STUDENT HANDBOOK
CELLULAR BIOLOGY AND ANATOMY
BIOMEDICAL SCIENCES Ph.D. PROGRAM

REV: 8/6/2021

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Chapter 1 -
Welcome to the Cellular Biology and Anatomy (CBA) Graduate Program

Departmental Mission

The Department of Cellular Biology and Anatomy has as its core mission the advancement of outstanding research and education. We work collaboratively to discover new knowledge through innovative biomedical research, to transmit that knowledge to students, and to train future researchers, educators and health care professionals.

This mission carries through in the Cellular Biology and Anatomy (CBA) Ph.D. Program, as described in this handbook. We begin with a message from **Dr. Sylvia B. Smith**, Chair of the Department of Cellular Biology and Anatomy.

Welcome to the Department of Cellular Biology and Anatomy!

Our graduate program offers excellent research training opportunities in the dynamic field of cell biology. Faculty members are eager to engage energetic pre- and post-doctoral fellows in research that covers a broad spectrum of cell biological research from development through normal processes, disease/degeneration and death. The developmental biologists within our department investigate polarity and patterning in organisms, while other faculty members study mechanisms of protection, repair and regeneration related to diseases of the kidney, bone, breast, visual system and the central nervous system. A broad array of genetic, molecular, cell biological, and biochemical tools are used in *in vivo* and *in vitro* studies using multiple model systems including rodents, zebrafish, and Drosophila.

The department has strong collaborative ties with many of the research institutes and centers on campus, and offers a rich environment for scientific discovery and dissemination of new knowledge. There are numerous substantive interactions with clinicians offering myriad opportunities for translational research. As with all of the graduate programs in the Biomedical Sciences Ph.D. program, students are graduate research assistants and earn a stipend to support their studies. Our department also offers a robust seminar program, a dynamic and energized graduate journal club covering a broad range of cell biology topics (attended by faculty), as well as graduate courses tailored to the needs of our students.

There are a number of career opportunities that await an individual who has earned a Ph.D. in Biomedical Sciences with a concentration in Cellular Biology and Anatomy. Our graduates are poised to pursue post-doctoral research in universities and research institutes across the US and beyond. Armed with a solid underpinning in the fundamentals of cell biological approaches to organisms, students are attractive also to industry and biotechnology companies. For those interested in pursuing academic careers that combine research and teaching, students not only build upon their research experience, but are afforded opportunities also to participate in teaching within the medical school curriculum (serving as teaching assistants in histology, anatomy, neuroanatomy/neuroscience). Students also have the opportunity to take advantage of educational experiences offered at the nearby AU

undergraduate (Summerville) campus that can include non-science fields such as business or education.

We are delighted that you are exploring the opportunities within our program and look forward to working with you as colleagues!

About this CBA Program Handbook

The material in this handbook has been provided for the benefit of graduate students in the Cellular Biology and Anatomy (CBA) Ph.D. Program. This handbook is designed to simplify what can often be a confusing journey to graduation, and to compile in one place both general information and topics specific to this graduate program. The rules and procedures stated herein are consistent with those in the manual provided to all Biomedical Sciences PhD students by the Graduate School. However, it is important that CBA students understand that this handbook is not designed to replace the Graduate School Ph.D. Guide that gives detailed information essential for meeting requirements of the Graduate School. Please also be aware that policies and forms generated by the Graduate School and the CBA PhD Program may be updated after this handbook edition is published.

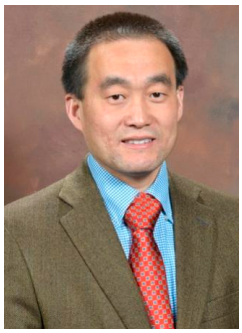
For the most current TGS policies and forms, please visit the following link:
https://www.augusta.edu/gradstudies/biomed/students/index.php

Please also consult with program staff and the CBA Program Director for assistance with questions that undoubtedly will arise and are not covered in this handbook or where your specific situation requires a more detailed response.

We acknowledge the foundational documents provided by the Graduate School and the BCB Graduate Program on which portions of this CBA Program Handbook are based.

Cover Art: The colorful painting by Brian Phillips represents some of the research ongoing in the Department of Cellular Biology and Anatomy.

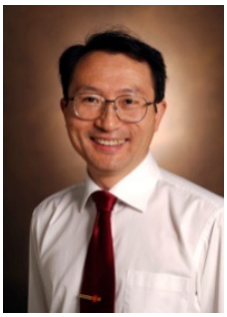
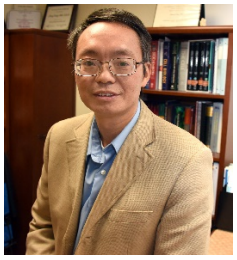
ADMINISTRATION OF CBA GRADUATE PROGRAM

	**Department Chair: Sylvia B. Smith, Ph.D.** CB1101 706.721.3731 sbsmith@augusta.edu Thank you for your interest in the graduate program of the Department of Cellular Biology and Anatomy. Our program offers research training opportunities in the dynamic field of cell biology, which covers the continuum of development, normal processes, disease/degeneration and death. Our faculty work collaboratively and are dedicated to the success of our students. The department has strong collaborative ties with many of the research centers, institutes and clinical departments on campus offering a rich environment for scientific discovery and dissemination of new knowledge. We welcome your participation in our program!
	**Program Director: Yutao Liu, M.D, Ph.D.** CB1123 706.721.2015 yutliu@augusta.edu On behalf of my fellow faculty and graduate mentors, I welcome you to the Graduate Program in Cellular Biology and Anatomy. We are here to help you through the hurdles and exciting training toward earning your Ph.D. and beyond. I look forward to meeting each new student and seeing you mature as a colleague. Please call or e-mail with questions or to set up an appointment to see me, or feel free to drop by my lab.
	**Administrative Manager: Sharon Lever** CB1101 706.721.3731 slever@augusta.edu Welcome to the Department of Cellular Biology and Anatomy Graduate Program. I look forward to meeting and working with each of you. If you need assistance with your stipend, health insurance payments, grant submissions, and any other administrative issues, please feel free to contact me. I will be willing to assist you in any way I can.
	**Office Coordinator: Diane Riffe** CB1101 706.721.3731 driffe@augusta.edu Welcome to the CBA graduate program. The success of our graduate students is important to me and I am always available to help with any questions or concerns. You will work with me on most of your administrative issues and I will be your contact (Academic Administrator) with deadlines or information from the Graduate School and the Registrar's Office.

CBA Graduate Program Council: Drs. Xingjun Fan, Sang-Ho Kwon, Morganne Manuel and Yutao Liu, Program Director.

CBA FACULTY

CBA RESEARCH FACULTY

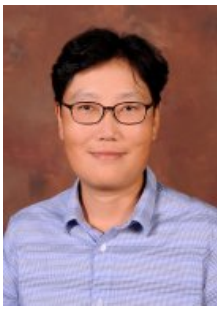
RUTH CALDWELL, Ph.D. Professor Emerita Our lab focuses on vascular biology and the molecular mechanisms that control retinal vascular function and growth during health and disease. We seek to understand the role of the enzyme arginase in altering retinal blood flow and causing neuronal cell death in diseases like diabetic retinopathy and retinopathy of prematurity.	
JIAN-KANG CHEN, Ph.D. Associate Professor Compensatory nephron hypertrophy (CNH)-induced progressive nephron damage, ischemia or nephrotoxin-caused acute kidney injury (AKI), and diabetes-associated kidney disease (DKD) are major problems causing progressive nephron damage, which is the fundamental mechanism underlying the progressive nature of chronic kidney disease (CKD). CKD causes more deaths than breast cancer and prostate cancer combined annually. Our lab is interested in the cellular and molecular mechanisms underlying progressive nephron damage. Our goal is to identify molecular targets to preserve nephrons and prevent progressive CKD.	
ZHENG DONG, Ph.D. Leon H. Charbonnier Endowed Chair and Regents' Professor The overall goal of our research is to delineate the molecular mechanism of cell injury/death, its protection and subsequent regeneration. Our focus has continued to be the response of kidney and cancer cells/tissues to pathological conditions of hypoxia/ischemia, metabolic stress, and DNA damage. Our current work includes the investigation of cell death, cell cycle, DNA damage response, autophagy, and microRNA regulation.	
XINGJUN FAN, Ph.D. Associate Professor The research in my laboratory centers on the lens, an important structure within the eye that focuses light on the retina. We study the role of reactive oxygen species (ROS) in aging and age-related disease, i.e., age-related nuclear cataract (ARNC) and Alzheimer's disease (AD). We also use in vitro and in vivo model systems to study posterior capsule opacification (PCO), a common post cataract surgery complication.	

GRAYDON GONSALVEZ, Ph.D.
Associate Professor
The focus of our research is on understanding the mechanisms by which cells establish polarity. Establishment of cell polarity is essential for normal cell function. We also seek to understand how misregulation of this process results in disease.

MARK HAMRICK, Ph.D.
George G. Weiss Research Professor and Regent's Professor
The primary objective of our research program is to understand how soft tissues, muscle and fat, influence bone metabolism and bone strength. We are particularly interested in defining the molecular mechanisms by which muscle and fat regulate bone formation and bone loss, so that these pathways can be targeted therapeutically in order to prevent and treat bone fractures.

YUQING HUO, M.D., Ph.D.
Professor
The overall goal of our research is to understand mechanisms of inflammatory diseases, including metabolic and cardiovascular diseases at the molecular and cellular levels as well as in vivo animal models. We hope that eventually our studies can lead to the development of therapeutic approaches for above diseases for future clinical use in patients.

SANG-HO KWON, Ph.D.
Assistant Professor
A major question in cell biology is how cells communicate with each other. One mechanism involves exosomes, a type of extracellular vesicles released after fusion of the internal vesicles with the cell surface. Because exosomes mirror the origin and status of the cells, the analysis of the content encapsulated in exosomes from biological fluids can reveal information relevant to human health and disease. Currently, work in our group is aimed at 1) building exosome detection toolboxes that can be applied to various exosome fields; 2) dissecting exosome biogenesis at the molecular levels; and 3) understanding the roles of exosomes in regeneration following organ injury.



ELLEN K. LEMOSY, M.D., Ph.D. Associate Professor Our laboratory studies extracellular matrix proteins and carbohydrates that regulate growth factors having key roles in embryo patterning, craniofacial, nervous system, and renal development. We use cell culture, fruitfly, and zebrafish genetic model systems as needed. This work is relevant to human birth defects and diseases such as inflammation and cancer.	
YUTAO LIU, M.D., Ph.D. Associate Professor Dr. Liu's research interest is to identify and characterize genetic risk factors related to complex human diseases including keratoconus (KC) and primary open-angle glaucoma (POAG). Dr. Liu's lab has identified many genetic factors involved in the pathogenesis of KC and POAG. Dr. Liu is also interested in the role of extracellular vesicles (EVs) and their contents in human disease. We use multi-omics approach including next-generation sequencing and bioinformatics.	
MEGHAN McGEE-LAWRENCE, Ph.D. Associate Professor The overall goal of my research is understanding the epi/genetic biology behind the development, maintenance, and regeneration of skeletal structure and biomechanical strength, focusing on biological, mechanical, and epigenetic control of bone remodeling, as well as integrative pathways involved in crosstalk between the skeleton and other organ systems to regulate development and disease progression.	
PATRICIA SCHOENLEIN, Ph.D. Associate Professor Our overall goal is to improve the treatment of breast cancer by preventing resistance. Autophagy, a process of recycling organelles when cells are stressed, allows cancer cells to survive chemotherapy and radiation. Our laboratory seeks to identify key molecules that could be targeted to prevent pro-survival autophagy.	

