

# INTEGRATED BIOMEDICAL SCIENCES (IBMS)

## Overview

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 primary mission of the IBMS Graduate Program is to train Ph.D. students to graduate as highly skilled thinkers and problem solvers that 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.

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.

**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):

- Biology of Aging (<http://barshop.uthscsa.edu/main/graduate/biologyofaging>) [BA]
- Cancer Biology (<http://gsbs.uthscsa.edu/cb>) [CB]
- Cell Biology, Genetics & Molecular Medicine ([http://gsbs.uthscsa.edu/ibms\\_disciplines/cgm](http://gsbs.uthscsa.edu/ibms_disciplines/cgm)) [CGM]
- Infection, Inflammation & Immunity (<http://uthscsa.edu/mimg/phd>) [III]
- Molecular Biophysics & Biochemistry (<http://mbb.uthscsa.edu>) [MBB]
- Neuroscience (<http://uthscsa.edu/neuroscience>) [NS]
- Physiology & Pharmacology (<http://pharmacology.uthscsa.edu/ppgd.asp>) [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 eCOGS (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 to guarantee that that the needs and preparation of each student are satisfied. However, 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 Executive Committee on Graduate Studies (eCOGS) 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 eCOGS will provide the organization and facilitate 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 eCOGS are followed. Each Discipline will be responsible for implementing its Plan of Study and for monitoring the conduct of its students. As part of the execution of its responsibilities, Disciplines will report student progress to the IBMS eCOGS (*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 eCOGS 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 through the membership of eCOGS that combines Discipline Directors and Department Chairs.

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

**Biology of Aging** (<http://barshop.uthscsa.edu/main/graduate/biologyofaging>) (BA). Many of the faculty of the BA discipline are associated with the Barshop Institute for Longevity and Aging Studies, head quartered at UT Health San Antonio and brings together the world’s leading scientists in aging and longevity research, and provides them with the latest technologies in the application of cutting-edge research methods, and supports their drive for excellence in scientific inquiry. BA faculty members are dedicated to the training and mentoring of promising new physician-scientists and basic researchers in aging through a wide-range of educational and research opportunities. The mission of the BA discipline is four-fold: To understand the basic biology

of aging; to discover the therapies that will treat and cure the diseases of aging by fostering dynamic, collaborative research; to educate and train our future scientists and clinicians; and to promote public awareness of age-related issues. BA researchers sustain their scientific endeavors by successfully competing for funding at the national level. In addition, the Barshop Institute supports their research through a wide range of core services and clinical facilities including those that support advanced technologies such as genomics and proteomics, transgenic animal models, and pathological assessments.

**Cancer Biology** (<http://gsbs.uthscsa.edu/cb>) (**CB**). The program in Cancer Biology 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, genomics, 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 bring in nearly \$50M in funding per year and have funded collaborations with investigators across academia and industry. It is our mission 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. Our curriculum stresses both basic and translational research with a strong focus on critical thinking, and provides our trainees with the skills and knowledge needed for productive careers in many areas, including academia, industry, patent law/intellectual property, government, public policy, and research administration. After meeting academic milestones, students in the Cancer Biology Discipline are eligible to apply for training grant support through our CPRIT- and NCI-funded Cancer Biology Training Programs. Our comprehensive training environment brings together faculty, curricula and accessibility to infrastructure that optimize training of graduate students as cancer researchers and educators to meet the growing demands for scientists trained in multiple facets of cancer biology.

**Cell Biology, Genetics and Molecular Medicine** ([http://gsbs.uthscsa.edu/ibms\\_disciplines/cgm](http://gsbs.uthscsa.edu/ibms_disciplines/cgm)) (**CGM**). The CGM discipline provides a gateway to all basic, medical and translational research by emphasizing the importance of cell and molecular biology approaches to study the foundations of life, health and disease. Our discipline is designed for graduate students with a broad interest in investigating how prokaryotic and eukaryotic 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 curriculum offers maximum flexibility and can be individually tailored to a specific student's interests including aging, cancer, genetics, immunology, neuroscience, metabolism and physiology. 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 any of the advanced core courses in the other IBMS disciplines. Overall, the CGM discipline provides students with a comprehensive foundation in science and interdisciplinary training that can be utilized for future career development in more specialized areas of biomed.

