BIOMEDICAL SCIENCES (PHD)

The PhD degree program is designed to offer students the opportunity to complete didactic and laboratory studies through which they may gain the expertise to conduct independent and creative research that contributes new knowledge in an area of the biomedical sciences.

Programs

Faculty members have established formal programs of study to provide students with a structured curriculum within an area of research or a department. The Programs, approved by the Texas Higher Education Coordinating Board, provide students with a recommended series of courses appropriate for the area, collective advice on research training from the faculty members of the program, and an opportunity for interaction between students and faculty who have similar research interests.

PhD students are required to affiliate with a Program by the end of their first year of study.

The curricular recommendations developed within the Programs provide sufficient flexibility to permit students to develop an individualized program of study within the Program's framework. The Graduate School offers the following PhD Programs:

- PhD in Cancer Biology (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/cancer-biology/)
- PhD in Genetics & Epigenetics (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/genetics-epigenetics/)
- PhD in Immunology (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/immunology/)
- PhD in Medical Physics (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/medical-physics/)
- PhD in Microbiology & Infectious Diseases (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/microbiology-infectious-diseases/)
- PhD in Molecular & Translational Biology (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/molecular-translational-biology/)
- PhD in Neuroscience (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/neuroscience/)
- PhD in Quantitative Sciences (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/quantitative-sciences/)
- PhD in Therapeutics & Pharmacology (https://catalog.uth.edu/biomedical-sciences/programs/biomedical-sciences-phd/therapeutics-pharmacology/)

Curriculum

Successful students in this degree program will develop the necessary skills to conduct novel research at a professional level, learn the theoretical background for their particular area of study, and become familiar with the issues of biomedical ethics that interface with their chosen fields of study. To this end, the faculty have developed a challenging seven-step curriculum that gives the student the opportunity to attain the skills necessary to pursue a career in biomedical research. The seven steps of the curriculum include:

1. *Tutorial laboratory experiences:* This experience is primarily designed to offer a student the opportunity to select an area of research for the student's research dissertation and a mentor to guide this research. This phase of the curriculum occupies approximately one-half of the student's day for the first two semesters of study. During this time, the student must develop competence in research in three different tutorial laboratories.
2. *Breadth in the biomedical sciences:* Each student is required to develop a broad awareness of several different areas in the biomedical sciences. Most first-year PhD students are required to take GS21 1017 Foundations of Biomedical Research to satisfy the breadth requirement. The remaining PhD students take Program-specified courses to address breadth of knowledge.
3. *Depth in the biomedical sciences:* Students are required to join a GSBS Program and demonstrate knowledge in the Program area by meeting Program-specific course requirements.
4. *Appreciation of the ethical issues in biomedical research:* Each student is required to demonstrate knowledge in biomedical ethics by passing GS21 1051 Ethical Dimensions of the Biomedical Sciences. The course will provide students with a framework to recognize, examine, and resolve ethical conflicts in their professional lives.
5. *Scientific writing ability:* Each student is required to demonstrate knowledge in scientific writing either by passing GS21 1152 Scientific Writing or by passing an approved scientific writing course.
6. *Capability to formulate a significant research problem and to design a rigorous scientific plan to address it:* Through completion of the course curriculum, each student is given the opportunity to develop the skills needed to identify a significant research problem in their chosen area of research concentration and to write a research proposal aimed at rigorously investigating the problem. The attainment of this skill is demonstrated by the passing of a candidacy examination, which evaluates the ability of a student to produce a written research proposal and to defend this proposal in an oral examination. The examination also tests the student's depth of knowledge of the pertinent scientific background.
7. *Ability to perform research that significantly contributes to the scientific body of knowledge:* The student performs research and publishes it in a peer-reviewed journal. The student also writes a dissertation under the guidance of an Advisory Committee. Students must demonstrate competence in the formulation and performance of original research. After completing the research and writing the dissertation, the student must present a public seminar of the research findings and successfully defend the dissertation.

The seven steps in the curriculum of the PhD program described above represent the general GSBS academic requirements. Additional course work included in a student's program of study is selected by the student and a faculty Advisory Committee. The program of study should be selected to provide the student with educational experiences appropriate to the scientific disciplines with which the dissertation research is concerned.

