



2021-22 Genetics Discipline Handbook

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

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

Table of Contents

	Page
Description of the Genetics Discipline.....	3
Graduate Faculty and Their Research	4
Requirements.....	8
Required Courses	8
Journal Club and Seminar Courses	8
Elective Courses	9
Sample Degree Plans.....	10
Advancement to Candidacy.....	13
Additional Information.....	15

1. Description of the Genetics Discipline

Nicole Phillips, Ph.D., Graduate Advisor

Center for BioHealth, Rm 327

Phone: 817-735-5463

E-mail: Nicole.Phillips@unthsc.edu

Discipline website: www.unthsc.edu/graduate-school-of-biomedical-sciences/genetics/

Genetics is a broad interdisciplinary field that leverages biochemistry, microbial and cellular biology, molecular processes, biotechnology, computational biology, biogeography and human disease to gain an integrated understanding of environmental and clinical observations. The Genetics discipline offers training in analytical techniques and computational methods necessary for studies in the different fields of applied genetics. Our faculty have broad research interests as most analytical approaches to genetics studies are applicable to a myriad of biological processes. Faculty programs are funded by multiple sources including the federal government, state government, private foundations and industry, and collaboration between the various UNTHSC programs and schools is strongly supported. Students may undertake research in areas such as cancer genetics, computational genetics, pharmacogenetics, evolutionary genetics, medical genetics, microbial genetics, forensic genetics/genomics, and many other interrelated disciplines.

The faculty of the Genetics discipline have identified Student Learning Outcomes specific to the discipline. In addition to the GSBS competencies graduates will:

- Demonstrate mastery of cutting edge research approaches in genetics/genomics;
- Describe, critically evaluate, and apply current theoretical perspectives in genetics;
- Demonstrate proficiency in analytical and statistical procedures appropriate for genetic analyses; and
- Describe role of genetic and genomic assessment in clinical practice, including applications in disease screening, diagnosis, and pharmacogenetics.

Students may enter the discipline with a variety of academic backgrounds, provided they have fulfilled prerequisite core courses and have completed their required rotations with a minimum of one (1) Genetics faculty member. Experience in laboratory methods, computer programming and bioinformatics is strongly recommended. Students wishing to enter the discipline should meet with the Graduate Advisor at the earliest possible time to obtain information on the discipline and guidance in selecting lab rotations and potential mentors. Students may request to join the discipline at the end of the first semester.

Students will receive extensive training in the foundations and techniques of contemporary molecular genetics in their laboratories and through elective courses. Students will perform original, publishable research, and present their research findings at scientific meetings. Doctoral students are required to have a minimum of one paper published in their dissertation research area prior to applying to defend their dissertation. In addition, students are required to present an update on their research and solicit suggestions during the Department of Microbiology, Immunology and Genetics Works in Progress (WIPs) (MIMG 5140) sessions held weekly. With the consent of their research mentor, students may present their research progress at the annual UNTHSC Research Appreciation Day (RAD). Students should be aware that the timeline for their successful completion of the degree plan will vary depending upon the nature of their research, their time management skills and their level of academic development. Graduates with advanced degrees in Genetics typically find employment in higher education, industry and government agencies.

2. Graduate Faculty and their Research Interests

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

Michael Allen, Ph.D.

Associate Professor, Microbiology, Immunology & Genetics; **Full Member**

Research in the Allen Laboratory focuses on microbiology of vector-borne diseases and microbiome-host studies of human and animal systems. The former includes testing of all ticks submitted to the state of Texas for the presence of specific bacterial pathogens, and research into the factors influencing disease transmission and pathology. Microbiome research includes investigation of complex bacterial communities and their interactions with a wide variety of hosts (humans, arthropod vectors of disease, etc.), defining factors that disrupt or support microbial community assembly and structure, exploring community dynamics in polymicrobial diseases of different organ systems (e.g. gut, lung), development of genetically engineered probiotics for the treatment of disease, and applications of microbiome research to problems in forensic science.

Robert Barber, Ph.D.

