

Biochemical Mechanisms in Medicine Discipline

Discipline-specific Guidelines and Curriculum

Biochemical Mechanisms in Medicine (BMM) Discipline of the IBMS Graduate Program

BMM is one of seven disciplines within the IBMS Program. It focuses on the biochemical mechanisms underlying fundamental life processes ranging from DNA replication and repair, RNA/DNA epigenetics, protein folding and complex assembly, intercellular communication and signaling network, 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.

A. DISCIPLINE LEADERSHIP

The Discipline Executive Committee (DEC) will communicate with discipline faculty and trainees regarding decisions affecting BMM discipline policies and procedures. The following leadership team will be responsible for communications among the DEC, students, faculty, and administrators:

Discipline Directors and Administrator

Director: Patrick Sung, D. Phil., sungp@uthscsa.edu

Co-Director: David S. Libich, Ph.D., libich@uthscsa.edu

Academic Program Coordinator: Jennifer Ballesteros, ballesterosj@uthscsa.edu

Executive Committee Members

Yogesh K. Gupta, Ph.D. (faculty member)

Dmitri Ivanov, Ph.D. (faculty member)

Jean Jiang, Ph.D. (faculty member)

Rui Sousa, Ph.D. (faculty member)

Courtney N. Johnson (student member)

Bruce J. Nicholson, Ph.D. (ex officio)

DEC Purview: The DEC will help ensure that students and faculty follow the guidelines, requirements and expectations of the IBMS Program as described in the IBMS Handbook and the BMM Guidelines. In this role, the DEC will review policies and curriculum, monitor and evaluate student academic progress, and also approve the appointment of Supervising Professors and memberships of Qualifying Examination and Dissertation Supervising Committees. The DEC will mediate disputes between students and Supervising Professors. The Discipline Director will bring non-routine and urgent matters to the DEC for consideration.

Graduate Advisor

Patrick Sung

BMM Qualifying Examination Oversight Committee

Dmitri Ivanov

Phil Loverde

BMM Curriculum Advisor

Yuzuru Shio

BMM Recruitment Committee

David S. Libich (Chair)

Patrick Sung

Bruce Nicholson

IBMS Recruitment Committee

David S. Libich (member)

Bruce Nicholson (Representative for Basic Science Chairs)

IBMS Admissions Committee Representatives

Rui Sousa (member)

Yogesh K. Gupta (member)

David S. Libich (member)

IBMS Curriculum Committee Representative

Yuzuru Shio (member)

B. CONDUCTING DISCIPLINE BUSINESS

The DEC acts on such matters as curriculum, student recruitment and admissions, evaluation of student progress, mediation of disputes between students and Supervising Professors, reviewing qualifications for membership on the Discipline Faculty, and other policy considerations.

Executive Committee Meetings:

The DEC will meet quarterly and may call for interim meetings to discuss and vote on time-sensitive matters. Such matters include:

1. Consideration of a recommendation from the Qualifying Examination or Dissertation Supervising Committee to dismiss a student from the program;
2. Consideration of a recommendation from DEC Members to remove an individual from or add a new member to the Discipline Faculty;
3. Major curriculum changes;
4. Mediation of serious disputes involving students and faculty members; and
5. Consideration of substantive changes to the discipline.

Procedure of DEC meetings:

Agenda: Copies of the meeting agenda will be sent to DEC members prior to a meeting.

Voting: A quorum of voting DEC members must be present to conduct a meeting. A simple majority constitutes a quorum. For routine matters, voting may be conducted between scheduled DEC meetings electronically. A simple majority of the entire membership is required to pass any motion. Decisions typically made by e-mail vote include:

1. Approval of students' dissertation committee membership;
2. Approval of qualifying examination proposals and committees; and
3. Approval of dissertation proposals and waiving certain departmental requirements. Any DEC member may request an ad hoc committee meeting.

Minutes: The Discipline Director or Academic Program Coordinator will record the outcomes and decisions made at DEC meetings.

Amending DEC operating procedures: Changes to operating procedures may be suggested, in writing, to the Discipline Director by any member of the Discipline Faculty. At the discretion of the Discipline Director, the faculty member may be invited to present his/her proposal to the DEC. If the amendment is approved by the DEC, the Discipline Director will inform all members of the Discipline Faculty and students of the procedural changes.