General Requirements

The University of Texas MD Anderson Cancer Center UTHealth Houston Graduate School of Biomedical Sciences requires a minimum of 72 credit hours to obtain the degree of Doctor of Philosophy (PhD). Students specializing in Medical Physics must complete a minimum of 82 semester credit hours due to the extensive course requirements of

that area of concentration. Students are required to register as full-time students each term, for a minimum total of 24 credit hours earned each year. The average time to completion of the PhD degree is 5.4 years. On average, PhD students complete 135 credit hours by the completion of their degree requirements. The 72 credit-hour minimum includes:

Code	Title	Hours
GS21 1051	Ethical Dimensions of the Biomedical Sciences	1
GS00 1514	Tutorial Research Experience [1]	6
GS21 1017	Foundations of Biomedical Research [2]	7
GS21 1152	Scientific Writing [3]	2
GS00 1520 & GS00 1920	Research in Biomedical Science (P/F) and Dissertation for Doctor of Philosophy (a minimum of one year of registration for research, which includes these courses)	

1 each instance of the Tutorial Research Experience class is 2 hours, but students are required to complete the class a total of three times with three different faculty mentors

2 or required Program-specific courses

3 or another approved scientific writing course, any required Program-specific coursework

Any exceptions to this minimum credit-hour requirement must be approved by the Dean upon recommendation by the Academic Standards Committee. The majority of these 72 credit hours (i.e., over 50%), plus the majority of any additional coursework required by the Academic Standards Committee or the student's Advisory Committee, must be taken in residence at the GSBS, at other UT schools, or at an institution with which a consortium arrangement exists (i.e., Rice University, the University of Houston, Baylor College of Medicine, Texas A&M Health Science Center-Institute of Biosciences and Technology, and the Gulf Coast Consortium).

Tutorial Laboratory Requirements

PhD students must complete, with a grade of “Pass”, three different tutorial laboratory rotations under the supervision of three different GSBS faculty members.

The tutorials are each worth two credit hours (10 weeks per tutorial, 20 hours per week, or other arrangements resulting in a total of 200 hours in the laboratory) and are normally taken during the first two semesters. The tutorial laboratory experience serves the dual role of introducing the incoming student to a variety of research environments and allowing the student the opportunity to select an advisor to supervise future dissertation research.

One tutorial requirement may be waived at the discretion of the GSBS Office of Academic Affairs if:

- The student has an MS degree from another institution, provided the MS degree involved laboratory research and the preparation of a thesis; or
- The student has had laboratory research experience judged to be equivalent to a tutorial rotation; or
- The student has authored peer-reviewed publications in the biomedical sciences.

Waiver of more than one tutorial requirement will not be permitted except in extraordinary circumstances. Students wishing a tutorial waiver must submit a written request for waiver to the GSBS Office of Academic Affairs. Tutorial waivers will be considered only for students who have identified the laboratory in which they will remain for their dissertation research. Therefore, the request must also be supported by the student's proposed advisor.

PhD Students who have, prior to their enrollment in the degree program, carried out research under the employment of a GSBS faculty member, may do one required tutorial rotation under the supervision of that faculty member. In such instances the two remaining rotations must both be completed under the supervision of other GSBS faculty members. Such students will not be eligible for a third rotation waiver.

Students who previously completed an MS thesis under a GSBS faculty member may be permitted to waive the third rotation with approval of the GSBS Office of Academic Affairs after successfully completing a rotation with their MS advisor and successfully completing one rotation under the supervision of another GSBS faculty member.

Advisory Committee

Upon the completion of the tutorial rotations, the student identifies a research Advisor. The student, with the assistance of the Advisor, proposes an Advisory Committee and submits the proposal to the Academic Standards Committee for its approval. Upon approval by the Academic Standards Committee and the Dean, the Advisory Committee members are notified of their appointment. The student must meet with the Advisory Committee at least every 6 months to keep them apprised of progress toward the degree. As the student’s research progresses, a change in focus may necessitate a change in committee membership. This change must be approved by the Academic Standards Committee.

Breadth Requirement

Most PhD students are required to pass GS21 1017 Foundations of Biomedical Research. This course provides incoming graduate students with a broad overview of modern biomedical sciences, spanning historical perspectives to cutting-edge approaches. The course combines traditional didactic lectures and interactive critical thinking and problem solving exercises to provide students with a strong background in fundamental graduate-level biological topics including genetics, molecular and cellular biology, biochemistry, physiology, developmental biology and biostatistics. The remaining PhD students are required to pass Program-specific courses that are approved by the GSBS Curriculum Committee to meet this requirement.

