

TEXAS TECH UNIVERISTY
HEALTH SCIENCES CENTER
Graduate School of Biomedical Sciences

Guidelines and Requirements for Graduate Students
Biomedical Sciences Ph.D. Program

I. General Information:

The Doctor of Philosophy (Ph.D.) in Biomedical Sciences program is offered on the Lubbock campus only. All students enter this degree program with an undeclared concentration. Students complete the core curriculum and rotate in faculty labs prior to selecting a specific concentration and research mentor. The Biomedical Sciences Ph.D. program offers four concentrations: Biochemistry, Cellular, and Molecular Biology; Immunology and Infectious Disease; Molecular Biophysics; Translational Neuroscience and Pharmacology. Specific employment opportunities for graduates include faculty and research positions in academia, biotechnology, pharmaceutical industries, governmental agencies and governmental appointments.

II. General Program Requirements:

A. Curriculum:

- i. Core Curriculum: (Year 1 Fall Semester)
 - a. Core I: GSBS 5471-Molecules
 - b. Core II: GSBS 5372-Cells
 - c. Core III: GSBS 5373-Genes
 - d. Core IV: GSBS 5174-Biomedical Seminar Series
 - e. Core V: GSBS 5275-Introduction to Biomedical Research
- ii. Interprofessional Practice and Education (IPE): Institutional Requirement
 - a. GSBS 5000-Interprofessional Collaborative Practice (Year 1 Fall Semester)
 - b. IPE Learning Activity: Must be completed prior to degree completion.
- iii. Lab Rotations: (Year 1 Spring and Summer Semesters)
 - a. GSBS 5098-Techniques in Biomedical Research
 - b. All students are required to complete three lab rotations prior to declaring a concentration and choosing a lab.
- iv. Responsible Conduct of Research
 - a. GSBS 5101-Responsible Conduct of Research
 - b. Offered during spring semesters only.
- v. Statistics:
 - a. GSBS 5210-Biomedical Statistics
 - b. Offered during spring semesters only.
- vi. Minimum required hours for degree completion: 72 credit hours
 - a. Didactic coursework: 48 credit hours
 - b. Research coursework: 12 credit hours
 - c. Dissertation coursework: 12 credit hours

B. Dissertation:

Doctoral dissertation is required of every candidate for a doctoral degree. The doctoral dissertation defense is open to the public and presented as a seminar followed by a closed-door oral defense with the advisory committee. The dissertation must demonstrate a mastery of research techniques, a thorough understanding of the subject matter and its background, and a high degree of skill in organizing and presenting the materials. The dissertation is presented in a scholarly manuscript and should embody a significant contribution of new information to a subject or a substantial reevaluation of existing knowledge. The dissertation work is continually under the supervision of the advisory committee and any other faculty members the committee or the GSBS office deem necessary.

For detailed information on dissertations, please see the GSBS catalog.

C. Filing a Degree Plan:

The doctoral degree plan will be submitted to GSBS during the Spring semester of the second year. Revisions to the degree plan are permitted as needed by submitting the Changes to the Degree Plan form to GSBS.

D. First Authored Paper:

Every doctoral student is required to publish an original peer-reviewed research paper to demonstrate that the student has made a significant contribution to science based on work accomplished during their doctoral program.

- i. Review articles are not an acceptable contribution
- ii. The manuscript must be accepted (or accepted pending minor revisions), in press or published before submission of the Approval to Schedule Defense Form.
- iii. The manuscript must be in a journal indexed by PubMed or Web of Science.
- iv. The student must be the “first author” or share “first authorship” with a co-author of the manuscript.
- v. The work must be completed during the current degree program. Manuscripts published during a previous degree program will not fulfil this requirement.
- vi. Waiver to Schedule Defense:

If there are compelling reasons that the student will not have a published first authored manuscript when the approval to schedule defense form is submitted, the dissertation committee chair may request a waiver from the GSBS Dean.