Associate Professor, Pharmacology & Neuroscience; **Full Member**

Research projects in Dr. Barber's group include investigations of how DNA methylation and microRNA expression impact risk for neurodegeneration; efforts to use patterns of DNA variation to predict the age at onset of Alzheimer's disease (AD); and scanning the intestinal microbiome to determine how an individual's profile of gut bacteria may impact their cognitive ability as they age. I am also interested in AD pathophysiology among Mexican Americans and how disease mechanisms differ between members of this underrepresented ethnic group and Caucasians. Students in my lab are trained in the analysis of large genetic and biomarker data sets through collaborations with researchers at UNTHSC and other Texas Alzheimer's Research & Care Consortium institutions as well as the University of North Carolina at Chapel Hill. Active collaborative projects are ongoing with Drs. O'Bryant, Allen, Hall, Cunningham and others at UNTHSC; Drs. Sohrabji and Miranda at Texas A&M Health Science Center; Drs. Huebinger and Reisch at UT Southwestern; Drs. Royall and Palmer at UT Health Science Center at San Antonio and Drs. Wilhelmsen and Tilson at the University of North Carolina at Chapel Hill. Work in his lab is focused on personalized medicine. They are interested in how an individual's genetic makeup, epigenetic profile and microbiome impact risk for disease, rate of disease progression or likelihood of responding to various treatment options. Our work is focused on neurodegeneration and dementia (primarily Alzheimer's disease), but many of the tools and discoveries we make can be readily applied to other conditions and treatments.

Bruce Budowle, Ph.D.

Professor, Microbiology, Immunology & Genetics; **Full Member**

Forensic genetics traditionally has been dedicated to analysis of human DNA markers for identity purposes to support criminal and civil investigations. However, with the demands of stakeholders and advances in technologies and bioinformatics, there is a substantial expansion of the applications of forensic genetics (or better yet forensic genomics). In addition to

identification of humans associated with crime or missing persons due to mass disasters or other crimes, other areas of application include molecular autopsy and microbial forensics. Our research group has an advanced forensic genomics program using cutting edge genomics and technologies to effectively bolster current forensic and biosecurity capabilities. Some areas of interest are: computational genomics and bioinformatics; mixture interpretation; development of genetic diagnostics and detection capabilities; identification of novel genetic markers for human identification; population genetics studies; human microbiome studies for identification purposes; molecular autopsy (i.e. pharmacogenetics); and molecular mechanisms for DNA repair. These research efforts support a healthier and safer society as well as the government in achieving its mission of law enforcement, combatting terrorism, and providing biosafety and preserving national biosecurity.

Magdalena Buś, Ph.D.

Research Assistant Professor, Microbiology, Immunology & Genetics

Dr. Magdalena Buś serves at the Associate Director of the Center for Human Identification (CHI) Human Trafficking Program. Her main research interests are analysis of DNA from touch evidence, historical and forensic samples that are severely damaged; service support for forensic and crime scene investigations; historical museum specimens, excavation sites, and population genetics studies. Currently she coordinates and oversees the project addressing the human trafficking problem and crime reduction through forensic genetics and DNA databases in Central America. The primary purpose of the project is to address the human trafficking problem through forensics in Central America, with the current focus placed on Panama, Costa Rica, Guatemala, El Salvador, and Honduras. Dr. Magdalena Buś is also a part of the CHI team addressing domestic and local human trafficking issues in the state of Texas. She has substantial experience with analyses of limited quantity and severely degraded DNA acquired from human remains found at crime scenes, existing museum specimens, and samples recovered from historical excavation sites. Dr. Buś has developed and optimized sensitive techniques for low copy number DNA analyses using various technologies such as Sanger sequencing, Pyrosequencing, and Massively Parallel Sequencing. In addition, she has worked with DNA extracted from aged human skeletal remains found in mass-graves and ancient samples dating back to the Viking-age.

Jennifer Cihlar, Ph.D.