The breadth requirement must be met before the student petitions to take the PhD candidacy examination. The goals of this requirement are to:

- Provide students with a breadth of knowledge in relevant areas of biomedical sciences,
- Enhance their critical thinking and communication skills,
- Facilitate creative collaboration between biomedical scientists trained in depth in different disciplines.

A description of the Core Course is posted on the GSBS website and is available in the GSBS Office of Academic Affairs. A listing of Program-specified breadth courses is also posted on the GSBS website and available in the GSBS Office of Academic Affairs.

Recognition of Previous Graduate Course Work to Substitute for GSBS Required Courses

Students may petition to substitute previous graduate coursework taken at another institution for any course requirement by providing documentation that the course is equivalent to the required GSBS course.

Such requests must be approved by the GSBS Office of Academic Affairs. Undergraduate-level courses are unacceptable as substitutes for GSBS courses.

Ethics Course Requirement

All students are required to pass GS21 1051 Ethical Dimensions of the Biomedical Sciences prior to petitioning for candidacy. The aim of the course is to provide students with a framework to recognize, examine, and resolve ethical conflicts in their professional lives. The course explores issues such as the commitment to truth and its breakdown; the ethics of authorship; experimentation with human and animal subjects; management of scientific data; mentor and trainee responsibilities; collaborative research peer review; conflicts of interest; biosafety and biosecurity; and the relationships of scientists to industry, society at large, and future generations. In addition, two online modules, "Data Acquisition and Management" and "Responsible Authorship and Publication" must also be successfully completed by all students.

Scientific Writing Requirement

All PhD students are required to pass GS21 1152 Scientific Writing or another approved scientific writing course, prior to petitioning for candidacy.

MS Degree Bypass

Students will be considered for a bypass of the MS degree only after satisfactory completion of the PhD candidacy examination. A recommendation from the GSBS Examination Committee that the student should be permitted to bypass the MS degree will be reviewed by the GSBS Academic Standards Committee.

Completion of the Master of Science degree is recommended for students:

- With little experience in laboratory research;
- Who have not written research papers or literature reviews;
- Who would benefit from the opportunity to pursue a research project under close supervision;
- Who need significant improvement in written and oral communication; or
- Who have not determined which biomedical problem(s) they intend to pursue independently.

The PhD Candidacy Examination: Its Purpose

The purpose of the candidacy examination is to test the breadth and depth of knowledge in the biomedical sciences. The examination is meant to be an evaluation of the student's ability to construct a hypothesis, to design the means by which to test it, and to critically analyze obtained results. The oral candidacy examination gives the student the opportunity to demonstrate:

- An understanding of the research area in which he or she is being tested;
- The ability to formulate a research problem and to comprehend its significance;
- The ability to design appropriate experimental approaches to solve the problem.

A student's performance will be regarded as satisfactory only if the student:

- Demonstrates an adequate knowledge of the field and the research specialty in which he or she is being tested;
- Identifies a significant research problem, the solution of which will make a substantial contribution to our existing knowledge;
- Makes sound judgments in formulating a rigorous experimental design and can interpret critically the results anticipated;
- Demonstrates that the experimental design and methods proposed are appropriate to solving the problem.

Petition for the PhD Candidacy Examination

Students are required to petition for PhD candidacy by the end of the second year following matriculation.

Before submitting the petition for the candidacy exam, the student must have eliminated all deficiencies identified by the student's Advisory Committee and completed the tutorials, scientific writing and ethics requirements, and either the Core Course or Program-specific required courses to meet the breadth requirement.

PhD students must pass a candidacy exam in the format required by the student's Program. Program exam requirements and guidelines are posted on the GSBS website.

PhD Candidacy Examination

All PhD students must prepare and defend a written research proposal as part of their candidacy examination. The candidacy examination tests breadth and depth of the student's understanding of a defined research area. The examination includes both written and oral components.

The candidacy examination must take place before the end of the first semester of the third year following matriculation and after the petition is approved by the Academic Standards Committee. Completion of PhD candidacy and either the bypass (or completion) of the MS degree must be achieved by the end of the third year of enrollment. PhD students who fail to do so will be placed on academic probation and their progress will be reviewed by the GSBS Academic Standards Committee to determine if further action is needed.

It is the student's responsibility to select the date, time, and place of the examination. If a member of the GSBS Examining Committee is unable to attend the examination, a substitute who meets the same criteria (e.g., outside the student's major interest) should be added. The new member must be approved by the GSBS Office of Academic Affairs.