- a. In considering the waiver request there are three stipulations:
 1. The student’s mentor and advisory committee must consider the manuscript draft suitable for a first author (or co-first author) publication.
 2. The reasons for the delay must be explained
 3. The waiver only allows the student to schedule the defense.
- b. The GSBS Dean may grant a waiver based on the information above.

- c. The manuscript must be accepted or in press in order for the defense to take place.
- E. Full Time Study: Graduate students are required to be enrolled in full time study throughout their degree program. Please see the GSBS Course Catalog for full details.
- F. Graduate Advisor, Advisory Committee, and Student Progress Assessment:
 - i. The concentration Graduate Advisor, Student Affairs Advocate, and mentor (if available) will meet with each student at least once a year to monitor the students progress and/or address any academic issues.
 - ii. The student will meet with their advisory committee at least twice a year.
 - a. The student is required to take committee meeting minutes for each meeting.
 - b. The student will submit a copy of the meeting minutes to the Student Affairs Advocate once the minutes have been approved by the advisory committee.
 - iii. The student will meet with the GSBS Student Affairs Advocate every semester prior to advanced registration and as needed.
 - iv. Please refer to each concentration's specific advisory committee member requirements below.
- G. Qualifying Examination:

The purpose of the qualifying examination is to ensure the students have mastered the fundamentals in their major area of interest and they are adequately prepared to begin working full-time on doctoral research project. The examination requires a synthesis and application of knowledge acquired during the course of study for the doctoral degree; consequently, successful performance in course work does not necessarily guarantee successful performance on the qualifying examination.

- i. Eligibility to Stand for the Qualifying Examination:
 - a. Approved degree plan on file with the GSBS office.
 - b. Completion of core coursework and majority of additional coursework as prescribed by the approved degree plan.
 - c. Approval from the advisory committee.
- ii. Qualifying Examination Committee and Examination Chair
 - a. The qualifying examination committee will consist of the members from the student's advisory committee
 - b. The examination committee will elect an examination chair.
 - c. The mentor is not eligible to chair the examination committee.
- iii. Deadline:
 - a. Students must successfully complete and pass all examination components by the end of their third year.
 - b. A petition for an extension should be made by the mentor and approved by the GSBS Dean.
 - c. Failure to meet the deadline and the absence of extenuating circumstances will result in dismissal from the GSBS doctoral degree program.

- iv. Examination Information:

The qualifying examination will consist of two components; written and oral. The qualifying examination topic may be on any relevant research area but may not be the aims of an existing or submitted research proposal from the mentor or anyone other than the student

 - a. Written Component:

The written portion of the examination will be written in F30/F31 or R21 NIH grant format. The written component must be passed before the oral component can be scheduled
 - b. Oral Component:

The qualifying examination oral component should be presented as a typical public seminar (40-45 minutes) followed by an open Q&A discussion that will not exceed 15 minutes. The presentation will be followed by a closed-door committee examination with the qualifying examination committee.
 - c. Examination Voting:

The qualifying examination committee will vote (pass/fail) on both written and oral components

 - 1. More than one negative vote for an examination component will result in failure of the examination component.
 - 2. Each exam component (written and oral) can be remediated once.
 - 3. Failure to pass all exam components will result in dismissal from their degree program or they may be eligible to graduate with a non-thesis master's degree if they are in good standing and have met all degree requirements.
- v. Examination Timeline:
 - a. Year 1
 - 1. Definition of Year 1:
 - a. Ph. D. students: year 1 begins the year the student enters GSBS
 - b. M.D./Ph.D. students: year 1 begins when the student enters the Ph.D. portion of their program, after completing USMLE Step 1.
 - 2. Declare concentration and select a mentor
 - 3. Students and mentors establish an advisory committee.
 - b. Year 2 or Year 3
 - 1. Received approved degree plan from GSBS.
 - 2. Consensus is reached by the advisory committee that the student is ready to prepare their written portion of the qualifying examination.
 - 3. The student prepares and submits a one-page abstract and/or specific aims of the proposed topic to the advisory committee for approval
 - 4. The student notifies the Graduate Advisor and Student Affairs Advocate of the composition of the qualifying

examination committee no later than 3 months before the examination.

