

INTEGRATED BIOMEDICAL SCIENCES (IBMS)

Overview

This Overview is designed 1) to describe the academic and administrative structure that serves as the framework for the IBMS Graduate Program, and 2) to define for IBMS Ph.D. students and faculty mentors the mechanics for meeting programmatic expectations and successfully achieving the academic and research milestones required for graduation. Information provided herein is limited to essential elements of the Program; additional details may be found in the *IBMS Handbook of Policies and Procedures* posted on the IBMS website.

The Integrated Biomedical Sciences (IBMS) Graduate Program is a dynamic, integrated, multidisciplinary program structured as seven thematic disciplines led by faculty from across numerous basic science and clinical departments. The academic organization of the IBMS Graduate Program is shown below as part of UT Health San Antonio and divided into 7 academic/research disciplines.

Academic Organization

UT Health San Antonio
 #
 Graduate School of Biomedical Sciences
 #
 Integrated Biomedical Sciences (IBMS) Graduate Program
 #
 7 academic/research disciplines
 #
 Biochemical Mechanisms in Medicine (BMM)
 Biology of Aging (BA)
 Cancer Biology (CB)
 Cell Biology, Genetics, & Molecular Medicine (CGM)
 Molecular Immunology & Microbiology (MIM)
 Neuroscience (NS)
 Physiology & Pharmacology (P&P)

The primary mission of the IBMS Graduate Program is to train Ph.D. students to become highly skilled thinkers and problem solvers who are thoroughly prepared to successfully enter and sustain careers in research and education. Students matriculating into the IBMS Graduate Program are given the opportunity to select a dissertation mentor from among the many IBMS Graduate Faculty, to customize their educational experiences, and to pursue their unique research interests and professional aspirations.

Faculty Mentoring. Based on the research interests of individual members of the IBMS Graduate Faculty, seven thematic “disciplines” have been designated that provide a structure and mechanism to foster interactions and facilitate teaching and research collaborations among faculty members with common interests. Therefore, each faculty member has an affiliation with one or more IBMS discipline(s).

The 7 thematic IBMS disciplines (brief descriptions can be found below and on the IBMS website):

- Biochemical Mechanisms in Medicine (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/biochemicalmechanismsofmedicine/>) [BMM]

- Biology of Aging (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/biology-aging/>) [BA]
- Cancer Biology (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/cancer-biology/>) [CB]
- Cell Biology, Genetics & Molecular Medicine (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/cellbiology-genetics-molecularmedicine/>) [CGM]
- Molecular Immunology & Microbiology (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/molecular-immunology-microbiology/>) [MIM]
- Neuroscience (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/neuroscience/>) [NS]
- Physiology & Pharmacology (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/physiology-pharmacology/>) [PP]

Only members of the IBMS Graduate Faculty may serve as dissertation mentors for IBMS graduate students. In order to join the IBMS Graduate Faculty, candidates must demonstrate credentials indicating that they are prepared to offer effective student mentoring, sufficient research resources, and a laboratory environment and research projects appropriate for the training of graduate students. Following review and approval by the IBMS COGS (see below), all faculty members with full-time UT Health San Antonio appointments are eligible to be appointed to the IBMS Graduate Faculty. An individual from non- UT Health San Antonio institutions may also be eligible for appointment to the IBMS Graduate Faculty, but must first receive an adjunct appointment to the faculty of a UT Health San Antonio department before consideration.

Student Training. Although each IBMS graduate student has access to all offerings of the IBMS Graduate Program, all students are required to identify one of the disciplines of the Program as a “primary discipline-of-interest”, and each student will follow the core curriculum (Plan of Study) provided by the executive leadership of the chosen discipline. The Plans of Study may vary slightly from discipline-to-discipline, but all Plans guarantee that the needs and preparation of each student are satisfied. Also, appropriate coordination and communication is in place to ensure that discipline activities remain consistent with the expectations and requirements of the IBMS Graduate Program.

Administrative Structure and Responsibilities. The IBMS Committee on Graduate Studies (COGS) is the primary governing body of the IBMS Graduate Program and is responsible for developing policies and procedures for the Program, monitoring and maintaining the academic progress of all IBMS students, and overseeing the activities of the IBMS Student Admissions Committee, IBMS Student Recruitment Committee and the IBMS Curriculum Committee. The IBMS COGS provides the organization and facilitates the communication between students and faculty, and among faculty members of all disciplines, in order to promote the primary missions of the IBMS Graduate Program and to ensure consistency, cohesiveness, integration and quality control across disciplines.