**Infection, Inflammation and Immunity** (<http://uthscsa.edu/mimg/phd>) (**III**). The III discipline integrates studies 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, or parasites, or ii) allow the hosts immune system to "cross the line" into pathological inflammation or allergy or autoimmunity, or

iii) allow investigators to develop successful vaccines, or iv) to better predict influences of the immune system on diseases such as cancer. Together with newly renovated labs and state-of-the-art equipment and two core facilities (Nucleic Acid Core and the Flow Cytometry Core), recent aggressive recruitment of numerous young faculty investigators provides a high energy integrated research environment for our students and faculty.

**Molecular Biophysics & Biochemistry** (<http://mbb.uthscsa.edu>) (**MBB**). The MBB discipline is a dynamic program that is heavily focused on studying the structure and function of cellular components, from DNA repair complexes and chaperones that sustain survival of cancer cells to signaling proteins that underlie metabolic disorders, such as diabetes. The program is backed by state-of-the-art facilities for X-ray crystallography, NMR spectroscopy, surface plasmon resonance, analytical ultracentrifugation, and titration calorimetry; these provide a powerful set of tools to study macromolecular structure, dynamics, and interactions. The program provides a unique environment in which graduate students contribute to cutting-edge science and receive solid training in sophisticated research methods of biochemistry and biophysics. The focus on molecular mechanisms is the unifying research theme for the diverse group of faculty members in the MBB discipline. Great discoveries happen when scientists can traverse different disciplines, and one of the goals of the MBB discipline is to train students to be successful in the multidisciplinary environment of modern science.

**Neuroscience** (<http://uthscsa.edu/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 approximately 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. No other discipline probes the intricate machinery of the nervous system to address such fundamental issues as how we think, move, perceive, learn and remember. Neuroscientists are employed in many different settings, ranging from universities and medical centers to government agencies and private industry. The training students receive, emphasizing analytical thinking and problem solving in a scientific environment, is applicable to numerous disciplines. The pharmaceutical and biotechnology industries hire many neuroscientists for productive and exciting careers developing new therapeutic agents for human betterment. Some go into government, patent law or the publishing industry. Regardless of the path, students will leave our program equipped with an education, research experience and way of thinking that will prepare them for a successful future.

**Physiology and Pharmacology** (<http://pharmacology.uthscsa.edu/ppgd.asp>) (**PP**). The PP 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, diabetes, addiction and pain research. ical research and education.

## 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 Health Science Center requires that applicants to all graduate programs undergo security and criminal background checks prior to making an official offer of admission.

Applicants are required to have a Bachelor's degree or a Master's degree.

The decision to admit a candidate is based on several criteria: Grade point average; Research experience; GRE score; Personal statement; Interview; and Letters of recommendations; TOEFL/IELTS scores if applicable.

**Grade Point Average (GPA).** Transcripts from all colleges and universities attended must be provided, indicating grades and GPAs. International transcripts must be translated by an accredited agency.

### **Course Requirements are as follows:**

Chemistry: 1 Year Inorganic and Organic Chemistry and associated laboratory courses

Analytical and Physical Chemistry recommended

Physics: 1 Year

Calculus: 1 Semester Calculus or Statistics

Biology: 2 Years as required for Biology Majors

**Graduate Record Examination (GRE).** To be considered for admission, an applicant must provide GRE scores from tests taken within five years of applying for admission. While there is no official minimum requirement, successful applicants generally have a minimum combined GRE score of 315.

**Personal Statement.** The applicant must submit two essays that state reasons for wishing to pursue graduate education, and in particular in the IBMS Graduate Program, in relation to professional goals; and descriptions of past research and/or teaching activities (as an undergraduate, master's student, summer intern, or as an employee at a research facility).

**Interviews.** On-campus interviews of applicants are conducted in February. Phone and Skype interviews for international applications occur in January and February.

**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.

**TOEFL/IELTS.** International students who did not obtain their undergraduate degree from a U.S. institution are required to take either the Test of English as a Foreign Language (TOEFL) or the International English Language Testing Systems (IELTS). The minimum required score for the TOEFL is 68 for iBT. The minimum score for the academic version

of the IELTS test is 6.5. Scores for either test must have been taken within two years of applying for admission.

### **Commitment to Underrepresented Minorities**

The Health Science Center is designated as an Hispanic-Serving Institution by the U.S. Department of Education. Thus, the Health Science Center and the IBMS Graduate Program have a deep history of recruiting and retaining underrepresented racial/ethnic minority students into our programs.

**Application Deadline:** January 1 (priority), March 15 (final). Admission decisions are completed by April 15.

**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 in a **minimum of 12.0 semester credit hours per semester**. Prior to graduation, every Ph.D. student must have enrolled in 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 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 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, 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 the Dissertation Supervising Committee, the official proposal that describes the student's dissertation research project. 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.