- c. Qualifying examination written component is submitted to the committee.
 1. The examination committee submits to the committee chair within 2 weeks a pass or fail/revision memo.
 2. If the student doesn't receive more than one negative vote, this will constitute passing of the written component. The student will move forward with scheduling the oral component of the qualifying examination.
 3. If the student receives more than one negative vote, this will constitute a failure of the written component. The student may submit one revised written component which is then voted as pass/fail. More than one negative vote will constitute failure of the written component and a failure of the qualifying examination.
- d. Qualifying examination oral component is scheduled.
 1. The oral component is presented in a public seminar setting followed by an oral exam with the committee.
 2. The oral exam must take place within 4 weeks of receiving a passing grade on the written exam.
 3. The oral exam must take place within an active term (between the start and end dates of a term) and during regular business hours.
 4. Only one committee member may be absent from the oral component. If the committee chair is absent a new chair will be chosen.
- e. Procedure for Successful Qualifying Examination:

If the qualifying examination is considered successful, the committee chair of the qualifying examination committee will send a completed Admission to Candidacy form to the GSBS office for consideration by the Graduate Council. The recommendation should be forwarded as soon as possible after all the above requirements have been met.
- f. Procedure for Unsuccessful Qualifying Examination:

If the qualifying examination is not considered successful, the committee chair will notify the GSBS office in writing. Failure to complete/pass the qualifying examination within the specified time (by the end of the third year) will result in dismissal from the program, irrespective of the performance in other aspects of doctoral study.
- vi. Admission to Candidacy

Authority for admitting an applicant to candidacy for a doctoral degree is vested in the Graduate Council. The advisory committee can submit an admission to candidacy request after the student has successfully completed

their qualifying examination to the GSBS office. The request will then be submitted to the Graduate Council for approval.

For detailed information on admission to candidacy, please see the GSBS catalog.

H. Research Assistantships:

Upon matriculation, all doctoral students will be employed as a research assistant.

For detailed information on research assistantships, please see the GSBS catalog.

III. Concentration Specific Information and Requirements:

A. Undeclared

Students in the Biomedical Sciences Ph.D. program enter as undeclared, complete the core curriculum, and rotate in faculty labs prior to selecting a mentor and concentration.

Each student will meet with the First-year Student PhD Advisor before or after new student orientation to discuss the year 1 course selections, lab rotations, GSBS policy for selecting a concentration and other academic issues.

i. Core Curriculum Overview:

All biomedical science fields recognize the need for high levels of integration of scientific knowledge to accelerate opportunities for basic and translational research. Toward that end, full-time research is preceded by a curriculum that introduces scientific facts and provides opportunities for the development of critical thinking, synthesis of information, development of factual knowledge, and the ability to read and comprehend original literature. These skills serve as a foundation for all concentrations/programs in GSBS.

a. Core Curriculum Courses:

1. GSBS 5471-Core 1: Molecules-This course offers a broad coverage of biochemistry with an emphasis on structure and function of macromolecules, biosynthesis of small molecule precursors of macromolecules, and the pathways of intermediary metabolism.
2. GSBS 5372-Core II: Cells-The structure/function relationships that underlie basic cellular processes, including translation protein trafficking, cytoskeletal organization and motility, cell adhesion, and cell division.
3. GSBS 5373-Core III: Genes- Teaches essential scientific concepts underlying the field of molecular biology and molecular genetics.
4. GSBS 5174-Core IV: Biomedical Seminar Series- Students will attend and participate in seminars.
5. GBSB 5275-Core V: Introduction to Biomedical Research- Introduces the first-year graduate student to the fundamental principles and techniques in basic biomedical research.

b. Opting Out of Core Curriculum Courses:

Students who have a master's degree in a biomedical or biological sciences discipline may request to opt out of the individual core

courses; Core I, Core II, or Core III. Core IV and Core V may not be waived. A waiver request to the GSBS Dean must come from the GSBS Senior Associate Dean. When applicable, the request should include a course syllabus and grade received for each course that is considered equivalent to the course course(s) for which a waiver is requested. The waiver request must be made prior to the first day of class. The request will be reviewed by the course director of the course requesting to be waived and the recommendation evaluated by the Core Curriculum Coordination (CCC) Committee. The GSBS office will notify the student and graduate advisor prior to the census date of the term. While the waiver is pending, the student must audit the core course with the pending waiver request.

ii. Probation and Dismissal

All students are required to maintain a minimum overall grade point average (GPA) of 3.0. If a student fails to maintain the required minimum GPA, they will be placed on academic probation. For more information, please refer to the GSBS catalog.

- a. Students may be placed on probation for not completing the core courses within the first term.
- b. Students may not drop a core course for academic reasons (reasonable exceptions will be made for illness, etc., at the discretion of the GSBS Dean).
- c. Students receiving a grade of C or below in Core I, Core II, or Core II will be required to repeat the course.
- d. Students receiving grades of C or below in two or more core courses will be at risk of dismissal.

iii. Tutoring

Group tutoring is available through the GSBS office. Once tutoring dates have been scheduled, the students will be notified. Some group tutoring is also available and conducted by course directors or organized through the Graduate Student Association (GSA).

iv. Other Requirements

- a. Students are required to complete two lab rotations, however at least three rotations are recommended before selecting a mentor and concentration.
- b. The earliest students may select a mentor and concentration is the last day of the first Fall term. Additional lab rotations will occur during the following terms until a mentor and concentration is declared.
- c. Students must select a mentor and concentration by the end of the first Summer term.

B. Biochemistry, Cellular and Molecular Biology (BCMB)

The Biochemistry, Cellular and Molecular Biology concentration prepares students for careers in the fields of biochemistry, cellular, developmental, and molecular

biology. Dissertation topics in this concentration vary widely. Examples include regulation of gene expression, development and regeneration of the nervous system, protein amyloidogenesis, and tumor microenvironment in cancer progression.

- i. Additional Required Coursework:
 - a. GBCM 6320: Advanced Cell Biology
 - b. GBCM 6333: Advanced Protein Biochemistry
 - c. GBCM 5130: Research Presentation Skills
 1. Enrollment required every Spring term.
 2. Minimum of 4 credit hours
 3. Students must present a research presentation as a part of BCMB/CBB student seminars in the spring term.
 4. Students must present a research poster during Student Research Week.
 - d. GBCM 7101: Seminar
 1. Enrollment required every Fall and Spring term
 2. Minimum of 4 credit hours
 3. Students must attend at least 15 qualified seminars each term.
 - e. GBCM 7000: Research
 1. Enrollment required every term until the student transitioned to dissertation coursework.
 2. Minimum of 12 credit hours
 - f. GBCM 8000: Dissertation
 1. Enrollment required from starting term of dissertation coursework until graduation.
 2. Minimum of 12 credit hours
 - g. Electives:
 1. 12 credit hours
 2. To be determined by mentor and advisory committee.
- ii. Advisory Committee Requirements
 - a. Committee shall be composed of at least four graduate faculty members (although at least five is preferable)
 1. At least three graduate faculty members from the BCMB concentration.
 2. At least one graduate faculty member from outside the concentration, qualified faculty from other institutional, or qualified professionals who have or received formal GSBS membership.
 - b. Student committee meetings are mandatory and will be required twice a year, without excuse. Scheduling is the responsibility of the student and mentor. The GSBS office and the graduate advisor will monitor the committee meetings. The student is required to provide a handout to the mentor and committee at least one week before the meeting that summarizes the goals of the project and details of progress made since the last meeting.

