $Ca^{2+}$-conductive channels, particularly transient receptor canonical (TRPC) channels and store-operated channels, in glomerular mesangial cells and podocytes of the kidney in health and disease. Our major interests include molecular mechanisms for regulation of TRPC and store-operated channels, physiological relevance of TRPC and store-operated channels in kidney and the association of the channel dysfunction with kidney diseases, such as diabetic nephropathy.

**Robert Mallet, Ph.D.**
Regents Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/robert-mallet*
Kidney transplant is the only cure for end-stage renal disease (ESRD), which afflicts over 750,000 Americans. Unfortunately, the supply of transplantable kidneys is extremely limited, and only 1 in 5 ESRD patients ever receives a new kidney. To meet the need, kidneys increasingly are harvested from deceased victims of trauma or cardiac arrest. Despite perfusion with cold saline solution during transport to the surgery center, these kidneys suffer energy depletion, oxidative stress, inflammation and structural damage that may delay recovery of function or even can cause the transplanted organ to fail. The Mallet lab is focused on developing novel solutions affording more robust preservation of kidneys prior to transplant. Improved preservation may help meet the ever-increasing demand for transplant-grade kidneys.

**Caroline Rickards, Ph.D.**
Associate Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/caroline-rickards*
The general research interests of the Cerebral & Cardiovascular Physiology Laboratory encompass understanding vital organ perfusion in humans under stress. The laboratory is specifically focused on the regulation of brain blood flow and oxygenation during stressors that challenge cerebral perfusion such as traumatic hemorrhage, cardiac arrest, and stroke. A major research focus has

been on the early detection of hemorrhagic injury in trauma patients, characterizing physiological differences between individuals with high versus low tolerance to this stress. In addition to investigating these physiological mechanisms, we also collaborate with academic, industry, and government partners to develop and test sensor technologies that may improve the early detection of tissue hypoperfusion in clinical settings. We also study potential therapies that may improve cardiovascular and cerebrovascular tolerance to hypoperfusion, including resistance breathing, oscillatory perfusion therapy, and occlusive exercise.

**Steven Romero, Ph.D.**
Assistant Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/steven-romero*
Dr. Romero's Human Vascular Physiology Laboratory has two broad research themes. The first research theme centers on investigating how the human vascular system adjusts and adapts to exercise and environmental stress in healthy and diseased populations. The second research theme centers on investigating the vascular and functional maladaptations that accompany various diseases (e.g. hypertension, aging, vascular disease), in addition to identifying novel therapies that may mitigate such detrimental changes.

**Ann Schreihofer, Ph.D.**
Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/ann-schreihofer*
The Schreihofer lab studies how the brain controls blood pressure both under normal conditions and in the presence of disorders that raise blood pressure. Currently, we are studying how obesity and metabolic syndrome contribute to hypertension and instability of blood pressure. Metabolic syndrome changes how the brain controls blood pressure, but the mechanisms are not well understood. Many with obesity find it difficult to control their body weight in the long term. As the prevalence of obesity and metabolic syndrome continues to mount, so does the cardiovascular disease that accompanies them. Many hypertension medications act within the brain to control blood pressure. Our work examines which treatments are ideal for management of cardiovascular disease with obesity by determining how the brain changes with obesity and whether current medications can reverse these changes. In addition, we are examining how obesity and metabolic syndrome may contribute to Alzheimer's related dementia, which occurs at a higher rate in people with disordered regulation of blood pressure and blood glucose.

**Michael Smith, Ph.D.**
Professor, Department of Physiology & Anatomy
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/michael-smith*
Dr. Smith's research career has focused on human-based research that bridges systems-based physiological mechanisms to clinical application relating to cardiovascular diseases including

sleep apnea, heart failure and cardiac dysrhythmias. This work has focused on physiologic assessment of abnormal responses in disease and the application to predict outcomes. During the past 25 years, his focus has been on autonomic dysfunction in sleep apnea and cardiac dysrhythmias. Current projects merge these two areas with a focus on cardiac dysrhythmias and dysrhythmia risk in sleep and sleep apnea. In addition, he has active research on predictors of sleep disorders, associated cardiovascular risks and health disparities in sleep apnea.