Assistant Professor, Microbiology, Immunology & Genetics; **Associate Member**

Dr. Jennifer Cihlar is an Assistant Professor in the Microbiology, Immunology, and Genetics Department at UNTHSC and a member of the UNTHSC Center for Human Identification's Research Unit where her efforts focus on improving the forensic community's ability to identify humans associated with crime, missing persons, and human and wildlife trafficking victims through forensic genomic research. With these goals in mind, Dr. Cihlar's current research efforts include development of molecular biology technologies, optimization of SOPs for massively parallel sequencing and Rapid DNA technologies, bioinformatic assessment of the performance and noise in mitochondrial genome analyses that can help guide thresholding strategies for forensic laboratories, identification of novel genetic markers for human and wildlife identification, and investigation into the use of portable genetic technologies to aid law enforcement efforts in curtailing wildlife trafficking.

[Michael D. Coble, Ph.D.](#)

Associate Professor, Microbiology, Immunology & Genetics; **Full Member**

DNA evidence from crime scenes (including evidence from victims of sexual assault) can often contain mixtures of two or more contributors and can be challenging for the forensic scientist to interpret. Our research focuses on issues associated with DNA mixture interpretation and probabilistic methods of interpretation using software analyses. Other areas of research include haploid marker systems for forensic testing (mitochondrial DNA and Y-chromosome testing), and non-traditional marker systems (e.g. X-chromosomal STRs, insertion-deletion markers, etc.) to increase genetic information from challenged samples.

[Jianye Ge, Ph.D.](#)

Associate Professor, Microbiology, Immunology & Genetics; **Full Member**

Dr. Ge received his BS and MS degrees in Computer Science from Nankai University, China. He earned his PhD in Bioinformatics from the University of Cincinnati, and was employed as an Assistant Professor at the University of North Texas Health Science Center. He then took a position with the Human Identification Division (HID) of Thermo Fisher Scientific as algorithm leader and, later, as Global Market Development Manager. Dr. Ge has returned to the Health Science Center and is an Associate Director at the Center for Human Identification. His research relates primarily to computational analysis and interpretation of DNA forensic data. The software programs he has developed have been used by federal and state government agencies to assist in solving criminal cases. He is currently working on projects that apply the latest development in artificial intelligence and genomics technologies to solve challenging problems in forensic science.

[Nicole Phillips, Ph.D.](#)

Assistant Professor, Microbiology, Immunology & Genetics; **Full Member**

Dr. Phillips' research interests lie in the study of genetic interactions that contribute to one's risk for developing complex, age-related diseases. The bulk of her wet lab work has focused on the role of mitochondrial genetics in the progression of late onset Alzheimer's disease; however, she also works extensively with whole genome and transcriptome data. While her passion lies in the study of Alzheimer's disease, she has extended her skill set to the study of other age-related, complex diseases using novel *in silico* and experimental approaches. She is currently the Director of Genomics Research for the Osteopathic Research Center here at UNTHSC, where she oversees genetic testing for PRECISION TEXAS, a North Texas low-back pain registry, and she collaborates closely with colleagues in the study of preeclampsia (S. Goulopoulou), immune-psychosomatic stress (H. Jones), and drug addiction (R. Shetty, M. Forster).

[August Woerner, Ph.D.](#)

Assistant Professor, Microbiology, Immunology & Genetics; **Associate Member**

Dr. Woerner is an Assistant Professor in Dr. Budowle's research group. He has a M.S. in Computer Science and Ph.D. in Genetics from the University of Arizona. His research interests are generally in the areas of computation and population genetics, with a focus in forensics, bioinformatics and machine learning. His current research projects run the gamut from streamlining bioinformatics pipelines, making them faster and more user friendly, to machine learning and statistical approaches to processing and calling sequencing data, to inference problems in population genetics and genomics.

Yan Zhang, Ph.D.

Research Assistant Professor, Microbiology, Immunology & Genetics

Dr. Zhang has interests in how the microbiome and host interact in health and disease. Her projects include tick microbiome and disease associated human microbiome, using genomic and metagenomic approaches to investigate the microbiome dynamics and understand its role in disease development (such as tick born disease, Phenylketonuria, Alzheimer's disease, inflammation after severe injury and etc). Dr. Zhang provides services for Next Generation Sequencing using IonTorrent and Miseq platform. She also develops bioinformatics and statistical tools for metagenomic analysis.