SYLVIA B. SMITH, Ph.D.
Regents' Professor and Chair
Our lab focuses on retinal cell biology, specifically understanding normal function of the retina and the consequences when those functions go awry. One major area of interest is folate and homocysteine as related to retinal health and another is retinal neuroprotection in diseases such as retinal degeneration and glaucoma.

MITCHELL WATSKY, Ph.D.
Professor
My research interests have focused on corneal wound healing, ion channel function, cell signaling, and bioengineering of an artificial cornea. I also have a long term interest in bioactive lipids. Stemming from my corneal wound healing work, research projects in the lab have broadened to include translational projects aimed at understanding initiation of fibrotic diseases throughout the body, including scleroderma (SSc) and pulmonary fibrosis, as well as research involving osteoporosis and markers of bone metabolism. Most recently we have embarked on an exciting project examining vitamin D metabolism and function in the eye.

QINGQING WEI, Ph.D.
Assistant Professor
The primary objective of our research program is to understand Acute kidney injury (AKI). Acute kidney injury (AKI) is a major kidney disease with high mortality clinically, which can be induced by injurious factors such as ischemia, nephrotoxins, and sepsis. In addition, patients are at higher risk to develop chronic kidney diseases (CKD, characterized by maladaptive tubular repair and massive renal fibrosis development) even after they are recovered from an AKI episode. Our research interests are the pathophysiological mechanisms, specifically the epigenetic regulation, of AKI and CKD. Currently we mainly focus on the role of a long non-coding RNA GSTM3P1 (an RNA transcript from pseudogene). We will use both in vitro and in vivo mouse model to understand its pro-renal injury role in ischemic AKI, its interaction with microRNAs, and its regulation to the parent gene GSTM3. In addition, we will also explore the role of long non-coding RNAs and microRNAs in other AKI models and how they regulate the renal repair and fibrosis in CKD models.

MING ZHANG, M.D., Ph.D.
Associate Professor
The primary objective of our research program is to understand the pathogenesis of cytomegalovirus and herpes simplex virus ocular infections by using mouse models and organatypic retinal culture models. We are particularly interested in the roles of autophagy and inflammasomes in the innate immune response against ocular HSV-1infections and the mechanism of cell death of uninfected retinal cells during MCMV retinitis.

FULL TIME CBA FACULTY WITH PRIMARY DUTIES IN MEDICAL EDUCATION

ANNA EDMONDSON, Ph.D.
Professor and Director of Curriculum Operations for MCG
Teaching responsibilities include:

- Primary Anatomy Teaching Faculty in Medicine.
- Component Director of Medical Human Gross Anatomy.
- Component Director of Medical Human Development (Embryology) for pre-clerkship medical students.
- Director of the Musculoskeletal-Skin Module for pre-clerkship medical students.
- Course Director for Medical Education Elective for fourth year medical students.

My educational research interests are related to developing and determining the effectiveness of innovative instructional designs, learning tools, curricular initiatives, and assessments that have been designed to promote self-directed learning, critical thinking, and other competencies in the medical education curriculum.

GERARD GUILLOT, Ph.D.
Associate Professor
Teaching responsibilities include:

- Primary Anatomy teaching faculty in Medicine.
- Course Director for Integrated Science Elective.

My academic interests include cohorting methodologies when researching medical school faculty, student learning, and dermatological reconstructive surgical techniques.

MORGANNE L. MANUEL, Ph.D.
Assistant Professor

Teaching responsibilities include:

- Primary Anatomy teaching faculty in Medicine
- Assistant Module Director for Cardiopulmonary Hematology, Gastrointestinal, Genitourinary, Endocrinology and Brain and Behavior Modules.
- Case-Base Learning facilitator.
- Histology teaching faculty in Medicine.
- Neuroanatomy teaching faculty in Medicine.

My research interest is related to the relationship between cognitive dysfunction and neuroanatomy. Using imaging software, we can better understand what areas of the brain are involved in cognitive dysfunction in neurodegenerative disorders such as Multiple Sclerosis, Parkinson's Disease, and Dementia.

CAROL NICHOLS, Ph.D.
Professor and Assistant Dean for Curriculum: Foundations of Medicine

- Oversight of the pre-clerkship curriculum, in partnership with the Associate Dean for Curriculum and other Assistant Curriculum Deans, including management of day-to-day functions and operations.

Teaching responsibilities include:

- Medical gross anatomy classroom and laboratory teaching integrated into the MCG pre-clerkship curriculum
- Director of the Orientation to Medicine Course
- Assistant Director for the Healthcare Matters Course and Healthcare Across the Lifespan Course

As an Assistant Dean for Curriculum and trained Gross Anatomist, my research interests are related to medical education. Specifically, I am interested in innovative curricular and course development, instructional design, competency-based assessments and determining the effectiveness of educational strategies.

Graduate Faculty with Secondary Appointments in the Department of Cellular Biology and Anatomy

William "Bill" Andrews, MA, CMI, FAMI
Manuela Bartoli, Ph.D.
Wendy Bollag, Ph.D.
Kathryn Bollinger, M.D., Ph.D.
Richard Cameron, Ph.D.
Sadanand Fulzele, Ph.D.
Carlos Isales, M.D.
Linda James, M.S.
David J. Kozlowski, Ph.D.
David Munn, Ph.D.
Priya Narayanan Namboothiri, Ph.D.
Alexis Stranahan, Ph.D.

CURRENT GRADUATE STUDENTS

Theresa Akoto	Mentor: Yutao Liu, M.D., Ph.D.
Frederick Baker	Mentor: Graydon Gonsalvez, Ph.D.
Shannon Barwick	Mentor: Sylvia B. Smith, Ph.D.
Husam Bensreti	Mentor: Meghan McGee-Lawrence, Ph.D.
Jennifer Dorn	Mentor: Meghan McGee-Lawrence, Ph.D.
Karah Greene	Mentor: Yutao Liu, M.D., Ph.D.
Emily Parker	Mentor: Mark Hamrick, Ph.D.
Anik Tuladhar	Mentor: Meghan McGee-Lawrence, Ph.D.
Hannah Youngblood	Mentor: Yutao Liu, M.D., Ph.D.

WE ARE PROUD OF OUR RECENT GRADUATES:

Mackenzie Hagan, PhD. ~ May 2021; Dr. Meghan McGee-Lawrence

Chandler Goldman, PhD. ~ August 2020; Dr. Graydon Gonsalvez
Postdoctoral Fellow – University of Georgia, Athens

Devi Prasad Boggupalli, PhD. ~ May 2020; Dr. Graydon Gonsalvez
Postdoctoral Fellow – University of Florida

Helen Kaiser, PhD. ~ May 2020; Dr. Mark Hamrick
Clinical Anatomy Instructor – University of South Carolina School of Medicine, Greenville, SC

Ting Liu, PhD. ~ May 2020; Dr. Jian-Kang Chen
Postdoctoral Fellow – University of Tennessee, Knoxville, BCMB

Jingwen Cai, PhD. ~ December 2019; Dr. Yutao Liu
Postdoctoral Fellow – Augusta University

Jessica Pierce, PhD. ~ December 2019; Dr. Meghan McGee-Lawrence
Postdoctoral Fellow – Emory University

Mariam Khaled, PhD. ~ May 2019; Dr. Yutao Liu
Faculty – Cairo University, Cairo, Egypt

Soumya Navneet, PhD. ~ May 2019; Dr. Sylvia Smith
Postdoctoral Fellow – Medical University of South Carolina

Khaled El Masry, PhD. ~ May 2018; Dr. Mohamed Al-Shabrawey
Postdoctoral Fellow – Schepens Eye Institute, Harvard University

Lawrence Hicks, PhD. ~ May 2018; Dr. Graydon Gonsalvez
Instructor – Augusta University

Chunyuan Guo, PhD. ~ August 2017; Dr. Zheng Dong
Associate Professor – Shanghai Skin Disease Hospital, Tonji University School of Medicine

Kate Buckley, PhD. ~ October 2015; Dr. William Hill
Technical Professional – Oak Ridge National Laboratory

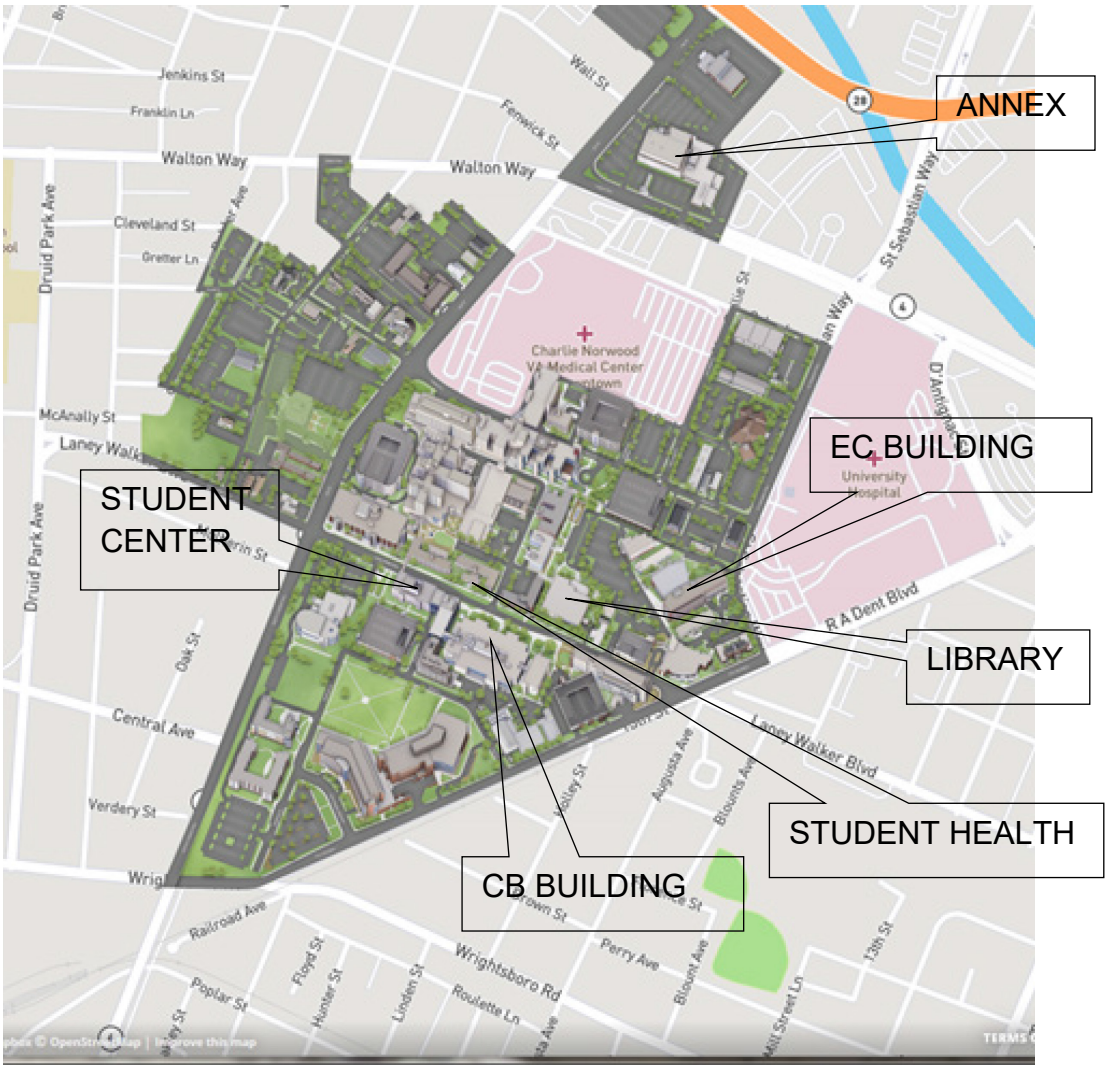
Paulomi Sanghavi, PhD. ~ August 2015; Dr. Graydon Gonsalvez
Early Career Fellow – Tata Institute of Fundamental Research, India