- c. Committee meeting minutes will be detailed. Minutes will specifically note any problems and demands made by the committee and/or mentor along with a timeline for addressing these issues. Minutes must be filed with both the GSBS office and the CBB department. Problems with students or their progress are expected to be documented in detail in the committee meeting minutes. Problems that cannot be resolved by the student, mentor and committee, will be resolved by a special meeting between the student, mentor, committee, graduate advisor and department chair.

C. Immunology and Infectious Disease (IID)

The Immunology and Infectious Diseases concentration integrates several disciplines, such as immunology, bacterial pathogenesis, virology, and parasitology. Dissertation topics in this concentration vary widely. Examples include microbial pathogenesis, biofilms, multi-drug resistance, and tumor antigen identification.

- i. Additional Required Coursework:
 - a. Two of the three Fundamental Micro and Immunology courses.
 - 1. GBTC 5212: Fundamentals of Bacteriology
 - 2. GBTC 5213: Fundamentals of Virology/Parasitology
 - 3. GBTC 5214: Fundamentals of Immunology
 - b. Two upper level Micro/Immunology courses
 - 1. GIID 6324: The Molecular Biology of Pathogenic Bacteria
 - 2. GIID 6325: Advances in Virology
 - 3. GIID 6329: Advances in Immunology
 - 4. GIID 6335: The Pathogenesis of Infectious Disease
 - 5. GIID 6340: Mucosal Immunology
 - c. GIID 7101: Seminar
 - 1. Enrollment required every Fall and Spring term
 - 2. Minimum of 7 credit hours
 - 3. Students must attend at least 15 qualified seminars each term.
 - d. GIID 7000: Research
 - 1. Enrollment required every term until the student transitioned to dissertation coursework.
 - 2. Minimum of 12 credit hours
 - e. GIID 8000: Dissertation
 - 1. Enrollment required from starting term of dissertation coursework until graduation.
 - 2. Minimum of 12 credit hours
 - f. Electives:
 - 1. 11 credit hours
 - 2. To be determined by mentor and advisory committee.
- ii. Advisory Committee Requirements
 - a. Committee shall be composed of at least four graduate faculty members (although at least five is preferable)

1. At least three graduate faculty members from the IID concentration.
 2. At least one graduate faculty member from outside the concentration, qualified faculty from other institutional, or qualified professionals who have or received formal GSBS membership.
- b. Student committee meetings are mandatory and will be required twice a year, without excuse. Scheduling is the responsibility of the student and mentor. The GSBS office and the graduate advisor will monitor the committee meetings. The student is required to provide a handout to the mentor and committee at least one week before the meeting that summarizes the goals of the project and details of progress made since the last meeting.
 - c. Committee meeting minutes will be detailed. Minutes will specifically note any problems and demands made by the committee and/or mentor along with a timeline for addressing these issues. Minutes must be filed with both the GSBS office and the IID department. Problems with students or their progress are expected to be documented in detail in the committee meeting minutes. Problems that cannot be resolved by the student, mentor and committee, will be resolved by a special meeting between the student, mentor, committee, graduate advisor and department chair.

D. Molecular Biophysics (MBP)

The Molecular Biophysics concentration is geared towards students who have a primary research interest in studying the structure of membrane proteins and their function in health and disease, as well as utilizing cellular and molecular approaches to study these areas. Dissertation topics in this concentration include ion transport and the role of ligand- and voltage-gated potassium channels in normal physiological and pathophysiological conditions, structure/function correlations and structural modeling of ion channels and transporters, and structure-function studies of proteins involved in membrane traffic and fusion.