3. Requirements

Students must have completed the first semester GSBS core courses and been enrolled in a rotation with a minimum of one Genetics faculty member prior to submitting a discipline change form to the GSBS Dean's Office. Although the discipline has several uniform course requirements, we try to work with each student in tailoring a degree plan that fits his/her particular interests and goals. Students entering Genetics must enroll in the two discipline specific required courses: MIMG 6301-Molecular Genetics and MIMG 6302-Medical Genetics for the Spring semester of their first year. Students are expected to score a minimum B grade in the GSBS core courses (BMSC 6200, BMSC 6201, BMSC 6202, BMSC 6203, and BMSC 6204). A student who receives a single "C" in a GSBS core course but maintains an overall GPA of 3.0 or better after the first semester will be permitted to enter the discipline. Acceptance into the Genetics Discipline is dependent on the signing a Designation/Compact between the graduate student and a research advisor/mentor and completion of the Discipline Change Form.

Students in Genetics are required to enroll and participate in the Genetics Journal Club course (MIMG 5170) beginning in the Spring semester and during all long semesters for the duration of their enrollment. The faculty encourage students to explore the other areas of biomedical science that are available at UNTHSC. Students are advised to discuss course selection with their mentor and advisors to determine the courses from Genetics, as well as other disciplines, that are most advantageous for achieving their individual goals and objectives.

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

I Genetics Required Courses

Genetics students are required to take the following discipline specific courses:

MIMG 6301 – Molecular Genetics
MIMG 6302 – Medical Genetics

A student who receives a "C" in one of the discipline-specific required courses (MIMG 6301 or MIMG 6302) will be allowed to self-remediate the course and still take the oral qualifying exam in the Summer of year 1 or the Fall of year 2. A student who receives two or more "C's" or "F's" in the discipline-specific required courses must retake those courses in their entirety the following year. If the remediating student receives "A's" and/or "B's" upon retaking the courses, they will be allowed to take the oral qualifying exam. Remediation must be completed prior to scheduling the Oral Qualifying Exam. Failure to obtain a minimum B upon retaking in the discipline-specific required courses will result in dismissal from the Genetics Discipline.

II Journal Clubs and Seminar Courses

Students are required to enroll in each of these courses every long semester until program completion. All MS and PhD students are required to present their research in Seminar in Microbiology, Immunology and Genetics (MIMG 5140), also known as "Works in Progress or WIPs," once per year beginning in their second year.

MIMG 5140 Seminars in Microbiology, Immunology and Genetics (1SCH)
MIMG 5170 Journal Club in Genetics (1 SCH)

III Advanced Elective Courses and Technique Courses

Students are encouraged to select elective courses from the following listing in addition to offerings from other disciplines under the advice of their Advisory Committee. (4-6 SCH for M.S. students and 8-10 SCH for Ph.D. students).

- MIMG 6200 Mitochondria and Complex Diseases (2 SCH); Offered Fall
- MIMG 6210 Practical Fluorescence for Biomedical Science (2SCH); Offered Fall
- MIMG 5500 Emerging Role of the Microb. in Health & Disease (2 SCH); Offered Spring
- MIMG 6250 Molecular and Cell Biology of Cancer (2 SCH); Offered Spring
- MIMG 6206 Fundamentals of Microbiology (2 SCH); Offered Spring
- MIMG 6203 Advanced Cell Biology (2 SCH); Offered Spring
- PHRM 6440 Methods in Molecular Biology (4 SCH)
- MIMG 5201 Bioimaging (3 SCH)
- MIMG 5160 Current Topics in Cancer Biology (1 SCH)
- BMSC 6102 Grant Writing (1 SCH)