**Albert Yurvati, D.O. Ph.D.**
Emeritus Professor, Department of Physiology & Anatomy; Chairman and Professor, Dept. of Medical Education
SBS Faculty Membership Category: Full Member
Primary Discipline: Integrative Physiology
*https://experts.unthsc.edu/en/persons/albert-yurvati*
Dr. Yurvati's research interests include tissue reperfusion injury and hemorrhagic shock. The Yurvati laboratory has received funding to seek ways to lessen injury to the brain during prolonged cardiopulmonary resuscitation (CPR), shock and the effects of cardiopulmonary bypass. Dr. Yurvati also is studying novel methods of preserving kidneys to improve renal function after transplant, and to protect muscle and nerve function in limbs deprived of blood flow by tourniquets. As a board-certified cardiothoracic surgeon, Dr. Yurvati is ideally positioned to translate his research results to improve clinical treatment to protect vital organs threatened by shock or ischemia-reperfusion.

**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 not more than one "C" in BMSC 6201, BMSC 6202 or BMSC 6203, earns an "A" or "B" in BMSC 6204, and maintains an overall GPA of 3.0 or better after the first semester of graduate study will be allowed to enter the Integrative Physiology Discipline and enroll in PHAN 6400. For the MS and PhD programs, the student is required to maintain a minimum GPA of 3.0.
Ph.D. students in Integrative Physiology who are in good academic standing will take the Oral Qualifying Examination in the summer of year 1.

**I. PhD REQUIRED COURSES**
Physiology in Health and Disease (PHAN 6400) – 4 SCH
A grade of "A" or "B" in this course is required. A PhD student who receives a "C" or "F" in this course must retake the course, and must do so before taking the Oral Qualifying Examination.

**II. SEMINAR/JOURNAL CLUB AND SCIENTIFIC COMMUNICATION COURSES**
Journal Club in Physiology (PHAN 5140) – 1 SCH
- Offered in the Fall and Spring
- Minimum of 2 SCH required

Advanced Scientific Communication Skills in Physiology (PHAN 6185) – 1 SCH
- Offered in the Fall

## III. PhD ELECTIVE (ADVANCED AND TECHNIQUE) COURSES

PhD students are required to take at least 6 SCH of advanced courses in addition to PHAN 6400. At least 3 SCH must be earned by taking PHAN advanced course(s), selected from the following list. Students may take advanced courses from PHAN or other SBS disciplines in order to complete the 6 SCH requirement. These advanced courses should be selected in consultation with the student's major professor and advisory committee.

*Offered in fall semesters*:
Cardiovascular Physiology (PHAN 5300) – 3 SCH
Ion Channel Function (PHAN 6505) – 3 SCH

*Offered in spring semesters:*
Physiology & Pathophysiology of the Renal&Respiratory Systems (PHAN 5302) – 3 SCH
Coronary Circulation (PHAN 5303) – 3 SCH

A comprehensive physiology course also is available via the Medical Sciences Distance Learning (i.e., Online) Program:
BMSC 5304DL – 5 SCH

## SAMPLE DEGREE PLANS

**1. 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 M.S. thesis research projects require additional semesters to complete. The typical time-to-degree for M.S. students is two years.