- i. Additional Required Coursework:
 - a. GMBP 5321: Biochemistry and Biophysics of Membranes
 - b. GMBP 7101: Seminar
 1. Enrollment required every Fall and Spring term
 2. Minimum of 8 credit hours
 - c. GMBP 7102: Readings
 1. Enrollment required every Fall and Spring term
 2. Minimum of 8 credit hours
 - d. GMBP 7000: Research
 1. Enrollment required every term until the student transitioned to dissertation coursework.
 2. Minimum of 12 credit hours
 - e. GMBP 8000: Dissertation

1. Enrollment required from starting term of dissertation coursework until graduation.
 2. Minimum of 12 credit hours
- f. Electives:
1. Required hours will vary
 2. To be determined by mentor and advisory committee.
- ii. Advisory Committee Requirements
- a. Committee shall be composed of at least four graduate faculty members (although at least five is preferable)
 1. At least three graduate faculty members from the MBP concentration.
 2. At least one graduate faculty member from outside the concentration, qualified faculty from other institutional, or qualified professionals who have or received formal GSBS membership.
 - b. Student committee meetings are mandatory and will be required twice a year, without excuse. Scheduling is the responsibility of the student and mentor. The GSBS office and the graduate advisor will monitor the committee meetings. The student is required to provide a handout to the mentor and committee at least one week before the meeting that summarizes the goals of the project and details of progress made since the last meeting.
 - c. Committee meeting minutes will be detailed. Minutes will specifically note any problems and demands made by the committee and/or mentor along with a timeline for addressing these issues. Minutes must be filed with both the GSBS office and the MBP department. Problems with students or their progress are expected to be documented in detail in the committee meeting minutes. Problems that cannot be resolved by the student, mentor and committee, will be resolved by a special meeting between the student, mentor, committee, graduate advisor and department chair.

E. Translational Neuroscience and Pharmacology (TNP)

The Translational Neuroscience and Pharmacology concentration facilitates graduate study in several areas, including systems and cellular neuropharmacology and neuroscience, molecular pharmacology, biochemistry, and neurobiology of disease. Dissertation topics in this concentration vary widely. Examples include pain mechanisms and therapies in various preclinical models (arthritis, multiple sclerosis, HIV, chemotherapy and nerve injury-induced neuropathic pain), alcohol abuse disorders, neurodegenerative disorders (Alzheimer's disease), and anti-neoplastic drug development and mechanisms of drug resistance.

- i. Additional Required Coursework:
 - a. GTNP 5303: Principles of Translational Neuroscience and Pharmacology
 - b. GTNP 7101: Seminar
 1. Enrollment required every Fall and Spring term

2. Minimum of 8 credit hours
 - c. GTNP 7102: Readings
 1. Enrollment required every Fall and Spring term
 2. Minimum of 8 credit hours
 - d. GTNP 7000: Research
 1. Enrollment required every term until the student transitioned to dissertation coursework.
 2. Minimum of 12 credit hours
 - e. GTNP 8000: Dissertation
 1. Enrollment required from starting term of dissertation coursework until graduation.
 2. Minimum of 12 credit hours
 - f. Electives:
 1. Required hours will vary
 2. To be determined by mentor and advisory committee.
- ii. Advisory Committee Requirements
- a. Committee shall be composed of at least five graduate faculty members (although at least five is preferable)
 1. At least three graduate faculty members from the MBP concentration.
 2. At least two graduate faculty members from outside the concentration, qualified faculty from other institutional, or qualified professionals who have or received formal GSBS membership.
 - b. Student committee meetings are mandatory and will be required twice a year, without excuse. Scheduling is the responsibility of the student and mentor. The GSBS office and the graduate advisor will monitor the committee meetings. The student is required to provide a handout to the mentor and committee at least one week before the meeting that summarizes the goals of the project and details of progress made since the last meeting.
 - c. Committee meeting minutes will be detailed. Minutes will specifically note any problems and demands made by the committee and/or mentor along with a timeline for addressing these issues. Minutes must be filed with both the GSBS office and the TNP department. Problems with students or their progress are expected to be documented in detail in the committee meeting minutes. Problems that cannot be resolved by the student, mentor and committee, will be resolved by a special meeting between the student, mentor, committee, graduate advisor and department chair.