Results of the PhD Candidacy Examination

The Chair of the GSBS Examining Committee is responsible for submitting the results of the examination to the GSBS Office of Academic Affairs for review by the GSBS Academic Standards Committee. The results of the examination will be one of the following (students are recommended to candidacy by the Academic Standards Committee and admitted to candidacy by the Dean only after review and approval of the examination results):

- **Student passes unconditionally**. The GSBS Examining Committee, where appropriate, also may recommend that a student who receives an unconditional pass may bypass the MS degree.
- **Student passes conditionally, with the conditions clearly stated, i.e., the exact nature of the deficiency/ies along with a suggested mechanism to repair the deficiency/ies**. The Examining Committee may choose to formulate the final mechanism for removing the deficiency/ies, or the Examining

Committee may at its discretion assign this responsibility to the student's Advisory Committee. Conditions must be fulfilled within one year of the exam date. The Chair of the Examining Committee must write a letter of certification to the Office of Academic Affairs when the student has resolved the conditional pass. The Chair of the Examining Committee must serve as a member of the Advisory Committee, at least until the conditional pass has been resolved. Requests for an extension of the one-year deadline, with justification by the Advisory Committee, must be submitted to the Academic Standards Committee for its approval. In all cases, conditions must be fulfilled before the student requests the defense of the PhD dissertation.

- **Student is to be re-examined at some future date before the Examining Committee will render a decision**. Results of the first exam (where it was determined that the student would be re-examined) must be submitted to the GSBS Office of Academic Affairs immediately following the exam. Specifically, in a memo to the student and the Academic Standards Committee, the Chair of the Examining Committee should describe areas that need improvement, areas of strength, conditions for re-exam and a deadline for the re-exam (maximum one year after original exam). The Exam Committee for the re-evaluation must be composed of the same faculty members that conducted the first exam. Upon re-examination, the Committee may only elect to Unconditionally Pass or Fail the student. Students may be re-examined only once. The Chair of the Examining Committee must separately communicate to the Office of Academic Affairs the result of the re-exam. If the student fails to successfully complete the re-examination prior to the deadline determined by the Examining Committee (not to exceed one year from the first examination), the Academic Standards Committee will dismiss the student from the PhD program.
- **Student fails**. Failure of the examination means the Examining Committee has determined the student has not demonstrated the requisite potential to complete the PhD program, and the Academic Standards Committee will dismiss the student from the PhD program. The Academic Standards Committee may, at its discretion, determine that the student will be permitted to continue towards a terminal MS degree. Subsequent to dismissal, the student may re-apply to the School after one year; the application will be considered in competition with other applications pending at the time.

Registration for PhD Dissertation

After being admitted to candidacy for the PhD degree, the student is permitted to register for GS00 1920 Dissertation for Doctor of Philosophy. The student must register for at least one semester of Dissertation before becoming eligible for the PhD dissertation defense. The student must be registered for Dissertation in the final semester in which requirements are completed.

Expectations for the PhD Dissertation

The following are expectations for the PhD dissertation, established by the GSBS Faculty. They are based on the Council of Graduate Schools' publication, *Requirements for the PhD: A Policy Statement* (Washington: Council of Graduate Schools in the United States, 1979 – used with permission of the CGS).

Nature and Purpose

The doctoral dissertation is the final and most important component of the series of academic experiences, which culminate in the awarding of the PhD degree. Four major functions are fulfilled by the dissertation experience:

- It is a work of original research or scholarship which makes a contribution to existing knowledge;
- It is an educational experience which demonstrates the candidate's mastery of research methods and tools of the specialized field;
- It demonstrates the student's ability to address a major intellectual problem and arrive at a successful conclusion; and
- It demonstrates that the student possesses the potential to function as an independent researcher.

In view of the wide range of fields of knowledge in which the PhD degree is awarded, it is not feasible to set specific requirements and standards for this degree. Nevertheless, there is a general -- and usually explicitly stated -- agreement among American universities that the doctoral dissertation should be a distinct contribution to knowledge, and of sufficient value to warrant its publication in a reputable journal, or as a book or monograph.

Relationship with MS Thesis

GSBS students may utilize a MS degree project as the basis of the hypotheses to be tested by the doctoral research. The PhD dissertation must not include data that are part of the MS thesis. Data from the MS thesis may be included in the dissertation as part of the Introduction or as an appendix. In all cases, data from the MS thesis must be identified clearly as originating from the previous work. Furthermore, the PhD dissertation must have a title that is distinct from the MS thesis.