Each Discipline has a Discipline Executive Committee that is responsible for directing, monitoring and evaluating all aspects of a student’s graduate education, and ensuring that the policies and procedures established by the IBMS COGS are followed. Each Discipline is responsible for implementing its Plan of Study and for monitoring the conduct of its students. As part of the execution of its responsibilities, Disciplines

report student progress to the IBMS COGS (e.g., reports of major student advances or failures in academic progress such as Qualifying Exam results, Admission to Candidacy, Research Progress, Defense of Dissertation, etc.) and, where appropriate, seek COGS approvals. Although the overall structure and procedures of the individual disciplines are designed to promote integration and collaboration among the disciplines, in order to provide the most effective training to its students, there are some expectations that are “discipline-specific”. Furthermore, although the Disciplines of the IBMS Graduate Program are not academically aligned with any specific department, strong administrative relationships with the departmental structure is maintained.

Brief Discipline Descriptions (detailed descriptions can be found on the IBMS website)

Biochemical Mechanisms in Medicine (BMM). The Biochemical Mechanisms in Medicine (BMM) discipline focuses on the molecular mechanisms underlying fundamental life processes ranging from DNA replication and repair, RNA/DNA epigenetics, protein folding and complex assembly, intercellular communication and signaling networks, and host defense against pathogens. Dysfunctions in these processes often give rise to debilitating conditions such as cancer, neurological disorders, developmental abnormalities, infectious diseases, and metabolic syndromes. BMM laboratories place special emphasis on the development of small molecules as chemical biology tools and as lead candidates in drug discovery programs.

BMM students work with faculty members dedicated to mentoring and are treated as colleagues while learning fundamental principles of biochemistry to develop new treatments for various illnesses. The BMM Discipline strives to educate its students to develop a vision of health, disease and therapy that integrates knowledge from the atomic to the cellular level, while stressing the development of core skills such as critical thinking and problem solving. Our curriculum is tailored to each student and can include courses from across all IBMS disciplines to provide the most relevant coursework for their chosen project. BMM is unique in its innovative integration of advanced tools of biochemistry, biophysics, structural biology, molecular biology, cell biology, and chemical biology in our scientific pursuits, and is well recognized for its quantitative rigor.

Biology of Aging (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/biology-aging/>) (BA). The mission of the BA discipline is to train the next generation of scientists to be leaders in Geroscience, the interdisciplinary field that aims to elucidate the biological mechanisms of aging and develop therapies to ameliorate its deleterious consequences. The BA discipline is headquartered in the Barshop Institute for Longevity and Aging Studies, one of the nation's only freestanding research entities solely devoted to Geroscience. We offer trainees intellectual, technological and physical resources dedicated to aging research that are among the best. Our faculty are leaders in aging research, cover a broad spectrum of biomedical disciplines, and are dedicated to mentoring students to become independent scientists with expertise in the basic biology of aging as well as translational and clinical research. Resource strengths include 1) world class aging animal cores (mice, rats, naked mole rats and marmosets), 2) a functional and behavioral assessment core, 3) an aging pathology core, and 4) a core for drug development, delivery and pharmacodynamics. The Barshop Institute's faculty, Core facilities, and Research Centers are well funded by NIH and other agencies-- most notably, by the National Institute on Aging at one of the highest funding levels in the nation.

Cancer Biology (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/cancer-biology/>) (CB). The Cancer Biology discipline is a vibrant and successful community of researchers and educators with expertise across the spectrum of bench research to bedside application and a track record of training successful graduates. Our 62 faculty members have successful programs in genomics/proteomics, DNA repair, cell signaling and receptor biology, structural biology, RNA biology, tumor immunology, metastasis, tumor microenvironment, radiology, radiation therapy, drug discovery, chemoprevention, experimental therapeutics and clinical trials. These experienced mentors, many of whom are members of the NCI-designated Mays Cancer Center, bring in nearly \$50M in funding per year and collaborate with investigators across academia and industry. Our innovative curriculum integrates both basic and translational research with a strong focus on critical thinking to provide our trainees with the skills and knowledge needed for productive careers in many areas, including academia, industry, patent law/intellectual property, government, public policy, research administration and patient/survivor advocacy. After meeting academic milestones, students are eligible to apply for training grant support through our CPRIT- and NCI-funded Cancer Biology Training Programs; many are successful in securing independent funding. Our comprehensive training environment brings together faculty, curricula and infrastructure to guide our trainees in defining their own, unique, educational paths and in developing and executing research projects that contribute to our understanding of cancer biology to meet the growing demand for scientists trained in multiple facets of cancer biology.