Shanu Markand, PhD. ~ May 2015; Dr. Sylvia Smith
Assistant Professor – Kirksville College of Osteopathic Medicine

R. Nicole Howie, PhD. ~ April 2015; Dr. Mohammed Elsalanty
Research Manager - Medtronic

LOCATIONS AND MAPS

HEALTH SCIENCES CAMPUS:



Chapter 2: General Expectations and Your Advisory Committee

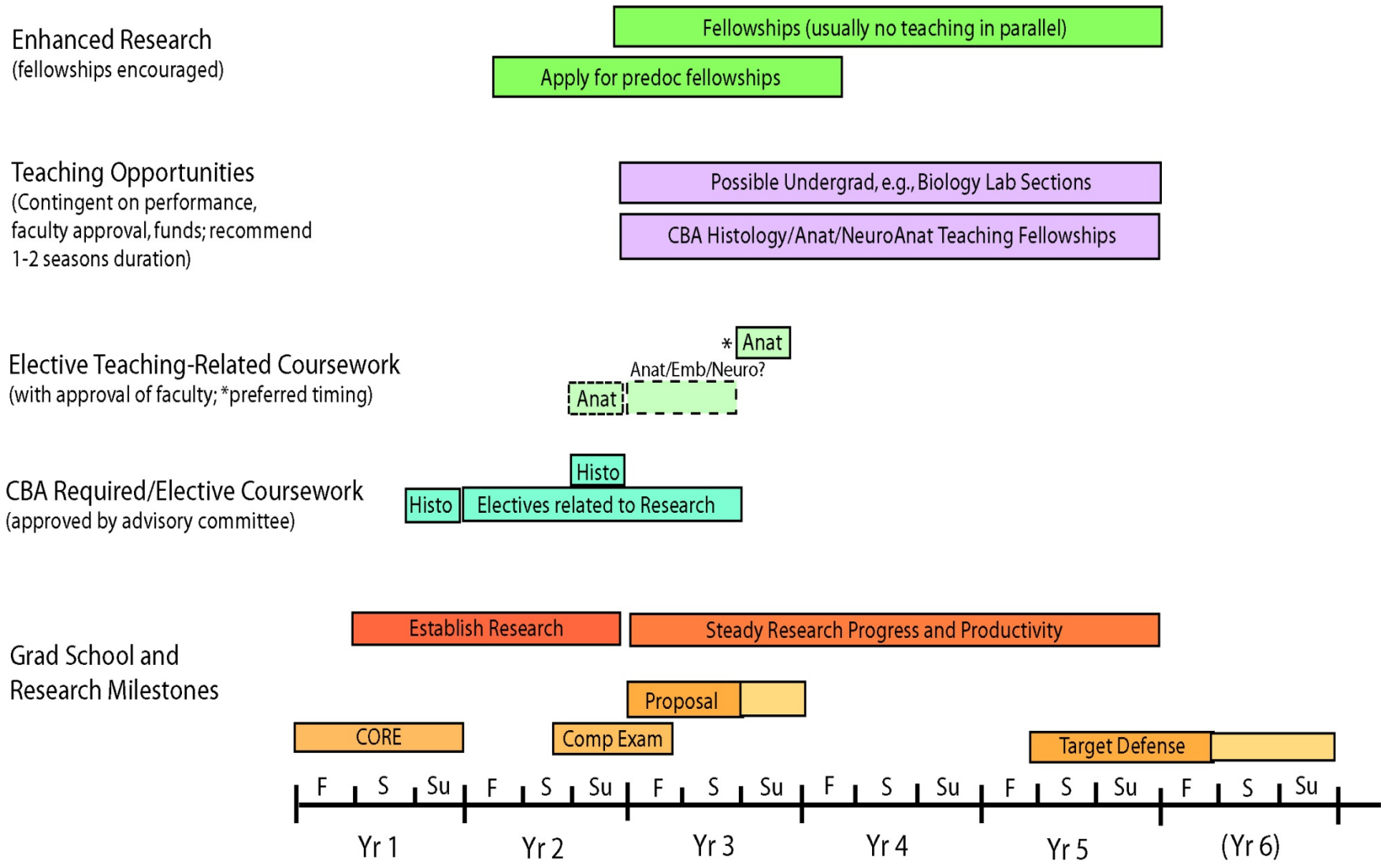
Overview and Timeline

The Cellular Biology and Anatomy Ph.D. Program aims to provide outstanding training for students seeking independent science leadership careers in academic, technology, and public service sectors. As such, the students do not advance in lock-step through a highly prescribed program. Instead, they will develop details of their training in conjunction with their major advisor, advisory committee, and program director. This handbook chapter outlines the major elements of the training experience and discusses the timeline for their integration. The timeline begins with the first year of graduate school.

Year 1. The student completes the core Biomedical Sciences Ph.D. curriculum, selects a research lab and major advisor via the rotation system, and begins to gain familiarity with research methods and the problems studied in their new laboratory and in the Department of Cellular Biology and Anatomy. The CBA program does not require completion of a specific Selective course in the Spring semester. Students may select a course of interest and are encouraged to seek advice of faculty with whom they are rotating or program directors.

Year 2. The student's main objective during the second year should be to establish their research, and thus start on a strong path to success despite the many hurdles, distractions, and additional training goals that are part of graduate training. The student will delve deeply into the primary literature and gain direct expertise in the array of techniques used in their laboratory. With the major advisor, the student will assemble an advisory committee, which will oversee research progress and preside over major milestones of the student's Ph.D. training, including Comprehensive Exam, Research Proposal, and Dissertation Defense. The advisory committee must meet by the end of the Spring semester of Year 2 (fifth semester of graduate school). CBA students are encouraged to present a departmental research seminar in their second year, and are required to present a journal club session. Though it may seem intimidating to begin presentations to the entire department so soon after beginning as a researcher, it is excellent preparation for the Comprehensive Exam as well as an opportunity for deep discussion with your research mentors. The Comprehensive Exam is taken between the fifth and seventh semesters of enrollment in graduate school, i.e., Spring of Year 2 through Fall of Year 3, and must be completed by Thanksgiving break of Year 3. The student should also complete the required Histology course (ANAT 8050) in the summer after Year 1 or after Year 2 as determined with major advisor as being least disruptive of research progress and preparation for the Comprehensive Exam. Students typically take 1-2 additional elective courses relevant to their research in Year 2, or in Year 3 if not offered in Year 2. Only one elective (with minimum 3 credit hours) is required by the CBA Program, but the student and their advisory committee may decide on additional coursework as a valuable addition to their training.

Timeline For Students In CBA Graduate Program



Year 3. If the Comprehensive Exam is not completed by the end of Year 2, the student must take it in Fall semester of their third year (7th semester of graduate school). Furthermore, the student must successfully submit to the Graduate School a formal Research Proposal approved by their advisory committee by the end of the 9th semester of enrollment (Summer at the end of Year 3). CBA students typically complete the Research Proposal by the end of the 8th semester of enrollment (Spring of Year 3), or within 2 semesters of passing the Comprehensive Exam. If elective CBA coursework requirement is also completed to the satisfaction of the advisory committee, the student may be admitted to Ph.D. Candidacy during Year 3. The student continues a principal focus on their experimental research, is required to present and participate in departmental Seminar course (ANAT 9010/ANAT 9020) and Journal Club (ANAT 8090), and is expected to present a poster at Graduate Research Day.

CBA Program students who have completed the Comprehensive Exam, and are performing well in coursework and research progress, are competitive for medical school teaching opportunities in Histology, Gross Anatomy, and Neuro-anatomy offered by the Department of Cellular Biology and Anatomy. Exceptional students may be considered for these positions prior to completion of the Comprehensive Exam if slots are available and if they have completed the relevant coursework. Completion of the Comprehensive Exam is required for eligibility to apply for TA positions in undergraduate Biology course lab sections coordinated by the Graduate School. Application for pre-doctoral fellowships, e.g., NIH, NSF, AHA, is encouraged, typically in Years 2 and 3, but timing and content should be discussed with major advisor and program director so as to avoid conflict with the Graduate School's criteria for student's independence in the written portion of the Comprehensive Exam. Further criteria for these enrichment opportunities are outlined in Chapter 5 of this handbook. If the student is interested in pursuing dual degree programs including PhD and MBA, they will be able to apply for admission into the MBA program upon the mentor's permission and the successful admission to Ph.D. Candidacy.

Year 4. The student should be making good progress in carrying out research, publishing, and presenting work in AU, regional, national, and/or international settings. The student should be on track to be able to meet the program's Publication Requirement prior to dissertation defense (see Chapter 4). At this point in training, all didactic coursework and Graduate School milestones, other than the dissertation defense, have generally been completed and the student can concentrate fully on research and, as appropriate to their career goals, training in teaching. Achieving the best balance of research productivity and other training goals can be challenging; however, CBA students are encouraged to undertake 1-2 seasons of teaching fellowship(s) as this will increase career options and competitiveness for future employment. The student continues to present and participate in departmental Seminar and Journal Club, and is expected to present a poster at Graduate Research Day.

Year 5. Students in their fifth year of graduate training are generally completing their research and writing their dissertation, which, on average, is defended at the end of Year 5. Teaching activities should be secondary if there is any question of the excellence of progress on research. Planning for life after graduation, e.g., postdoctoral fellow position or other employment is a priority, as is completing publications and presenting work at scientific conferences. The student continues to present and participate in departmental Seminar and Journal Club, and is expected to present a poster at Graduate Research Day. Often the student may substitute the

dissertation defense seminar for their departmental seminar in Year 5 if it is certain the defense will occur before the end of Spring semester.

Major Advisor

The major advisor chosen by the student must be a member of the Graduate Faculty and have either a primary or secondary appointment in the Department of Cellular Biology and Anatomy. The Department Chair and the Program Director must approve the selection of major advisor. The major advisor is responsible for guidance of the student's research project, technical direction in the laboratory and financial support of the project. The major advisor also should be a role model and guide for learning scientific approaches to problems; for ethical, safe, and well-documented laboratory practices; and for the collaborative environment in which scientists work. The major advisor is responsible for guiding the student in the writing of manuscripts and the dissertation, in preparing presentations and the thesis defense. They should be instrumental in helping the student choose and interact with their advisory committee.

It is the student's responsibility, not the major advisor's, to maintain good standing in the Graduate School through satisfactory completion of all coursework, exams, and research requirements, arranging their required advisory committee meetings, and ensuring submission of appropriate paperwork in a timely manner. The student may consult with the CBA Program academic administrator and Program Director in completing these administrative requirements.

PhD Thesis Advisory Committee

After beginning research work in the laboratory, the student, in consultation with the major advisor, will assemble their advisory committee. Four additional faculty members are chosen, three of whom must hold appointments on the faculty of the Graduate School. At least three members of the advisory committee, including the major advisor, must hold appointments in the Department of Cellular Biology and Anatomy. If the major advisor holds a secondary appointment in CBA, at least one of the other advisory committee members must be a primary CBA faculty member. It is anticipated that the major advisor will play a key role in recommending faculty members to serve as advisory committee members because of their familiarity with the expertise of other faculty, but the student will also contribute to the process. Typically, the student will approach prospective advisory committee members about their willingness to serve, and should be prepared to discuss how the proposed committee composition will contribute to the student's success in the CBA Program. Once all faculty have agreed to serve on the advisory committee, the student must complete the Advisory Committee Form, obtaining members' and department chair's signatures, and submit the completed form to The Graduate School.