IV Degree Plans


M.S. Degree Plan for Genetics

YEAR 1	Fall	BMSC 6200 Introduction to Experimental Design and Biostatistical Methods BMSC 6201 Fundamentals of Biomedical Science I BMSC 6202 Fundamentals of Biomedical Science II BMSC 6203 Fundamentals of Biomedical Science III BMSC 6204 Fundamentals of Biomedical Science IV BMSC 5150 Lab Rotations (2) MILESTONES: (1) <i>File Request for Change of Discipline</i> (2) <i>File Major Professor Designation/Compact</i>	2 SCH 2 SCH 2 SCH 2 SCH <u>2 SCH</u> 12 SCH
	Spring	MIMG 6301 Molecular Genetics MIMG 6302 Medical Genetics BMSC 5160 Biomedical Ethics MIMG 5140 Seminars in Microbiology, Immunology & Genetics MIMG 5170 Journal Club in Genetics BMSC 5315 Principles of Scientific Communications BMSC 5109 Diversity, Equity and Inclusion in Biomedical Sciences BMSC 5998 Individual Research MILESTONES: (1) <i>File Designation of Advisory Committee</i> (2) <i>File M.S. Degree Plan</i>	2 SCH 2 SCH 1 SCH 1 SCH 1 SCH 2 SCH 1 SCH <u>2 SCH</u> 12 SCH
	Summer	BMSC 5998 Individual Research for MS Students BMSC 5108 Transferable Skills Advanced Electives and/or Technique Courses	1-5 SCH <u>1 SCH</u> <u>0-4 SCH</u> 6 SCH
YEAR 2	Fall	BMSC 5998 Individual Research for MS Students MIMG 5140 Seminars in Microbiology, Immunology & Genetics MIMG 5170 Journal Club in Genetics Advanced Electives and/or Technique Courses MILESTONES: (1) <i>File Notice of Research Proposal Seminar and Defense <u>30 days prior to proposal defense</u></i> (2) <i>Complete and file Research Proposal (Advanced to Candidacy)</i> Note: course load reduces to 9 SCH for long semesters <u>only</u> after advancement to candidacy; the degree plan from this point on assumes successful advancement in Year 2 Fall.	4-8 SCH 1 SCH 1 SCH <u>2-6 SCH</u> 12 SCH
	Spring	BMSC 5395 Thesis MIMG 5140 Seminars in Microbiology, Immunology & Genetics MIMG 5170 Journal Club in Genetics (continued enrollment in these courses until completion) MILESTONES: (1) <i>File Intent to Graduate (according to Academic Calendar deadline)</i> (2) <i>File Declaration of Intent to Defend <u>30 days prior to thesis defense</u></i> (3) <i>File Report of Final Comprehensive Examination (Defense) form</i>	7 SCH 1 SCH <u>1 SCH</u> 9 SCH
TOTAL			51 SCH

Ph.D. Degree Plan for Genetics

YEAR 1	Fall	BMSC 6200 Introduction to Experimental Design and Biostatistical Methods 2 SCH BMSC 6201 Fundamentals of Biomedical Science I 2 SCH BMSC 6202 Fundamentals of Biomedical Science II 2 SCH BMSC 6203 Fundamentals of Biomedical Science III 2 SCH BMSC 6204 Fundamentals of Biomedical Science IV <u>2 SCH</u> BMSC 5150 Lab Rotations (2) 12 SCH MILESTONES: (1) <i>File Request for Change of Discipline</i> (2) <i>File Major Professor Designation/Compact</i>
	Spring	MIMG 6301 Molecular Genetics 2 SCH MIMG 6302 Medical Genetics 2 SCH BMSC 5160 Biomedical Ethics 1 SCH MIMG 5140 Seminars in Microbiology, Immunology & Genetics 1 SCH MIMG 5170 Journal Club in Genetics 1 SCH BMSC 5315 Principles of Scientific Communications 2 SCH BMSC 5109 Diversity, Equity and Inclusion in Biomedical Sciences 1 SCH BMSC 6998 Individual Research <u>2 SCH</u> 12 SCH MILESTONES: (1) <i>File Designation of Advisory Committee;</i> (2) <i>File Ph.D. Degree Plan</i>
	Summer	BMSC 6998 Individual Research 1-5 SCH BMSC 5108 Transferable Skills <u>1 SCH</u> Advanced Electives and/or Technique Courses <u>0-4 SCH</u> 6 SCH MILESTONES: (1) <i>File Evaluation of Oral Qualifying Examination</i>
YEAR 2	Fall	BMSC 6998 Individual Research 0-10 SCH MIMG 5140 Seminars in Microbiology, Immunology & Genetics 1 SCH MIMG 5170 Journal Club in Genetics 1 SCH Advanced Electives and/or Technique Courses <u>0-10 SCH</u> 12 SCH
	Spring	BMSC 6998 Individual Research 0-7 SCH MIMG 5140 Seminars in Microbiology, Immunology & Genetics 1 SCH MIMG 5170 Journal Club in Genetics 1 SCH Advanced Electives and/or Technique Courses <u>0-7 SCH</u> 9 SCH
	Summer	BMSC 6998 Individual Research 1-5 SCH BMSC 6101 Responsible Conduct of Research <u>1 SCH</u> Advanced Electives and/or Technique Courses <u>0-4 SCH</u> 6 SCH MILESTONES: (1) <i>File Notice of Research Proposal Seminar and Defense <u>30 days prior to proposal defense</u></i> (2) <i>Complete and file Research Proposal (Advanced to Candidacy)</i> Note: These milestones may be completed in Spring or Summer of Year 2; course load reduces to 9SCH for long semesters <i>only</i> after advancement to candidacy; the degree plan from this point on assumes successful advancement by Year 2 Summer.