Cell Biology, Genetics and Molecular Medicine (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/cellbiology-genetics-molecularmedicine/>) (CGM). The CGM discipline is the gateway to all basic, medical, and translational research by emphasizing the importance of cell, molecular, and genomic approaches to study the foundations of life, health, and disease. The CGM discipline is designed for graduate students with an interest in understanding biological systems and molecular mechanisms by investigating how cells function as a living unit, respond to external cues, communicate with other cells, and contribute to the homeostatic and pathological processes in complex systems. The program offers maximum flexibility and can be individually tailored to a student's specific interests in aging, cancer, genetics, immunology, virology, neuroscience, metabolism, or genomic medicine. We stress the development of a student's ability to think critically and to pursue hypothesis-driven research. We also encourage students to combine our advanced curriculum in CGM with the advanced core courses in other IBMS disciplines. Overall, the CGM discipline provides students with a comprehensive foundation in systems-based science and interdisciplinary training that can be utilized for future career development in more specialized areas of biomedical research and education.

Molecular Immunology & Microbiology (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/molecular-immunology-microbiology/>) (MIM). The MIM discipline integrates the study of immunology with studies of host defense against microbial infection, autoimmune diseases, allergy, and cancer. These investigations lead to an understanding of mechanisms that: i) allow the host to resist infections by bacteria, viruses, fungi, and parasites, ii) allow the host immune system to “cross the line” into pathological inflammation, allergy, or autoimmunity, iii) allow development of successful vaccines, iv) allow better prediction of the influences of the immune system on diseases such as cancer and metabolic disorders. Together with newly renovated labs and state-of-the-art equipment, the Flow Cytometry Core, and recent aggressive recruitment of numerous young and well-established faculty investigators, the MIM discipline provides a high energy integrated research environment for our students and faculty.

Neuroscience (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/neuroscience/>) (NS). The NS discipline provides didactic and laboratory training in subject areas and levels of analysis ranging from molecular, cellular, and neurochemical to systems, behavioral, and clinical, all focused on the regulation and function of the nervous system. Drawing on the expertise of over 50 faculty from 5 basic science departments and 8 affiliated departments or divisions within the medical and dental schools, we emphasize a flexible program of study and research tailored to the individual needs and interests of all students in the neurosciences. Neuroscientists probe the intricate machinery of the nervous system to address such fundamental issues as how we think, move, perceive, learn and remember. Our students receive training that emphasizes analytical thinking and problem solving in a scientific environment, that is applicable to many related careers. Neuroscientists are employed in universities and medical centers, government agencies and private industry, and in related fields such as scientific publishing, policy, administration and law. The pharmaceutical and biotechnology industries hire many neuroscientists for productive and exciting careers developing new therapeutic agents to improve human health. Regardless of their ultimate career path, students will leave our program equipped with an education, research experience and a way of thinking that will prepare them for a successful future.

Physiology and Pharmacology (<https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/physiology-pharmacology/>) (P&P). The P&P discipline encompasses the study of fundamental mechanisms of normal and disease function. Investigators seek to integrate information from molecular, cellular and organ/system levels to spur discoveries, which will lead to new and improved drug treatments for human and animal disease. Using sophisticated genetic and molecular tools, our scientists are unraveling the fundamental mechanisms that underlie tissue and cellular physiology, and how these processes are compromised in injury and disease. Using multidisciplinary approaches, our scientists offer a unique perspective in determining the effects of chemical agents upon biological processes at the sub-cellular, cellular, organ system, physiological and behavioral levels. Internationally recognized research expertise is assembled in areas of neuropharmacology, cancer pharmacology, cardiovascular disease, neurodegeneration, diabetes, addiction and pain research.

Admissions Requirements

Applications to the IBMS Graduate Program are reviewed and evaluated by the IBMS Admissions Committee. Recommendations for admission are submitted to the Dean of the Graduate School of Biomedical Sciences.

The decision to admit an applicant is based on several criteria:

Grade Point Average (GPA)

Applicants to the Integrated Biomedical Sciences (IBMS) Graduate Program must have, or be in the process of completing, a bachelor's degree with a final GPA of 3.0 or above. The average GPA of students entering the IBMS Graduate Program over the last several years was 3.4 on a 4.0 point scale. Transcripts from all colleges and universities attended must be provided, indicating grades and GPAs. **International transcripts** must be appropriately translated by a NACES member (<http://www.naces.org>).

Course Requirements

Although there are no specific course requirements for admission into the IBMS Graduate Program, past experience has shown that undergraduates entering this interdisciplinary program benefit from

having completed upper-division courses in cell or molecular biology, biochemistry, and genetics. In addition, successful applicants often have evidence of previous research experience.