The advisory committee is responsible for administering the Comprehensive Exam and Dissertation Defense, meeting at least annually or more frequently as required for appropriate progress of the student, and providing feedback and approval for research milestones such as the Research Proposal. The student should feel comfortable approaching advisory committee members for technical or professional guidance throughout their tenure in the graduate program. One or more of the advisory committee members may become research

collaborators and/or trusted mentors, and the student may need to call on them in the future for writing letters of recommendation for fellowship or postdoctoral job applications. Thus, the student and major advisor should choose these key resource faculty carefully and interact with them professionally and productively throughout the student's tenure in the program.

Committee Meetings

The Graduate School mandates that at least one advisory committee meeting must occur within each 12-month period. Typically, the CBA Program recommends that students have their first committee meeting in late Fall or in the Spring of their second year of graduate school (first year in the lab; fourth or fifth semesters of graduate school), and then annually thereafter. This timing facilitates organization of the Comprehensive Exam, which is generally taken between April and November after about a year of work in the laboratory (fifth to seventh semesters of graduate school). Students and advisory committees also often find it convenient to combine attendance at the student's mandatory CBA seminar, presented annually from second year of graduate school, with a committee discussion afterwards. The student schedules the committee meetings, usually coordinating schedules by e-mail, and arranges reservation of a conference room with the CBA Program academic administrator.

It is important that the advisory committee be kept informed of major findings and setbacks associated with the student's research, to ensure agreement on the direction and progress of the student's project. Productive, focused annual committee meetings can ensure that there are no surprises or disagreements toward the end of the student's tenure regarding whether enough work, and the "right" work, has been accomplished to warrant awarding the Ph.D. Prior to each meeting, the student should discuss goals for, and structure of, the meeting with their major advisor. The student is also advised to prepare and practice presenting an oral presentation of their progress (~30 minutes, if not associated with annual seminar attended by the committee members). The major advisor chairs and mediates each meeting, but the student should take the lead role in presenting the agenda and project goals, and for fielding questions from the advisory committee. These meetings should be viewed as a positive opportunity to gain the focused attention and feedback of faculty who have committed to aid the student's research and career development. In this relatively informal and non-public setting, the student can gain experience in "thinking on their feet" in response to the broad range of questions and thoughtful critiques presented by expert colleagues, and may want to practice "chalk talk" skills as well, presenting some of their plans without benefit of slides. If paperwork is to be signed at the committee meeting, the student is responsible for bringing forms (e.g., approval forms for coursework or research proposals). A summary of the meeting and advisory committee feedback is prepared and signed as described in the next section on Progress Reports, and submitted within 2 weeks of the committee meeting.

Progress Reports

Progress is documented in each semester of enrollment via submission of reports that are part of the Investigation of a Problem and Research courses (ANAT9210 and ANAT9300). Essential elements of these reports include: (a) outline or narrative description of major experimental

accomplishments in the current semester, and plans for the next semester, relating them to context of the overall project goals, and (b) if significant variance from normal progress occurs, e.g., due to illness or heavy non-research commitments, this should be noted and a plan briefly outlined to establish how such delays will be compensated for. Attach additional sheets if necessary to convey an accurate report. The student writes the Progress Report, and their major advisor approves the content and writing. In semesters where no advisory committee meeting is held, the second page (of three) of the Report of Research Progress and Advisory Committee Meetings Form should be used, and signed by student and major advisor. In semesters where an advisory committee meeting is held, pages two and three of the Report of Research Progress and Advisory Committee Meetings Form should be used, and the completed form is to be signed by student, major advisor, and advisory committee members. In semesters where a committee meeting is held, the student also provides to the CBA office a print-out of slides used in their oral presentation to the committee (e.g., department seminar if the meeting was combined), and reviews with CBA Program Director their Degree Works (JagTrax) report of coursework and research milestones.

The Progress Report provides an opportunity for the student to assess overall progress and short-term goals and accomplishments. It affords review with the major advisor and advisory committee at regular intervals about how the project is proceeding, what is working and what is not working. Thoughtful completion of these reports will facilitate communication within the student-major advisor-committee unit, actual progress toward timely and highly accomplished completion of training, and preparation for seminars, conference presentations, and manuscripts.

Mentoring

The interaction of the student with their major advisor is the single most important relationship contributing to the student's success in the Ph.D. program. Clear communication of expectations and respectful dialogue about critiques are key components of successful student-mentor collaboration. Many guides and resources are available that discuss how to select a laboratory and major advisor, and how to navigate through graduate school with this key mentor. Here, we offer some suggested topics that the student may wish to address early with their major advisor, and review as appropriate over the course of the project.

- Time expectations: how many hours per week are expected, and do these need to be specific times of day or can they be flexible? How long does a PhD project in this laboratory generally take, what outcomes are achieved, and what is required from the student in order to achieve the agreed-upon expectations?

- Meetings: How often will you meet one-on-one to discuss the project, e.g., daily, weekly, monthly? What level of communication is expected by each party, and what issues require direct meetings instead of e-mails? How much project planning will be done in conjunction with senior lab personnel such as a Research Associate or Postdoc, instead of the major advisor? How often will there be lab group meetings? Discuss expectations of each party. For example, most faculty expect the student to prepare an agenda for the meeting, present their data, its analysis and questions that need to be

discussed, and have all data and notebooks available. The mentor monitors and gives feedback on the quality of the experimental design and data.

- Project: How does this project fit into the overall research of the laboratory? If it is collaborative, how will the dissertation research be delineated as independent? What are general funding streams for this project, and what are expectations for the student in generating data for new funding? How risky versus sure-thing is the project, and does it offer appropriate opportunities for the student to develop approaches to thinking and doing research that are suitable for an advanced degree?

- Editing/Critique of Manuscripts or Proposals: How rough a draft is acceptable? Does the mentor want to see a complete draft rather than sections? Should the student expect to see many corrections, or few, so not surprised? Should the student continue to work on the document while it is being reviewed? What is a typical timeline and effective scheme for collaboratively writing a manuscript or for critiquing a fellowship proposal? How to distinguish between "secretarial"-level acceptance of corrections and Ph.D.-level dialogue over ideas?

- Other Training Opportunities and Student Life: What amount of teaching is expected, or allowed, by this mentor? When will a teaching opportunity fit into my training, and how important is it to funding the student's stipend? What opportunities make the most sense with regard to student's future career goals? How much involvement in activities outside the laboratory is acceptable? Will the student be encouraged to write proposals for independent fellowship funding? If so, when?

Many other questions will arise over the course of Ph.D. training, such as credit by authorship for work and ideas; ethical and safety questions in the laboratory; and opportunities to present work. The student should seek advice of their major advisor, as well as that of advisory committee members. One mentor is not likely to be sufficient for all of the student's professional and personal guidance.

Here are a few thoughtful resources on how students can get the mentoring they want, and need:

https://cft.vanderbilt.edu/guides-sub-pages/mentoring-graduate-students/
https://grad.uw.edu/for-students-and-post-docs/core-programs/mentoring/
https://rackham.umich.edu/downloads/how-to-mentor-graduate-students.pdf
https://www.nature.com/nature/articles?type=career-feature

Chapter 3: Coursework

Course Requirements

The first year Biomedical Sciences Ph.D. Program core curriculum provides a fundamental knowledge base relevant to cell and tissue function, and to underlying molecular mechanisms and methods, e.g., in biochemistry and physiology. The CBA Program coursework then promotes a comprehensive understanding of discipline-specific knowledge and research skills. The required Graduate Histology course (ANAT 8050) provides a solid grounding in tissue structure and the analysis of cells and tissues by histochemical and electron microscopy

techniques. Additional elective courses led by expert Cellular Biology & Anatomy faculty combine didactic and discussion-based primary literature approaches to understanding state-of-the-art research in vision science and developmental biology, as well as in special topics such as cell imaging techniques. Our students may further select elective course(s) from offerings of other departments, e.g., BCMB 8201 (Current topics and techniques in molecular biology), VBI 8140 (Cell signaling in vascular biology), and BIOM 8130 (Scientific grant writing), as appropriate for their chosen research area and interests, and as approved by their advisory committee. At least 3 hours of elective coursework must be taken in addition to the required Histology course to fulfill CBA Program requirements. Research effort in the laboratory is assessed via the required Investigation of a Problem course (ANAT 9210) taken each semester prior to admission to Ph.D. candidacy, and via the required Research course (ANAT 9300) taken each semester following admission to Ph.D. candidacy.

Opportunities to present work to peers and faculty are provided in the required Seminar in Cell Biology course (ANAT 9010), taken in Fall and Spring semesters each year. In addition to seminars presented by the CBA graduate students, this course includes presentations by department faculty, postdoctoral fellows, and guest faculty speakers from within other GRU departments and from other universities and industry. The CBA graduate students have been able to invite and host outside speakers in this series. In addition, the Dr. G. Lombard Kelly Lecture was established in the CBA to honor the late Dr. George Lombard Kelly, a 1924 graduate of the Medical College, in 2017. The Dr. G. Lombard Kelly Lecture is led and organized by graduate students in CBA. They select, invite, and host the speaker by overseeing all aspects of the visit including arranging meetings with students and faculty members. The Dr. G. Lombard Kelly lecturers include 2006 Nobel Laureate Dr. Andrew Fire from Stanford University, 2011 Nobel Laureate Dr. Bruce Alan Beutler from UT Southwestern Medical Center, and leading aging scientist Dr. Christiaan Leeuwenburgh from the University of Florida. This has becoming a great platform for leadership and organizing skills with CBA graduate students.

Additionally, Ph.D. students and faculty in CBA are expected to fully participate in a bi-monthly Journal Club designed for the benefit of all department researchers. Each Ph.D. student will be assigned a topic chosen by a faculty member as a “key area” for understanding in Cellular Biology, will work with that faculty member one-on-one to become familiar with the literature, and the student will present background and a key paper at one departmental Journal Club each year. In addition to providing an opportunity to present, all participants will benefit from greater understanding of discipline-specific knowledge, which is helpful to the Ph.D. students in preparing for their Comprehensive Exam and dissertation defense.

Completion of the summer Graduate Histology course qualifies CBA Ph.D. students to apply for a teaching opportunity in the Medical Histology course offered to first-year medical students across the Fall and Spring semesters. Similarly, CBA students who wish to be considered for teaching opportunities in Medical Gross Anatomy or in Medical Neuroscience must first complete with high performance the Human Gross Anatomy (ANAT 7300) Summer course or the Neuroscience (ANAT 7030) Spring course, respectively, or alternatives acceptable to the faculty director of the course in which they would like to teach. These teaching opportunities are normally only available to CBA Ph.D. Program students, and can significantly enhance our

students' competitiveness for postdoctoral and faculty positions in medical schools or in other undergraduate or health sciences departments where expertise in these content areas is sought.

Students are referred to the Graduate School's Ph.D. Guide and website for detailed discussion of scholastic regulations and procedures. A cumulative GPA of at least 2.8 must be maintained for all courses attempted, and a minimum grade of C (or satisfactory in courses graded S or U) must be earned in each course. Failure to complete Comprehensive Exam and/or Research Proposal requirements by deadlines will result in a U grade being assigned for the Investigation of a Problem course; major advisors may also assign a U grade in Investigation of a Problem or Research courses if progress in the laboratory is not satisfactory. A U grade in these courses or failure to maintain an overall GPA of 2.8 will result in placement on academic probation with terms for remediation specified by the Dean of the Graduate School. Failure to meet academic expectations can result in recommendation for academic dismissal and/or termination from GRA appointment.

Coursework Proposal

A plan for the student's coursework should be discussed with the advisory committee in Year 2, and be approved at latest by the end of Year 3. This coursework proposal should include the courses the student must satisfactorily complete for Graduate School and CBA Program requirements, and include required electives and any additional coursework that the student and advisory committee determine is appropriate for facilitating the student's research project and any training in teaching. The advisory committee should be fully apprised of the student's plans at the time of approving the Coursework Proposal form, which must be further signed by department chair and Dean of the Graduate School. Historically, the student must demonstrate through their coursework a proficiency in two appropriate tools of research, where graduate courses demonstrating research communications and statistics literacy are recommended. The Graduate Histology and Seminar courses typically contribute to the Research Tools requirement, as would courses directly in imaging or molecular techniques, or those involving extensive analysis and presentation of primary literature. The student will not be admitted to Ph.D. candidacy without satisfactory completion of research tools requirements and the coursework approval form, as well as comprehensive exam and research proposal requirements.