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YEAR 3	Fall	BMSC 6998 Individual Research MIMG 5140 Seminars in Microbiology, Immunology & Genetics MIMG 5170 Journal Club in Genetics Advanced Electives and/or Technique Courses	0-7 SCH 1 SCH 1 SCH <u>0-7 SCH</u> 9 SCH
	Spring	BMSC 6998 Individual Research MIMG 5140 Seminars in Microbiology, Immunology & Genetics MIMG 5170 Journal Club in Genetics Advanced Electives and/or Technique Courses	0-7 SCH 1 SCH 1 SCH <u>0-7 SCH</u> 9 SCH
	Summer	BMSC 6998 Individual Research Advanced Electives and/or Technique Courses	1-6 SCH <u>0-5 SCH</u> 6 SCH
YEAR 4	Fall	BMSC 6998 Individual Research MIMG 5140 Seminars in Microbiology, Immunology & Genetics MIMG 5170 Journal Club in Genetics Advanced Electives and/or Technique Courses	0-7 SCH 1 SCH 1 SCH <u>0-7 SCH</u> 9 SCH
	Spring	BMSC 6998 Individual Research MIMG 5140 Seminars in Microbiology, Immunology & Genetics MIMG 5170 Journal Club in Genetics Advanced Electives and/or Technique Courses	0-7 SCH 1 SCH 1 SCH <u>0-7 SCH</u> 9 SCH
	Summer	BMSC 6395 Doctoral Dissertation	<u>6 SCH</u> 6 SCH
YEAR 5 (onward)	Fall	BMSC 6395 Doctoral Dissertation (maintained in continuous enrollment until completed)	<u>9 SCH</u> 9 SCH
	Spring	<p>MILESTONES: (1) File Intent to Graduate (according to the posted Academic Calendar deadline)</p> <p>(2) File Declaration of Intent to Defend <u>30 days prior to thesis defense</u></p> <p>(3) File Report of Final Comprehensive Examination (Defense) form</p>  <p>Note: These may be completed at the conclusion of the semester once requirements to defend and graduate are complete (e.g., in Spring of Year 4, if requirements are met).</p>	
	Summer		
TOTAL			114 SCH

4. Advancement to Candidacy

I. Master of Science

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

The research proposal is a detailed outline of the thesis project. It must include a summary of the proposed project, the hypothesis and aims to be investigated, significance and innovation of the project, research design and methodology to be used, a review of the salient literature that supports or opposes the hypothesis, and potential limitations. To take advantage of the advisory committee's expertise and advice, and to clearly define the project and the committee's expectations, it is imperative that the student meets with his/her advisory committee before preparing the research proposal. **The research proposal should be provided to the advisory committee no later than 14 days prior to the defense.** The formal presentation and defense of the research proposal will only be to the members of the student's advisory committee. The research proposal must be approved by the advisory committee and the Dean prior to registering for Thesis (BMSC 5395). It is expected that M.S. students will complete their Research Proposal in the Fall of Year 2. Research Proposal Guidelines and the Research Proposal approval forms are available on the GSBS Forms and Guidelines website.

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

Once a master's student has successfully advanced to candidacy, he/she may use "MS Candidate" as a title on any general business correspondence such as business cards, e-mail messages, etc. In addition, the minimum number of credit hours required for full-time enrollment drops from 12 SCH to 9 SCH in long semesters.