| ***Dept*** | ***Course Number*** | ***Title*** | ***SCH*** | ***Semester to be completed*** |
|---|---|---|---|---|
| BMSC | 5150 | Lab Rotations | 2 | Fall year 1 |
| BMSC | 6200 | 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: Complete Laboratory Rotations, 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 | 0-4 | Spring year 1 |
| PHAN | 5140 | Journal Club in Physiology | 1 | Spring year 1 |
| BMSC | 5109 | Values-Based Considerations in Biomedical Sciences | 1 | Spring year 1 |
| PHAN | | Advanced Course/Electives | 0-6 | Spring year 1 |
| | | ***Subtotal*** | ***12*** | |
| *Milestones to be completed: Designation of Advisory Committee, Degree Plan.* | | | | |
| | | | | |
| BMSC | 5108 | Transferable Skills | 1 | Summer year 1 |
| BMSC | 5395 | Thesis | 0-5 | Summer year 1 |
| BMSC | 5998 | Individual Research | 0-5 | Summer year 1 |
| | | Advanced Courses | 0-3 | Summer year 1 |
| | | ***Subtotal*** | ***6*** | |
| | | ***Total for Degree*** | ***30*** | |
| *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 5395.* | | | | |
| PHAN | 6185 | Advanced Scientific Communication Skills in Physiology | 1 | Fall year 2 |
| BMSC | 5998 | Individual Research | 1-11 | Fall year 2 |
| BMSC | 5395 | Thesis | 1-11 | Fall year 2 |
| | | ***Subtotal*** | ***12*** | |
| | | | | |
| BMSC | 5395 | Thesis | 1-9 | Spring year 2 |
| PHAN | 5140 | Journal Club in Physiology | 1 | Spring year 2 |
| | | Subtotal | ***9*** | |
| | | ***Minimum Total for Degree*** | ***30*** | |

**2. 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 doctoral dissertation research projects require additional semesters to complete. The typical time-to-degree for Ph.D. students is approximately five years.

| ***Dept*** | ***Course Number*** | ***Title*** | ***SCH*** | ***Semester to be Completed*** |
|---|---|---|---|---|
| BMSC | 6150 | Lab Rotations | 2 | Fall year 1 |
| BMSC | 6200 | 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: Complete Laboratory Rotations, 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 |
| PHAN | 5140 | Journal Club in Physiology | 1 | Spring year 1 |
| PHAN | 6400 | Physiology in Health and Disease | 4 | Spring year 1 |
| BMSC | 6998 | Individual Research (**max 20 SCH**) | 3 | Spring year 1 |
| | | ***Subtotal*** | ***12*** | |
| *Milestones to be completed: Designation of Advisory Committee, Degree Plan* | | | | |
| | | | | |
| BMSC | 6998 | Individual Research | 1-5 | Summer year 1 |
| BMSC | 5108 | Transferable Skills | 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 | 6102 | Grant Writing | 1 | Fall year 2 |
| BMSC | 6998 | Individual Research | 0-10 | Fall year 2 |
| PHAN | 6185 | Advanced Scientific Communication Skills in Physiology | 1 | Fall year 2 |
| | | Advanced Course/Electives | 0-9 | Fall year 2 |
| | | ***Subtotal*** | ***12*** | |
| | | | | |
| BMSC | 6998 | Individual Research | 1-11 | Spring year 2 |
| PHAN | 5140 | Journal Club in Physiology | 1 | Spring year 2 |
| | | Advanced Courses | 0-11 | Spring year 2 |
| | | ***Subtotal*** | ***12*** | |
| | | | | |
| BMSC | 6998 | Individual Research | 1-5 | Summer year 2 |
| BMSC | 6101 | Responsible Conduct of Research | 1 | Summer year 2 |
| | | Advanced Courses | 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 student completes qualifying exam and research proposal, SCH can be reduced to 6 SCH per semester.* | | | | |
| | | | | |
| BMSC | 6395 | Doctoral Dissertation (**max 30 SCH**) | 2-6 | Fall year 3 |
| | | Advanced Courses | 0-4 | Fall year 3 |

| | | | | |
|---|---|---|---|---|
| | | ***Subtotal*** | ***6-9*** | |
| | | | | |
| BMSC | 6998 | Individual Research | 2-6 | Spring year 3 |
| BMSC | 6395 | Doctoral Dissertation | 0-6 | Spring year 3 |
| PHAN | 5140 | Journal Club in Physiology | 0-1 | Spring year 3 |
| | | Advanced Courses | 0-4 | Spring year 3 |
| | | ***Subtotal*** | ***6-9*** | |
| | | | | |
| BMSC | 6998 | Individual Research | 0-6 | Summer year 3 |
| BMSC | 6395 | Doctoral Dissertation | 0-6 | Summer year 3 |
| | | Advanced Courses | 0-5 | Summer year 3 |
| | | ***Subtotal*** | ***6*** | |
| | | | | |
| BMSC | 6998 | Individual Research | 0-3 | Fall year 4 |
| BMSC | 6395 | Doctoral Dissertation | 2-6 | Fall year 4 |
| | | ***Subtotal*** | ***6-9*** | |
| | | | | |
| | | ***Minimum Total for Degree*** | ***90*** | |
| *130 SCH is the maximum hours for in-state tuition. In some cases, a different degree plan may be applicable. In all cases, the degree plan must be approved by the student's advisory committee, the graduate advisor and the Dean of the SBS.* | | | | |