COURSE DESCRIPTIONS

Mandatory CBA Program Courses

ANAT 8050 GRADUATE HISTOLOGY (Option 1)

This course provides the student a detailed study of the microscopic anatomy and development of all human organ systems plus the cellular biology of various tissues and organs. In addition, early human development and systemic development will be considered in detail. Cellular Biology, as it relates to anatomic structure, will be presented.

This course is offered in the Summer Semester for 5 credit hours.

ANAT 8051/ANAT8052 GRADUATE HISTOLOGY (Option 2)

This course provides the student a detailed study of the microscopic anatomy and development of all human organ systems plus the cellular biology of various tissues and organs. In addition, early human development and systemic development will be considered in detail. Cellular Biology, as it relates to anatomic structure, will be presented.

ANAT8051 (Fall) and ANAT8052 (Spring) must be taken consecutively to meet the graduate histology graduation requirement for 5 credit hours.

ANAT 8090 CELL BIOLOGY JOURNAL CLUB

This course provides students the opportunity to explore recent high- impact publications utilizing state-of-the-art techniques in cellular and molecular biology. The thematic focus may vary by semester, for example the focus may be on novel techniques one semester whereas in another students may simply select papers that are of broad interest. Students present the paper to the other graduate students and faculty and are evaluated using a standard rubric.

This course is offered in Fall and Spring Semesters for 1 credit hour.

ANAT 9010/ANAT9020 SEMINAR IN CELL BIOLOGY

This course provides our students a forum for MCG faculty, visiting faculty, and graduate students to present their research. Students in the third year and beyond present a full research seminar at least once a year where confidential summary feedback will be provided to the student, faculty advisor and program director. Students are expected to attend every CBA department seminar as part of this course.

This course is offered in Fall and Spring Semesters for 1 credit hour.

ANAT 9210 INVESTIGATION OF A PROBLEM

This course provides students an introduction to analytical techniques and the scientific method in action. The students work with individual faculty members on a specific investigative research problem.

This course is offered every semester for 12 credit hours.

ANAT 9300 RESEARCH

This course is to provide the student an opportunity to work closely with his/her faculty advisor on an in-depth study of a research problem that culminates in the preparation of a PhD dissertation.

This course is offered every semester for 12 credit hours.

Elective Courses Offered by Cellular Biology and Anatomy

ANAT 7030 NEUROSCIENCE

This course will provide the student with an in-depth study of the central and peripheral nervous system as related to functional and clinical neurology. Lectures are based on 18 units of the nervous system as covered in the course textbook. Laboratories consist of the study of the surface anatomy of the brain, spinal cord and peripheral nervous system. Internal structures of the brain and spinal cord are studied in coronal, sagittal and axial sections, as well as x-rays, CT-scans and MRI series. The second half of the laboratory is devoted to special dissections of nuclei, tracts and other internal structures of the brain and spinal cord.

This course is offered in the Spring semester.

Prerequisite: Satisfactory completion of the first year biomedical sciences core curriculum, or permission of the course director.

ANAT 7300 HUMAN GROSS ANATOMY

This course will provide the student with an introduction to specialized areas of the macroscopic structures of the human body through the use of lectures, laboratory dissection, and demonstrations.

Prerequisite: Biomedical Sciences Ph.D., are admitted only with permission of instructor.

ANAT 8010 SPECIAL TOPICS IN ANATOMY

This course will provide the student with an opportunity for discussion and analysis of current research areas applicable for their field of study. This course was most recently taught by Dr. Yutao Liu, the Graduate Program Director, on scientific writing, but other topics are possible.

This course is offered every semester for variable credit hours.

Prerequisite: Satisfactory completion of the first year biomedical sciences core curriculum and permission of the course director and program director.

ANAT 8030 FUNDAMENTALS OF VISION SCIENCE

This introductory course will provide the student the fundamentals of the visual system including anatomy and development of the eye, biochemistry, cell biology and physiology of vision, general and ocular pharmacology, immunology and overview of pathology of the eye.

This course is team-taught by Culver Vision Discovery Institute (VDI) faculty.

Prerequisites: Satisfactory completion of the first year biomedical sciences core curriculum, or with permission of the course director.

ANAT 8040 CURRENT TOPICS IN VISION SCIENCE

This course will provide the students an opportunity to familiarize themselves with recent discoveries in vision research and ophthalmic disease. The forums for interaction and learning include: formal journal clubs, ophthalmology grand rounds, the Culver Vision Discovery Institute (VDI) seminar series, and Culver VDI monthly group meetings. The course will include interactive discussions of recently published vision science papers and current research being pursued by the enrolled students. Students will develop their skills in reading the vision research literature critically and in effective presentations of scientific and clinical information.

This course is team-taught by Culver Vision Discovery Institute faculty.

Prerequisites: Satisfactory completion of the first year biomedical sciences core curriculum, or with permission of the course director.

ANAT 8060 VISUAL NEUROSCIENCE

This course covers current topics of advanced research in visual information processing. It focuses on a thematic area of research, including, but not limited to neurological deficits in vision, visual prosthesis, 3-D vision, color vision, developmental disorders of vision, commercial aspects of vision, etc. Students read relevant literature critically and present to fellow students under faculty guidance.

Prerequisite: Satisfactory completion of the first year biomedical sciences core curriculum, or permission of the course director.

ANAT 8070 PROGRESS IN VISION RESEARCH

This course covers current progress in all aspects of advanced vision research, including, but not limited to, various aspects of eye development, ocular function in healthy vision, ocular disorders, dysfunction and therapies, neurological aspects of vision and visual dysfunction, rehabilitative treatments for low vision, visual prostheses, commercial and societal aspects of vision, etc.

Prerequisites: Satisfactory completion of the first year biomedical sciences core curriculum, or permission of the course director.

ANAT 8080 CELLULAR MECHANISMS IN DEVELOPMENT AND DISEASE

This introductory course provides students a foundation in the cellular and molecular mechanisms underlying the development of multi-cellular organisms. Experimental examples will come from genetic model organisms. Correlations between developmental cell biology and processes relevant to diseases and injury responses will be discussed. Students also read relevant literature critically and present to fellow students under faculty guidance. It is planned that this course will be offered in alternating Fall semesters.

Prerequisite: Completion of Biomedical Sciences Ph.D. Program core curriculum, or permission of the course director.

ANAT 8120 INVESTIGATIVE TECHNIQUES IN CELL BIOLOGY

This course is designed to introduce Biomedical Sciences doctoral students to a wide array of methods used in cell biology applications. Faculty will use a mixture of lectures,

demonstrations, and hands-on instruction to familiarize students with specialized methods used in their laboratories.

This course will be offered every Spring semester beginning for 3 credit hours.

Prerequisite: Completion of Biomedical Sciences Ph.D. Program core curriculum, or permission of the course director.

Registration for Classes

A week before registration opens, students will receive emails from the Registrar's Office and from the CBA Program Academic Administrator (Diane Riffe) alerting them of the date registration will be open in POUNCE. Diane will list the CBA course numbers for classes offered in that semester and any important information necessary for students to be able to register on time. It will be the student's responsibility to resolve issues with the cashier's office or the registrar's office concerning holds on their personal accounts. If, for some reason, a student does not register during the appointed time they will have to get with Diane to generate and route a drop/add form. Timely registration is greatly appreciated.

Registration for 12 total hours of coursework, and for a minimum of 5 research course hours, is required to maintain GRA eligibility. A 'typical' registration has been for 12 total hours, with Investigation of a Problem or Research courses being assigned the difference between Seminar plus any elective course hours and the 12 total. However, the Graduate School has standardized the ratio of actual lab hours/week to credit hours/semester to be 3:1, thus each credit hour of a research course is considered to correspond to a *minimum* of 3 hours in the lab each week. So, a student signing up for 1 hour of Seminar and 12 hours of Investigation of a Problem or Research is 'getting credit for' **33 hours/week** of time in the lab. Note that this time for which academic credit is given is in addition to the ~13 hours/week expected for maintaining GRA eligibility. (Discuss specific expectations with your major advisor and advisory committee, and also with program director if there is confusion or concern.) You are welcome to sign up for more than 12 total hours of coursework without additional fees, up to a maximum of 20 hours of coursework.

Chapter 4: Major Milestones Along the Path to Your Ph.D.

Comprehensive Examination

The Comprehensive Exam is the first major milestone the student must achieve following completion of the core Biomedical Sciences curriculum. It assesses the student's aptitude as an independent investigator, and knowledge base spanning the Biomedical Sciences and CBA Program curricula, the general discipline of Cell Biology, and research and technical areas necessary for undertaking research within their chosen laboratory. Detailed instructions for the Comprehensive Exam and the Graduate School's requirements for Biomedical Sciences Ph.D. students are provided here:

https://www.augusta.edu/gradschool/documents/comprehensive-exam-policy.pdf

There should be a pre-exam meeting with the committee where the committee members will discuss who develops which question, and if there are any topics to add/subtract. This should be a month or so before the student want to take the exam so that the student has adequate time to prepare for the exam itself. This pre-exam meeting and the exam will be chaired by the Exam Committee Chair who is not one of the five committee members.

The comprehensive exam is composed of two parts: A one-half day (4 hours), written exam followed by a two-hour oral exam. The chair will moderate and handle the written and oral exams by collecting / averaging / reporting all the exam results. In the majority of cases the written exam will consist of five questions (one submitted by each committee member, including the major advisor). The student will then select four of the five questions to answer on the exam. Each written exam question will be given a grade A-F (A= 5 points, B= 4points, C= 3 points, D= 2 points and F= 1 point). Grades will be converted to numerical value and averaged for final score. If multiple faculty members grade questions, the average score for each question will be used for the overall average score. A 3.5 is required for passing. Students will be notified of the results of their written exam within one week of taking the exam. If the student has passed, then the student will continue on to the oral exam. Best practice advises that the oral exam will occur within two (2) weeks of the notification of written exam outcome. Each committee member will provide a score of A-F based on answers to their questions and faculty submit scores anonymously to the Exam Committee Chair. The committee can discuss the student's performance prior to submitting their scores. Chair will convert scores to numerical value and average for final score. An average score of 3.5 is required for passing. No further discussion to adjust or change scores is permitted once scores have been submitted to the Chair. Both the written and oral exams must be completed no later than the end of the semester.

In the event of failure, a student will be afforded one opportunity to retake each section (written and oral) of the exam after additional study. Students are allowed one retake for the written portion of the exam and one retake for the oral portion of the exam. Students only need to retake the exam (written or oral) that they failed on the first attempt. If a student

passes one section (written or oral) on the first attempt and fails the other, he/she only has to retake the failed portion. The second attempt (retake) of the exam, should occur within three months of the first attempt. A written plan of action for retaking the exam must be submitted to the graduate school and student within two weeks of the original unsuccessful attempt at the exam. Second attempts scheduled beyond three months, must be pre-approved by the Program Director and Dean. A new exam will be prepared by the Examination Committee for the second attempt. Failure of the second retake of either portion of the exam (written or oral) will result in the student being considered for dismissal from the graduate program and The Graduate School.