Personal Statement

The applicant must submit two essays that describe professional goals and reasons for wishing to pursue graduate education, and particularly in the IBMS Graduate Program. In addition, descriptions of past research and/or teaching activities should be included (as an undergraduate, master's student, summer intern, and/or as an employee at a research facility).

Letters of Recommendation

Three letters of recommendation are required. Letters should be from individuals who have information regarding academic, research, and personal accomplishments of the applicant that are predictive of success in graduate school. Letter writers should be chosen to enhance, not duplicate, information found in academic transcripts.

TOEFL/IELTS/Duolingo

International students are required to take either the Test of English as a Foreign Language (TOEFL), the International English Language Testing Systems (IELTS) or the Duolingo English Test. The minimum required score for the TOEFL is 84 (for the internet-based test). A minimum band score for the **Academic version** of the IELTS is 7.0 and 115 for the Duolingo. Tests must have been taken less than two years of applying for admission.

Interviews

Top domestic candidates are invited for on-campus interviews. Interviews of applicants are conducted in January/February. Virtual interviews are conducted for top international applicants (also in January/February).

International applicants who have completed or will complete their degree prior to matriculation at an accredited U.S. Institution may be exempted from the TOEFL/IELTS/Duolingo requirement.

Background Checks. UT Health San Antonio requires that applicants to all graduate programs clear a security and criminal background check prior to matriculation.

Start Term: Fall

Degree Requirements

It is the responsibility of each IBMS student to: 1) Successfully complete all coursework required by the IBMS Graduate Program and the specific Plan of Study of the student's IBMS discipline; 2) Maintain a grade point average of 3.0 or greater; 3) Carry out independent and original investigation; and 4) Demonstrate an intellectual command of the subject area of the student's research project. It is also the responsibility of each IBMS student to complete all administrative and academic milestones of the IBMS Graduate Program and adhere to the required timeline for completing those milestones (including the submission of all paperwork required to verify appropriate academic progress in the IBMS Graduate Program).

Full-time student status requires enrollment for a **minimum of 12.0 semester credit hours per semester**. Prior to graduation, every Ph.D. student must have enrolled for a **minimum of 72.0 total semester credit hours**. Note: Depending on the extent of classroom contact necessary to adequately prepare students for their research activities, or intrinsic differences in the time required to complete different research projects,

actual total semester credit hours in the Plans of Study provided by the 7 disciplines may vary, although total semester credit hours typically will exceed the 72 semester credit hours minimum.

Expected Academic Progression of IBMS Students:

In any Plan of Study, there are three types of courses: i) Required IBMS courses taken by all graduate students in the IBMS Graduate Program; ii) Required discipline-specific courses taken by students who choose a particular Discipline; and iii) Advanced elective courses that may be selected, with approval of the student's Discipline leadership, from the curricula of any IBMS discipline.

Typical Academic Timeline

(see IBMS Handbook of Policies and Procedures for more exact details): Discipline-specific Plans of Study are shown in subsequent sections of this catalog. In general, during the IBMS Graduate Program **Year 1 Fall semester**, all students will complete the common core courses (IBMS 5000 Fundamentals of Biomedical Sciences; TSCI 5070 Responsible Conduct Of Patient-Oriented Clinical Research; and IBMS 5008 Laboratory Rotations). By the end of the Fall semester of Year 1, each student is expected to identify a permanent dissertation research mentor (supervising professor), and in consultation with the research mentor will select a particular IBMS discipline and its Plan of Study. Beginning in the **Year 1 Spring semester**, the typical Plan of Study prescribes required discipline-specific courses combined with certain IBMS common courses such as Experimental Design and Analysis, Seminar, Journal Club/Student Presentations and Research. **Years 2-5** will include a mixture of recurring IBMS courses and discipline-specific courses, with the Qualifying Examination (IBMS 7001) administered in the Spring semester Year 2, followed by Admission to Candidacy. In **Year 3**, each student will seek approval for the membership of a Dissertation Supervising Committee, and the official proposal that describes the student's dissertation research project, and will commence meetings with the Dissertation Supervising Committee a minimum of once per semester. Each student must begin enrolling in the two semesters of Dissertation credit (IBMS 7099) required for graduation.

Objectives/Program Outcomes

1. The student will be able to conduct independent scientific research.
2. The student will be able to critically evaluate scientific literature.
3. The student will be able to demonstrate effective written communication skills.
4. The student will be able to demonstrate effective oral communication skills.
5. The student will be able to demonstrate professional and ethical behavior.
6. The student will be able to demonstrate mastery of core biomedical science principles.