## IV. ACADEMIC PROCEDURES

Once a PhD student has advanced to candidacy (completed OQE and research proposal milestones), they can enroll in a minimum of **6** SCH per semester. However, at least two of the six SCH must be in BMSC 6395 (Doctoral Dissertation). This is to maintain full-time status. The PhD candidate must maintain continuous enrollment (at least 2 SCH/semester) in BMSC 6395 until they graduate.

The minimum requirement to graduate for BMSC 6395 (Doctoral Dissertation) is 6 SCH. A maximum of 30 SCH of BMSC 6395 can be applied to the 90 SCH minimum required for the PhD degree.

The minimum requirement to graduate for BMSC 6998 (Individual Research) is 6 SCH. A maximum of 20 SCH of BMSC 6998 can be applied to the 90 SCH minimum required for the PhD degree.

Once a PhD candidate submits the "Declaration of Intent to Graduate" Form, they can enroll in a total of 3 SCH of Doctoral Dissertation in the semester in which they will defend their dissertation (the final semester of enrollment).

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

### Advancement to Candidacy

### 1. Master of Science

Advancement to Master's Candidacy is achieved after successful completion and approval of a research proposal.

The research proposal is a detailed outline of the thesis project. It must include a summary of the proposed project, the hypothesis and aims to be investigated, significance and innovation of the project, research design and methodology to be used, a review of the salient literature that supports or opposes the hypothesis, and potential limitations. To take advantage of the advisory committee's expertise and advice, and to clearly define the project and the committee's expectations, it is imperative that the student meets with their advisory committee before preparing the research proposal. **The research proposal should be provided to the advisory committee no later than 14 days prior to the defense.** A formal public presentation of the research proposal 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 semester 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 "M.S. Candidate" as a title on any general business correspondence such as business cards, e-mail messages, etc.

## 2. 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 major 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 Integrative Physiology 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 field of Integrative Physiology. The graduate advisor will distribute a list of key topics to the student at least three months 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 Integrative Physiology graduate faculty and the student's university member. The committee is established by the Integrative Physiology Graduate Advisor. The composition of the committee will be provided to the student at least 2 weeks prior to the oral qualifying exam. The Graduate Advisor will either chair the committee or select an alternate chair if their student is taking the oral qualifying exam. The student's major professor may attend the qualifying examination but may not ask questions, be present during the voting, or cast a vote. 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 attempt should be completed within twelve weeks of the original examination, unless otherwise specified by the examination committee. If unsuccessful on the second attempt, the student may be allowed to transfer to the M.S. degree program to complete the requirements for the M.S. degree.

The appropriate form may be obtained from the SBS Forms and Guidelines website.

B. Research Proposal

The research proposal is a detailed outline of the dissertation project. It must include a summary of the proposed project, the hypothesis and aims to be investigated, significance and innovation of the project, research design and methodology to be used, a review of the salient literature that supports or opposes the hypothesis, and the project's potential limitations. To take advantage of the advisory committee's expertise and advice, and to clearly define the project and the committee's expectations, it is imperative that the student meets with their advisory committee before preparing the research proposal. **The research proposal should be submitted to the advisory committee no later than 14 days prior to the defense.** A formal public presentation of the research proposal will be followed by a private defense of the research proposal to the student's advisory committee. The research proposal must be approved by the advisory committee and the Dean prior to registering for Dissertation (BMSC 6395). It is expected that Ph.D. students will complete and defend his/her 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 "Ph.D. 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 in the Fall and Spring semesters.