Research Proposal

The research proposal is an important milestone in the path towards graduation because it encourages the student to focus their studies on specific questions. It also forces one to look at the experimental results from a larger perspective that is central to creating the dissertation later in the program. Finally, the research proposal should be considered as a structural framework that, if carried out successfully, will result in a dissertation of sufficient breadth and significance to warrant successful graduation. **The research proposal should not be considered to be a binding contract, or a promise to successfully complete the proposed experiments, but it does bind the student to a specific study area.** Failure to complete experiments outlined in the research proposal should be explained to the committee in subsequent advisory committee meeting(s). The research proposal must be approved and submitted to the Graduate School by the end of the 9th semester at AU (2nd year in the research laboratory).

The Research Proposal generally involves extensive discussions with the major advisor prior to submission to the advisory committee. The Research Proposal is sent to advisory committee members for review, and **then approved at an advisory committee meeting in which the student presents its main elements with a slide presentation**. Each committee member must complete the Research Proposal Evaluation Rubric and submit to The Graduate Studies Education Programs Coordinator in the Graduate School, in addition to the student's submission of the final approved Research Proposal to CBA Program Director and Graduate School.

Instructions for Writing a Research Proposal

Following the outline below, provide the details of the proposal.
(1) **Hypothesis and Specific Aims**. State the hypothesis to be tested and the specific aims of the research proposal.
(2) **Background and Significance**. Describe briefly the background to the proposal, including relevant studies by other investigators. State concisely the importance of the research described in this proposal by relating the specific aims to broad, long-term research objectives in the field.
(3) **Research Design and Methods**. Provide a description of:

- Research design and the specific procedures to be used to accomplish the specific aims;
- Tentative sequence for the investigation;
- Statistical procedures by which the data will be analyzed; and
- Any procedures, situations, or materials that may be hazardous to personnel and the

precautions to be exercised.
Potential experimental difficulties should be discussed together with alternative approaches that could achieve the desired aims.
(4) **Previous Work Done in this or Related Fields.** Describe briefly any work you have done that is pertinent to this project or demonstrates your ability to carry out the study plan.
(5) **Personal Publications**. Cite your most important published and pending scientific publications in this or related work. Include all authors in the same order as they appear in the journals, as well as titles of articles and complete literature references.
(6) Provide **Literature Citations** at the end of the research proposal for any published work referenced in the proposal. Each citation must include names of all authors, titles, book or journal, volume number, inclusive page numbers, and year of publication.
(7) **Human Subjects/Vertebrate Animals**. Provide the rationale for the choice of any experimental animals or procedures involving human subjects. Also, summarize the gender and racial/ethnic composition of any human subject population.
SUBMIT RESEARCH PROPOSAL ON PLAIN 8 1/2" X 11" PAPER.

Alternative formats with similar length and detail, e.g., conforming to standard predoctoral fellowship application formats, may be substituted with prior permission of the advisory committee, department chair, and Dean. If appropriate, the Research Proposal for the Dissertation may be adapted, and usually expanded, from the research proposal written as part of the Comprehensive Exam. It will typically include more background and preliminary data, and should take into account feedback from the advisory committee.

Admission to Candidacy for the Doctor of Philosophy Degree

A student will be admitted to candidacy for this degree by the Dean of the Graduate School following successful completion of the research tools requirement, acceptance of the coursework and research proposals, and passing of the comprehensive exam. A completed Admission to Candidacy Form must be submitted to the Dean. The Dean notifies the student in writing of his/her admission to candidacy. Until this occurs, graduate courses taken are not credited toward the degree. **A student must be eligible for candidacy for the Ph.D. degree at least two semesters before the proposed graduation date.** In the CBA program, this milestone is typically met by the end of the third year of graduate school; however, note that Defense of the Dissertation must be completed within three years of Admission to Candidacy unless an exception is approved by the Dean of the Graduate School.

Publication Requirement for CBA Ph.D. Students

All CBA Program students are required to be the primary (first) author on a full-length peer-reviewed journal article published or accepted for publication in a national or International journal prior to defending their Ph.D. research. This must be a work of original research, and the student's research advisory committee must approve the selected journal. A co-first-authored journal article may be considered acceptable if the advisory committee confirms the substantive contribution of the student to this work. In general, the expectation is that the first-authored publication will be one part of a sustained pattern of scholarship during the Ph.D. training, e.g., as represented by conference presentations and co-authorships on review of

research articles. Exceptions to the publication requirement are anticipated to be rare and must be requested by a majority of the advisory committee, preferably 1-2 semesters prior to anticipated defense date. The CBA Program Graduate Council and CBA Department Chair will review and render decisions on individual cases.

Residence and Time Limits

The minimum requirement for the Doctor of Philosophy degree is three full academic years beyond the bachelor's degree, which cannot be satisfied through summer work alone. At least two full consecutive semesters must be spent in residence on the campus. If the student has part-time duties (employment or an assistantship), the residence requirements will be increased accordingly to provide the equivalent of two semesters of full-time study in residence. All coursework and other requirements for the Doctor of Philosophy degree, including the Final Oral Examination, ***must be completed within seven (7) consecutive calendar years from the date of enrollment in the Graduate School.*** Leaves of absence do not extend the seven-year limit. It is the student's responsibility to meet all the requirements for the degree in the proper sequence and in the time limits specified in this document. *For students in combined MD/PhD or DMD/PhD degree programs, the seven-year limit does not include semesters of enrollment in the professional degree program.* Where circumstances warrant, a student may petition the Dean for exceptions to this residence and time limit policy.

Dissertation

The dissertation is the culmination of the student's research, representing an original investigation leading to new information that provides evidence of independent thinking, scholarly ability and critical judgment. It should also demonstrate mastery of research methods and analytic techniques. The dissertation should make a compelling case for the importance of the findings as they apply to the field of study, and put them in context with this field. Publication of the dissertation research as one or more journal articles is urged, and the Graduate School has in 2013 recommended a program expectation for the student to have (at least) one first-author peer-reviewed publication accepted or in press prior to graduation. Having only a submitted first-author manuscript at time of graduation is risky for students in that substantial changes or additions may be required before the manuscript is acceptable for publication. Defense (Final Oral Examination) of the dissertation is required and must be completed within three years of admission to candidacy. If it is not, the Advisory Committee and graduate program may require that the student be re-examined.

As the student approaches the semester in which they plan to defend their dissertation, it is recommended that students review this chapter and Graduate School documents, as well as meeting with the CBA Program Director and with the Graduate Studies Education Programs Coordinator in the Graduate School office to discuss timing, deadlines, and requirements. Writing and defending the dissertation is not something that can be done on short notice, and students are urged to schedule the defense by the beginning of the semester in which they plan to graduate. Once the final oral defense is scheduled, the student must complete the online

Application for Graduation that can be found at:
https://www.augusta.edu/graduation/healthsciences-graduation-app.php

Directions for the preparation of the written aspects of the dissertation are available from the Graduate School office and website:
https://www.augusta.edu/gradschool/documents/thesis-dissertation-preparation-booklet.pdf
This Thesis/Defense Preparation Booklet provides formatting requirements, as well as a description of the defense (final oral examination) format. In no instance should another thesis/dissertation be used as a guide for the style and format of the dissertation manuscript. It is the responsibility of the major advisor to see that the student adheres to the policies outlined in the Thesis/Defense Preparation Booklet. The Graduate School will not approve dissertations that do not follow the prescribed format.

The dissertation should be the work of the student with only organizational and editorial input from the mentor. Generally there are two acceptable formats, the first being a traditional manuscript, with Aims, Introduction, Methods, Results, Discussion, and References sections. The student should pay particular attention to the Methods section, which should be much more detailed than in a typical published paper so as to enable future investigators to easily reproduce or continue the work in their laboratory. In addition, highly compact/crowded figures generally encouraged in manuscripts with limited publication space should be avoided in a dissertation, which in contrast should focus on presenting the information in the most clear and understandable format possible. The alternative format for a dissertation that is acceptable is the compilation of papers if the dissertation work has been published. However, a common Introduction and Discussion is required and the Methods should be expanded as described for the recommended traditional format. This alternative format is rarer, and often is preferred in cases where several loosely related projects are carried out rather than a larger project with several inter-related sub-topics. **Extra attention is required by students opting to use the alternative format for their dissertation because published papers generally have several contributing authors. Since a dissertation is to reflect the student's work, it is imperative that notarized acknowledgment of the role of each co-author is included. Moreover, if AU students are co-authors on any of the manuscripts, it is very important to provide a notarized letter from the student acknowledging that they resign their claims on any data included in the dissertation. The same data cannot be included in two different dissertations.**

Approval of the Dissertation

The student and advisory committee should follow these procedures for approval of the dissertation:

1) A**t least five (5) weeks** before the date of the student's final oral examination, a good draft of the dissertation, proof-read and corrected by the student and approved by the major advisor, is distributed by the student to members of the advisory committee.
2) **At least three (3) weeks** before the oral examination, the dissertation should be approved by the advisory committee. This approval is documented by completion of the Dissertation Approval Form submitted to the Dean. The signed form indicates that the members of the committee have read the draft copy of the dissertation and find it

acceptable for the purpose of examining the student. The student will be responsible for making all changes recommended by the committee.

3) **At least two (2) weeks** before the oral examination, a corrected printed draft copy of the dissertation (in required format) must be submitted to the major advisor, advisory committee, readers, and the Graduate School. Also at this time, the signed Dissertation Approval Form, signed Faculty Agreement Form (verifying planned attendance of all participants at the final oral examination), and an electronic copy of the dissertation seminar announcement must be provided to the Graduate School.

Final Oral Examination

The Dissertation must be defended in a Final Oral Examination involving the advisory committee, dissertation readers, faculty, students and the public. This examination is based *primarily* on the dissertation and the field of knowledge that constitutes the student's major subject. **The student must be enrolled in the semester that the examination is administered.** The student is not enrolled in the semester(s) after they defend unless they fail or pass with major revisions.

Typically, a 3-hour exam will include a 40-minute un-interrupted seminar by the student, followed by questions from any audience member. After a short break, a closed session takes place, at which senior students and CBA Program Director may be present as observers, and involves up to 90 minutes of questioning. Format of the exam is determined by the Graduate School and is subject to change; students will be informed of any changes in advance of the examination.

The Final Oral Examination for the Doctor of Philosophy degree is chaired by the major advisor, unless another member of the advisory committee has been designated and approved as Chair. In addition, an external examiner (reader) must be present, who participates in the exam and votes along with the student's advisory committee on the performance. A majority vote of the examining committee is required for satisfactory performance to be established.

It is the responsibility of the student and their major advisor to select a reader for approval by the Dean. After approval is granted, the student contacts the reader to confirm that they will be available to serve in this capacity. The Graduate School office must be notified when the reader agrees. The Dean and reader, must receive a corrected copy of the dissertation approved by the advisory committee at least two (2) weeks before the Final Oral Examination is administered.

Well in advance of the oral exam, the student must contact the Graduate School office, CBA Program Director, advisory committee and reader to arrange a time that all individuals will be able to attend the oral examination. Once the time is established, notification in writing is sent to the Dean on a completed Oral Examination Faculty Agreement Form. The oral defense must take place no later than three (3) weeks before the end of the term and during a term (related to the requirement that the student must be enrolled at time of the Final Oral Examination). No oral defenses will be scheduled to take place between semesters. The student is responsible for scheduling the room location and coordinating distance technology for committee members

who cannot be present face-to-face at the final oral defense. The CBA Program Academic Administrator will help in making these arrangements. The student must send electronic copies of the PowerPoint presentation in advance to any committee member or reader participating via distance technology, and confirm successful access to the documents and distance technology prior to the exam.

The examination is open to the public, and the CBA Department is responsible for transmitting a formatted Exam Announcement to all Biomedical Sciences faculty and students. A sample of the Final Oral Examination announcement is included in the "Thesis/Dissertation Preparation" document and available at the Graduate School office and its website. The Final Oral Examination Form, provided by the Graduate School, and Rubrics for Evaluating Ph.D. Dissertation and Defense (Final Oral Exam) forms must be completed at the end of the examination by the advisory committee, readers, and other indicated signators.