Defense of the PhD Dissertation

At a time deemed appropriate by the Advisory Committee, the student will submit a complete draft of the dissertation to each member of the Advisory Committee, together with the form requesting to defend the PhD dissertation. The completed defense form and a one-page summary of the research must be submitted to the GSBS Office of Academic Affairs. The dissertation defense will be held no sooner than two weeks nor later than three months after the request form is received by the Office of Academic Affairs and approved by the Dean.

- Prior to the defense, students who matriculated prior to Summer 2014 must submit at least one first-authored paper related to their education and research at GSBS to a peer-reviewed journal for publication.
- Students who matriculated in Fall 2014 and thereafter must also submit at least one first-authored paper related to their education and research at GSBS to a peer-reviewed journal for publication prior to the defense, and the paper must be accepted for publication prior to graduation.
- The student's Advisory Committee must approve the quality of the journal for the required publication.
- A request for exception to these policies must be recommended by the Advisory Committee or the Academic Standards Committee and approved by the Dean.

Guidelines for the PhD Dissertation Defense

The purpose of the dissertation defense is to provide a consistent and complete evaluation of the dissertation and the student's understanding

of the research, as well as the student's ability to report information to the scientific community in a well-organized and interesting form.

An announcement of the defense will be distributed by electronic mail to all GSBS students and faculty.

Guidelines for the defense are:

- The student will deliver a 45- to 60-minute public presentation on campus, including a detailed description of the background, rationale, materials and methods, results, and conclusions appropriate to the research. Following the presentation, the student will respond to questions from the audience.
- Immediately thereafter, and at a location announced at the end of the seminar, the Advisory Committee will examine the student on the dissertation. Any member of the GSBS Faculty who attends the public presentation may participate in the examination to the extent described below. Others wishing to attend must be approved by the Advisory Committee.
- The student's Advisor will serve as moderator of the examination. The student will be expected to respond to questions from those attending on any aspect of the written dissertation or the material presented at the public presentation.

After the examination, the student will meet privately with the Advisory Committee to discuss the results. Finally, the Advisory Committee will determine what recommendation to make to the Dean and the Academic Standards Committee. The Committee may conclude that the student has passed, or it may require additional research, modifications to the dissertation, and/or another defense. The results of this meeting will be communicated through the GSBS Office of Academic Affairs to the Dean and the Academic Standards Committee for their information and approval.

Within one week of the dissertation defense, any member of the GSBS Faculty who has read the student's dissertation and has attended the defense may write directly to the Dean to provide an evaluation of the student's performance. In reaching a final decision on whether to award the PhD or require further work and/or another defense, the Dean will take into consideration the recommendation of the Advisory Committee and other comments received from GSBS Faculty. In particular cases, the Dean may solicit additional evaluations of the dissertation from experts in the field either within or outside the GSBS Faculty. Should a concern be raised by a GSBS faculty member about a student's performance, the decision of the Dean will be communicated to the student and the Advisory Committee within one month of the dissertation defense.

Approval of the Dissertation

All members of the Advisory Committee are expected to sign the student's dissertation to demonstrate their approval of the document. If any member refuses to sign the dissertation, the Academic Standards Committee will consider the matter and provide a recommendation to the Dean. In deciding whether to approve the dissertation, the Dean will take into consideration the recommendations of the Advisory Committee and the Academic Standards Committee. In particular cases, the Dean may solicit additional evaluations of the dissertation from experts in the field either within or outside the GSBS Faculty.

Completion of the PhD Requirements

The PhD degree is not awarded until the student has completed the following requirements:

- Successfully defended the dissertation;
- The final dissertation, approved by the Advisory Committee, is submitted electronically to the GSBS Office of Academic Affairs for the Dean's approval;
- The first-authored paper requirement has been met, if applicable, and
- All exit forms are completed and submitted to the GSBS Office of Academic Affairs.

The student must be registered for *Dissertation* in the final semester in which requirements are met.

Students must also complete a form indicating the dissertation-related research areas to be listed on the diploma. Students may request to list none, one or two areas on the diploma. If areas are listed, the first must be the Program with which the student is affiliated. The second area must correspond to one of the other GSBS Programs approved by the Texas Higher Education Coordinating Board and must overlap with the student's dissertation research topic. Any areas listed on the diploma must be approved by the director of the corresponding Program. Any second area must also be approved by the GSBS Academic Standards Committee.

The degree will be issued as of the final day of the semester in which all degree requirements have been met. The PhD degree must be completed within seven years of first registration in GSBS. Students may continue registration in GSBS after the seven-year limit only with the express written permission of the Dean.