II. Doctor of Philosophy

Doctoral students must complete the following two-part process to be advanced to candidacy. First, a discipline-based qualifying examination, designed and administered by the Discipline's graduate faculty, must be successfully completed. Second, the student must submit and defend their research proposal to their advisory committee. When successfully completed, the student is advanced to candidacy and may enroll in Doctoral Dissertation (BMSC 6395) in the first long semester immediately following approval of the research proposal and maintain continuous enrollment in this course until dissertation is defended and approved.

A. Qualifying Examination

The qualifying examination within the Genetics Discipline must be successfully completed by the end of Summer of Year 1 or Fall of Year 2. The qualifying examination ensures that a doctoral student has sufficient mastery of fundamental principles in the biomedical sciences to be successful as a Ph.D. candidate and subsequently, as an independent researcher. Topics included in the oral qualifying examination consist of fundamental understanding of biomedical sciences, genetics, experimental design, statistics and research techniques based on relevant GSBS core courses and the Genetics Discipline advanced courses.

The qualifying examination is administered by a committee comprised of members of the GSBS graduate faculty who have expertise in Genetics and the student's university member. The student will be provided the committee roster at least two weeks prior to the exam. The

committee is established by the Genetics Graduate Advisor. The committee is typically comprised of faculty members that taught in the advanced core courses and develop the exam questions as a committee. The Graduate Advisor will chair the committee, unless he/she is the major professor for the student taking the oral qualifying exam. In such a case, an alternate chair will be appointed by the graduate advisor. The student's major professor may attend the qualifying examination but may not serve on the committee, ask questions, be present during the voting, or cast a vote. The qualifying examination will be administered in the summer of the first year.

The student will be given a list of questions covering topics from core and required advanced courses. The student will be given 1 hour of preparation time to review the questions and select a specified number of questions upon which he/she will be examined. The student will address the selected topics as well as any questions from the committee that may arise from the question and answer session.

GSBS Oral qualifying Examination Procedures and Evaluation Rubrics are available on the [GSBS Forms and Guidelines website](#). Successful completion of the oral qualifying exam will be determined by the committee. If unsuccessful on the first attempt, a student may be allowed to retake the examination. The second examination should be completed within twelve weeks of the original examination, unless otherwise specified by the examination committee. If unsuccessful on the second attempt, the student will be required to transfer to the MS degree program to complete the requirements for the MS degree.

B. Research Proposal

Following the successful completion of the qualifying examination the student should meet with their advisory committee to establish a tentative timeline for their development of their research proposal and establish a tentative date for their proposal defense. All doctoral students must submit their dissertation research proposal no later than the end of the second year of study. The research proposal is an outline of the dissertation project. It must include a summary of the proposed project, the hypothesis to be investigated, significance of the project, research design and methodology to be used, and a thorough review of the salient literature that supports or opposes the hypothesis and potential limitations. To take advantage of the advisory committee's expertise and advice, students are encouraged to meet with committee members regularly during the development of their research project. Students should refer to the GSBS Research Proposal Guidelines in the preparation of their document. The written proposal must be supplied to the Advisory Committee **no less than two weeks (14 days) prior** to the scheduled proposal defense date for review. The student must prepare a formal oral presentation outlining their project, specific aims and proposed methodology in sufficient detail for the Advisory Committee to assess the scientific merit of the project. The research proposal must be approved by the Advisory Committee and the Dean prior to registering in Dissertation (BMSC 6395). Thereafter, the student is required to enroll for dissertation credit and must maintain continuous enrollment in Doctoral Dissertation (BMSC 6395) until the dissertation has been completed.

Upon completion of the qualifying exam and the research proposal, a Ph.D. student will be advanced to candidacy and he/she may use "PhD Candidate" or "Doctoral Candidate" as a title on any general business correspondence such as business cards, e-mail messages, etc. In addition, the minimum number of credit hours required for full-time enrollment drops from 12 SCH to 9 SCH in long semesters.

5. Additional Information

In addition to all of the information provided in this document, students should consult the [GSBS catalog](#) for admissions information, general degree information, and academic procedure information.