The possible outcomes of the final oral examination include:

1) **Pass/Minor Revisions:** If a student passes with minor revisions, they will not be enrolled (nor will be allowed to enroll) for the following or any subsequent semester in the degree program in which they have just defended the dissertation. **The student will be expected to graduate at the end of the semester in which they defend.** ALL final documents, including the required number of copies of the final, approved, revised dissertation on *Crane's Thesis paper*, must be submitted to the Graduate School at least one (1) week before the end of the term.
2) **Pass/Major Revisions or Fail:** If a student passes with major revisions or fails, a subcommittee will be appointed and the student must enroll for the following semester. The subcommittee will establish a list of necessary revisions and a timeline for completion that are required to be fulfilled to the satisfaction of the subcommittee in order for the dissertation to be approved and subsequently accepted by the Graduate School in partial fulfillment of the Ph.D. degree requirements. The student's final approved revised dissertation and ALL final paperwork is required to be submitted to the Graduate School at least one (1) week prior to the end of the semester/graduation.

Finishing Up for All Students

The Application for Graduation must be completed online, preferably early in the semester in which the student plans to defend.

Satisfactory fulfillment of any additional requirements of the CBA department or the institution is required. A recommendation for graduation signed by the CBA Department Chair and the Dean of the Graduate School is submitted to the Registrar verifying that the student has completed all requirements.

Finishing Up for International Students

It is the student's responsibility to meet with the International and Postdoctoral Services Office to discuss graduation plans to determine if/how their visa and student compliance status will be affected. If a student is planning to apply for OPT (Optional Practical Training), they must allow sufficient time for the application process. It is the student's responsibility to ensure they remain in compliance with all official paperwork for student status and that they have completed any paperwork that may be required for post-graduation plans in the United States. Students who have not made such arrangements may be caught by surprise as the AU affiliation is terminated soon after completion of dissertation defense and submission of related documents. It is NOT the responsibility of the major advisor or CBA Program personnel to handle timing or completion of paperwork for student status, or to remind students of their responsibilities regarding this matter.

Chapter 5: ENRICHING YOUR Ph.D. TRAINING

Teaching Opportunities Available to CBA Program Students

CBA Teaching Fellows

Through the Medical College of Georgia, the Department of Cellular Biology and Anatomy is able to offer a limited number of competitive fellowships for training in Medical Histology, Medical Gross Anatomy, Medical Neuro-Anatomy and Molecular Cell Biology teaching. Only CBA Ph.D. Program students are eligible to receive these fellowships, except in rare instances when there are too few qualified CBA Program applicants. First year medical students are the primary population taught, though medical illustration, allied health, and biomedical sciences Ph.D. program students may be represented as well. These students are highly motivated and engaged, providing a strong training ground for CBA Teaching Fellows. Faculty instructors include graduate faculty within the CBA department as well as professional teaching faculty. As a group and as individuals, these CBA faculty members have won many teaching awards and several are involved in the Education Innovation Institute performing educational research and pedagogical training.

Teaching Fellowships in Medical Histology are those most commonly undertaken by the CBA students, because they have taken the prerequisite Histology (ANAT 8050) course. Medical Histology Teaching Fellows are expected to actively engage students in lab sessions, prepare sufficiently to be able to respond to student questions from those labs and corresponding lectures, and proctor and grade lab quizzes and course examinations. Advanced Fellows may be chosen to give reviews at the end of lab sessions, and may have an opportunity to give a lecture. Overall, it is anticipated that Medical Histology Teaching Fellows will not spend more than 8-10 hours in any week on this activity; as our students remain GRAs (graduate research assistants), they are expected by the graduate school, the program, and their mentors to fulfill research progress along with their non-teaching peers.

Teaching Fellowships in Medical Gross Anatomy or Neuro-Anatomy are undertaken by students who want to strengthen their teaching credentials to become faculty in medical, allied health, and other programs where anatomical sciences expertise is highly valued. To become eligible for either of these fellowships, students must have taken and excelled in the relevant prerequisite course(s) as described in Chapter 3, and are advised to discuss plans to apply for these fellowships with the relevant Medical Course Director, CBA Program Director, and their major advisor early in their Ph.D. training. In Gross Anatomy, Teaching Fellows are expected to attend lectures and actively facilitate in all labs (with about 70% of the total time commitment in the Fall semester), prepare sufficiently to be able to respond to student questions during the lab sessions, and assist in setting up and grading lab exams. Advanced Fellows will be mentored in preparing course materials and delivering lectures. Overall, it is anticipated that Medical Gross Anatomy Teaching Fellows will spend 8-12 hours on this activity in each week. The dense

course content and increased lab hours compared to the Medical Histology teaching make this a more intensive teaching experience. Students remain GRAs and are expected by the graduate school, the program, and their mentors to fulfill research progress alongside teaching. Also available is a teaching fellowship in Molecular Cell Biology. In Molecular Cell Biology, Teaching Fellows are expected to attend lectures and prepare sufficiently in understanding the lecture and journal club material so they can assist in answering student questions throughout the semester. One primary duty of the Teaching Fellows will be to prepare a pre-exam student review session approximately one week before each of the scheduled course Exams. The Teaching Fellow will work with the faculty to understand the key points each faculty member wishes to emphasize from their lecture(s), and during the pre-exam review session, the Teaching Fellow will review these key points from each lecture with the students either via a PowerPoint presentation or some other suitable mode of communication. The Teaching Fellows may also hold a weekly "office hours" session during which time they will be available to help answer student questions, are also expected to assist with proctoring exams and/or post-exam review sessions when needed (for instance, in the case of scheduling conflicts for the Course Director). Students remain GRAs and are expected by the graduate school, the program, and their mentors to fulfill research progress alongside teaching.

The assignment of Teaching Fellowships is a competitive process. Students who have performed well in the prerequisite course, who are maintaining strong research progress and have support of their major advisor and advisory committee, and who have strong support of the medical course directors will improve their chances of selection. Students who have 0-1 years prior experience as a CBA Teaching Fellow and who have passed their Comprehensive Examination are given priority. In the Spring semester, the Program Director will solicit student applications and course preferences, and communicate with major advisors and the medical course directors. The Program Director and CBA Graduate Program Council will assemble a ranked list of recommendations, and Department Chair will make final decisions. Typically, a student may be a Teaching Fellow for up to 2 years, but will need to re-apply for the second and subsequent year. A third year is occasionally granted, but in no case should student and major advisor rely on teaching fellowships as a primary mechanism of funding the student's stipend.

For further information, please contact the course directors directly:

Medical Gross Anatomy –Anna Edmondson, PhD @ AEDMONDSON@augusta.edu

Molecular Cell Biology – Meghan McGee-Lawrence, PhD @ MMCGEELAWRENCE@augusta.edu

Undergraduate Lab Teaching Opportunity for Biomedical Sciences Ph.D. Students

The Graduate School collaborates with the Department of Biological Sciences on the AU-Summerville Campus to provide a mentored opportunity to teach a section of BIOL 1107 Principles of Biology I. An estimated 8 hours/week commitment is required, including meetings

with a Lab Section Coordinator and an assigned faculty mentor from the Biology Department, preparation and teaching a 2 hour laboratory, lab report grading, and e-mail availability to student queries. In addition to these teaching expectations, biomedical sciences Ph.D. students must fulfill their research commitment as required by their program, research course credit hour enrollment and conditions of their GRA; a portion of the GRA stipend will be covered by the Graduate School for participants.

Eligibility is restricted to full-time enrolled students who have successfully completed the first year curriculum and their Comprehensive Exam, who are in good academic standing, and who have the permission and support of their major advisor as articulated in a formal letter of support. An application and formal support letter must be submitted to the Vice Dean of the Graduate School in response to deadlines to be announced. This is a one-semester opportunity, and additional semesters require submission of a new application. Selected applicants will be asked to interview with the Chair of the Department of Biological Sciences and the faculty mentors. As an example of timetable, for Fall 2013, the application deadline was in mid-July, training activities began in early August, and classes began on August 19. Please contact the Graduate School directly for details of this program.

Teaching Practicum in Physiology

Dr. Ruth Harris offers a 2-credit hour course, PSIO 8315, open to Biomedical Sciences Ph.D. students in good academic standing, and who received an A or B grade in Integrated Systems Biology. Students who enroll in Teaching Practicum are assigned to one of the ~1-month modules of the core Integrated Systems Biology course. They are expected to attend class (6 hrs/week), hold weekly group review/tutoring sessions (~2 hrs/week), assist in proctoring exams, and to distribute and collect papers during an exam review session. Modules include 1 (cell structure/homeostasis, nervous system); 2 (cardiovascular and GI physiology); 3 (renal and respiratory physiology); and 4 (endocrinology). Interested students should discuss with their major advisor, and contact Dr. Ruth Harris directly prior to registering for this course.

Other Teaching Opportunities

Senior Ph.D. students in the CBA Program have independently found additional teaching opportunities suitable for their field of research and future career plans. It is important for the student to gain their major advisor's support/approval and to ensure they remain in compliance with conditions of their GRA. Here are some suggestions based on prior students' successes and new opportunities at AU:

- volunteer to teach a graduate school lecture for your major advisor; if the course director agrees and major advisor provides appropriate oversight, being a 'guest lecturer' can be a valuable addition to your curriculum vitae
- volunteer to teach a guest lecture in an undergraduate course such as developmental biology or cell biology
- experienced CBA Teaching Fellows may find opportunities to volunteer in various courses taught by the department's teaching faculty

- teach an evening lecture or lab class at one of the nearby colleges or universities; these can often be paid and recurring positions, however, only try this level of commitment if you are close to the end of your Ph.D. training and have your dissertation research and publications well in hand. Please check with the Graduate School regarding possible implications for your GRA status.

Applying for Predoctoral Research Fellowships

CBA Program students are strongly encouraged to apply for extramural, independent fellowship funding for their research. Writing a fellowship application gives practice in grant-writing, with the opportunity to build experimental strategies and have ideas critically assessed by outside reviewers. If successful, the fellowship will provide financial support, often including funds designated for the student to use for travel or other resources. Fellowships also may provide access to a peer network of fellow awardees across the country, opportunities to present at meetings sponsored by the awarding agency or foundation, and are a notable and prestigious item to add to the curriculum vitae. As a further incentive and reward, the Graduate School requires that major advisors supplement the stipends of students who have been awarded independent research fellowships, by up to $5,000 over the standard stipend.

It is beyond the scope of this handbook to outline all the possible sources of fellowship funding, but a few of the common ones will be mentioned. National Science Foundation (NSF), National Institutes of Health (NIH), and other federal agencies generally restrict fellowship eligibility to US citizens, US nationals, and permanent residents. The NSF Graduate Research Fellowship Program (http://www.nsfgrfp.org/) differs from most in that students are generally only eligible to apply in the first or second year of graduate training. While a research proposal is required as part of the NSF fellowship application, it does not require preliminary data nor in fact a hard commitment to work on the project described; selection is made on the strengths of the applicant student, their ideas, and the environment they describe for their research. The NIH Ruth L. Kirschstein National Research Service Award series for individual predoctoral fellows (F31; http://grants.nih.gov/training/F_files_nrsa.htm) is a mainstay of federal predoctoral fellowship applications, and gives a valuable introduction to the procedures and mechanisms employed by NIH in review and awarding of funding. Both NSF and NIH particularly encourage applications from historically under-represented ethnic and racial minority students, and disabled students. The American Heart Association welcomes predoctoral fellowship applications without regard to citizenship status, so is open to international students (https://professional.heart.org/en/research-programs/application-information/predoctoral-fellowship). Although students are expected to make a sincere effort to link their research field to cardiovascular disease and/or stroke, the relevance criterion is employed more loosely to predoctoral fellowship applicants than to any other category of AHA applicants.

The student's major advisor and advisory committee will be able to recommend fellowship opportunities relevant to their research area, e.g., from private foundations related to a disease. The Sponsored Programs Administration (Grants) Office may also have information for the student determined to get independent funding, as may web resources such as this NSF list https://www.nsf.gov/funding/

Opportunities to Present Your Work

As outlined in previous chapters, CBA students are required to present in the departmental seminar series from their third year onward, and encouraged to present in the second year if student and major advisor agree that they are ready. They are further expected to present in the departmental journal club series and to have posters at Graduate Research Day each Spring. These basic opportunities to present locally are a solid introduction to communicating your research to the scientific community.

Students and their mentors are also encouraged to present research at regional, national and international meetings when ready, and preferably on more than one occasion while in graduate school. CBA students have typically attended 1 or 2 such meetings each year from the third or fourth year of training. These presentations outside of the home institution facilitate networking, establishment of collaborations, and more exposure to critical and differing views than is possible when ideas are developed only within an insulated environment.

Funding for meeting travel typically comes from the major advisor's resources, but students are strongly encouraged to seek out their own travel funding. Many scientific societies offer competitive travel awards that students can apply for at the time they submit their meeting abstract and registration; as with predoctoral fellowships, travel awards are a notable achievement and may provide access to a professional peer network. The Graduate School also has a travel award program that may provide partial support for presenting a first-author abstract at one meeting per year, as funding permits. Students in their final two years of Ph.D. training are given priority, and those with fellowship or traineeship support are required to request support from those sources before applying for Graduate School travel funds. Official guidelines and an application for these funds are included in Appendix 1, Forms.

Coordinating and Timing Elements of Your Training

Looking ahead from the time a student commits to a major advisor's laboratory and the CBA Graduate Program, the contents of this handbook and the accompanying Timeline (p. 17) may seem daunting. There seem to be many activities to juggle and obstacles to be hurdled. Rest assured that many students have succeeded before you, and that the faculty and staff in CBA are knowledgeable and here to assist the motivated student in their program and longer-term goals. Here are just a few recommendations:

1) Remember that the Ph.D. is a research degree. Establishing the dissertation research project and mastering the techniques, experimental design, and analysis should be the top priority early, and maintaining progress with productivity documented by abstracts, publications, and presentations should remain the central activity of your training throughout the program.
2) We encourage students to get 1-2 years of teaching experience and to apply for research fellowship funding, yet the terms of research fellowships often preclude time spent on non-research activities. Also, these activities both typically occur in the 2-4

years after completion of the Comprehensive Exam, again raising possibility of time conflicts. Since it may take two or more application rounds to be successful at gaining a research fellowship, its timing cannot be readily predicted. Find out the terms of the fellowships and if some teaching could be continued on a volunteer basis, but don't let a potential conflict be a barrier to trying for both activities if appropriate for your career goals and approved by your major advisor and advisory committee.

3) It is important to have open discussions early with your major advisor and/or other mentors about long-term career goals, and how training for these goals can be accommodated within the constraints of funding and your chosen research project. Not everything can be planned at once; adaptation and flexibility in taking advantage of new opportunities as they arise are skills that will serve you well in your future career.
4) Take advantage of CBA's peer mentorship program to get advice from senior students and alumni. They have been through what you are facing much more recently than faculty mentors, and will have current and practical perspectives. The CBA Program Director will match you up with a senior mentor early in your training, but we recognize your needs may change over time and you may want new or additional views.

APPENDIX #1 - REQUIRED FORMS & POLICIES

https://www.augusta.edu/gradschool/student-resources.php

APPENDIX #2 - DETAILED COMPREHENSIVE EXAM GUIDELINES

https://www.augusta.edu/gradschool/documents/comprehensive-exam-policy.pdf

APPENDIX #3 - AHA PREDOCTORIAL FELLOWSHIP APPLICATION GUIDELINES

https://professional.heart.org/en/research-programs/application-information/predoctoral-fellowship

APPENDIX #4 - NIH PHS SF424 (R&R) FELLOWSHIP APPLICATION GUIDELINES

https://grants.nih.gov/grants/funding/424/sf424_rr_guide_fellowship_verb.pdf

Doctor of Philosophy with a major in Cellular Biology & Anatomy

Curriculum Schema | **Level of Program Doctoral, PhD** | **CIP code for Program 26040701**

	FALL (SEMESTER 1)	SPRING (SEMESTER 2)	SUMMER (3)
YEAR 1 **42 credit hours**	BIOM 8011 (1): Responsible conduct of Research BIOM 8012 (1): Scientific Communication BIOM 8021 (5): Biochemistry BIOM 8022 (5): Molecular Cell Biology BIOM 8040(2): Introduction to Faculty Research BIOM 8050 (2): Introduction to Research I	BIOM 8033: Integrative Systems Biology (6) BIOM 8060: Introduction to Research II (4) *SELECTIVE COURSES: (Choose 4 credit hours):* • BIOM 8080 (4): Neuroscience I • BIOM 8090 (2): Fundamentals of Genomic Medicine • BIOM 8030 (2): Experimental Therapeutics • BIOM 8215 (2) Fundamentals of Oncology • BIOM 8230 (2) Biology of Proteins in Disease • BIOM 8240 (2) Introduction to Immunology and Infectious Disease	STAT 7070 (3): Biomedical Statistics BIOM 9210 (9) Investigation of A Problem
	16 credit hours	14 credit hours/30	12 credit hours/42
	FALL (SEMESTER 4)	**SPRING (SEMESTER 5)**	**SUMMER (6)**
YEAR 2 **36 credit hours**	**ANAT 8090 (1):** Journal Club **ANAT 9210 (12):** Investigation of A Problem **ANAT 9010 (1)** Seminar in Cell Biology *ELECTIVE COURSES:* • *ANAT 8040 (3) Topics in Vision Science* • *ANAT 8070 (1) Progress in Vision Research* • *ANAT 8080 (2) Cellular Mechanism in Development & Disease* • *ANAT 8120 (3) Investigative Techniques in Cell Biology*	**ANAT 8090 (1):** Journal Club **ANAT 9210 (12):** Investigation of A Problem **ANAT 9020 (1)** Seminar in Cell Biology *ELECTIVE COURSES:* • ANAT 7030 (3) Neuroscience • ANAT 8010 (1) Special Topics in Anatomy • ANAT 8030 (3) Fundamentals of Vision Science • ANAT 8060 (1) Visual Neuroscience • ANAT 8070 (2) Progress in Vision Research	**ANAT 9210 (12):** Investigation of A Problem **ANAT 8050 (5)** Graduate Student Histology *mandatory for CBA, elective for COGS. *ELECTIVE COURSES:* • ANAT 7300 (6) Human Gross Anatomy • ANAT 8050 (5) Graduate Student Histology • ANAT 8070 (1) Progress in Vision Research
	12 credit hours/54	12 credit hours/66	12 credit hours/78

	FALL (SEMESTER 7)	SPRING (SEMESTER 8)	SUMMER (9)
YEAR 3 **36 credit hours**	**ANAT 8090:** Journal Club **ANAT 9210 (12):** Investigation of A Problem (or ANAT 9300 if admitted to candidacy) **ANAT 9010 (1)** Seminar in Cell Biology *ELECTIVE COURSES:* • *ANAT 8040 (3) Topics in Vision Science* • *ANAT 8070 (1) Progress in Vision Research* • *ANAT 8080 (2) Cellular Mechanism in Development & Disease* • *ANAT 8120 (3) Investigative Techniques in Cell Biology*	**ANAT 8090:** Journal Club **ANAT 9210 (12):** Investigation of A Problem (or ANAT 9300 if admitted to candidacy) **ANAT 9020 (1)** Seminar in Cell Biology *ELECTIVE COURSES:* • ANAT 7030 (3) Neuroscience • ANAT 8010 (1) Special Topics in Anatomy • ANAT 8030 (3) Fundamentals of Vision Science • ANAT 8060 (1) Visual Neuroscience • ANAT 8070 (2) Progress in Vision Research	**ANAT 9210 (12):** Investigation of A Problem (or ANAT 9300 if admitted to candidacy) **ANAT 8050 (5)** Graduate Student Histology *if not completed previously *ELECTIVE COURSES:* • ANAT 7300 (6) Human Gross Anatomy • ANAT 8050 (5) Graduate Student Histology • ANAT 8070 (1) Progress in Vision Research
	12 credit hours/90 + **PhD COMPREHENSIVE EXAM**	12 credit hours/102	12 credit hours/114 **+ PhD RESEARCH PROPOSAL**
	FALL	SPRING	SUMMER
YEAR 4-7	**ANAT 8090 (1):** Journal Club **ANAT 9300 (12):** Dissertation Research (or ANAT 9210 if NOT admitted to candidacy) **ANAT 9010 (1)** Seminar in Cell Biology *ELECTIVE COURSES:* • *ANAT 8040 (3) Topics in Vision Science* • *ANAT 8070 (1) Progress in Vision Research* • *ANAT 8080 (2) Cellular Mechanism in Development & Disease* • *ANAT 8120 (3) Investigative Techniques in Cell Biology*	**ANAT 8090 (1):** Journal Club **ANAT 9300 (12):** Dissertation Research **ANAT 9020 (1)** Seminar in Cell Biology *ELECTIVE COURSES:* • ANAT 7030 (3) Neuroscience • ANAT 8010 (1) Special Topics in Anatomy • ANAT 8030 (3) Fundamentals of Vision Science • ANAT 8060 (1) Visual Neuroscience • ANAT 8070 (2) Progress in Vision Research	**ANAT 9300 (12):** Dissertation Research *ELECTIVE COURSES:* • ANAT 7300 (6) Human Gross Anatomy • ANAT 8050 (5) Graduate Student Histology • ANAT 8070 (1) Progress in Vision Research
	12 credit hours /126-4th	12 credit hours/138-4th	12 credit hours/150 4th

- ANAT 9210- Investigation of a Problem must be taken every semester until admissions to candidacy requirements are complete.
- ANAT 9300 - Research must be taken every semester after admission to candidacy until dissertation requirements are met.
- The number and type of advanced (2nd year and beyond) elective courses vary, and may include courses within the student's biomedical program as well as courses in other disciplines.
- Please note: some elective courses are only offered every other year. Check with CBA Academic Administrator for clarification of which courses will be offered over the coming 12-24 months when planning your elective course schedule.
- *Note for SACS review* – all elective courses include as a major component knowledge of the literature of the discipline, but also include discussion of methods and testing of experimental design skills in written examinations providing research training as well. Additionally, since Fall 2013, all students have taken part in a monthly Journal Club, each presenting a current research topic in cell biology following extended discussions with a faculty facilitator; this Journal Club, though not currently credit-bearing, is expected of all students. Comp exam proposal, PhD research proposal, and written dissertation documents also combine knowledge of the literature and research training components, further supporting that this training proceeds throughout the curricula.

Additional Requirements:

In addition to specific course requirements, students must complete additional PhD degree requirements, including satisfactory performance on the Comprehensive Examination, development of an approved research proposal, writing and obtaining approval of the doctoral dissertation, and satisfactory performance on the Final Oral Examination (dissertation defense). Publication of at least one first-authored original research article in an approved peer-reviewed journal is required for students entering CBA Graduate Program in 2014 and beyond. A CBA Program Handbook is available online and updated at least once yearly in the fall to reflect any changes that have occurred during the academic year.

The Doctor of Philosophy curriculum is not lock-step; students do NOT graduate as a class at the end of a specific semester. The average time to degree is approximately 5 years of full-time, year-round study; acceptable duration of the program may be between 3 and 7 years. The PhD curriculum is individualized for each student based on the Advisory Committee's recommendations. The number and type of advanced (2nd year and beyond) elective courses vary, and may include courses within the Cellular Biology and Anatomy program as well as courses in other disciplines.