C. PLAN OF STUDY

The following summarizes the Discipline Plan of Study. Further details that apply to all students of the IBMS Graduate Program may be found in the IBMS Handbook.

Plan of study for BMM can be found online at:

<http://catalog.uthscsa.edu/biomedicalsciences/ibms/molecularbiophysics/>

It is the responsibility of each student to adhere to the responsibilities, timelines, and to submit all paperwork required to verify appropriate academic progress in his/her Plan of Study. A delay in the progression described below could result in a student receiving a grade of Unsatisfactory (“U”) for academic/research progress. Extenuating circumstances may allow temporary exemption from this requirement only if approved by the DEC.

Note that there are required IBMS courses taken by all students of the IBMS Graduate Program, as well as specific required courses taken by students in the BMM Discipline. Advanced elective courses can be selected from the listed curriculum or the curricula of any of the IBMS disciplines. Full-time student status requires a minimum of 12 credit hours per semester; 72 total credit hours must be accrued prior to graduation.

In addition to the core required courses of all IBMS students, the BMM Discipline has the following specific requirements:

Two (4 credit hours total) of the 4 BMM core courses:

| | | |
|-----------|--|---------|
| BIOC 6036 | Macromolecular Structure and Mechanism | 2.0 SCH |
| BIOC 5085 | Biophysical Methods in Biology | 2.0 SCH |
| BIOC 6010 | Gene Expression and Omics | 2.0 SCH |
| BIOC 6037 | Integration of Metabolic Pathways | 2.0 SCH |

BIOC 6036 and 5085 are offered in the Spring semester of the first year for students entering the IBMS program in odd-numbered years (2019, 2021, 2023, etc.); BIOC 6010 and BIOC 6037 are offered in the Spring semester of the first year for students entering the IBMS program in even-numbered years (2020, 2022, 2024, etc.).

A minimum of 4 credit hours of elective courses chosen from BMM courses (either additional core or elective courses) or courses from other IBMS Disciplines pending approval from the Discipline Director in consultation with the Supervising Professor. More can be taken if desired, and agreed to by the supervising professor.

INTD 6033 Cell Signaling Mechanisms
BIOC 6035 Drug Discovery and Design
INTD 6043 Structure & Function of Membrane Proteins

Other discipline and departmental courses in any combination:

| | | |
|-----------|--|-------------------|
| CSAT 5007 | Methods in Cell Biology | 1 SCH |
| CSAT 5083 | Practical Optical Microscopy | 1 SCH |
| CSAT 6021 | Animal Models | 3 SCH |
| CSAT 6049 | Biology of Aging: Molecular and Cellular Homeostasis | 2 SCH Spring only |
| CSAT 6050 | Biology of Aging: Systems Homeostasis and Aging | 2 SCH Spring only |
| CSAT 6068 | Cancer Biology Core I | 2 SCH Spring only |
| CSAT 6069 | Cancer Biology Core II | 2 SCH Spring only |
| CSAT 6074 | Molecular Aspects of Epigenetics | 2 SCH |
| CSAT 6095 | Functional Genomic Data Analysis | 2 SCH Spring only |
| INTD 6008 | Mitochondria and Apoptosis | 1 SCH Fall only |
| INTD 5040 | Fundamentals of Neuroscience | 2 SCH |
| MICR 5025 | Eukaryotic Pathogens | 1 SCH Spring only |
| MICR 5026 | Pathogenic Microbiology | 1 SCH Spring only |
| MICR 5028 | Virology | 1 SCH Spring only |
| MICR 6052 | Immunology | 3 SCH Spring only |
| MMED 6016 | Advanced Molecular-, Cellular, and Synthetic Biology | 4 SCH Fall only |
| MMED 5015 | Modern Methods in Molecular Analysis | 2 SCH Fall only |
| PHAR 5013 | Principles of Pharmacology | 3 SCH |
| PHYL 5041 | Mammalian Physiology: Excitable Membranes | 1 SCH |

Sample BMM Discipline Plan of Study

Year 1 – Fall Semester

| | | |
|-----------|--|-----------------------|
| IBMS 5000 | Fundamentals of Biomedical Sciences (required for all GSBS students) | 8.0 SCH |
| IBMS 5008 | Lab Rotations | 3.0 SCH |
| TSCI 5070 | Responsible Conduct of Research | 2.0 SCH |
| | | TOTAL 13.0 SCH |

Year 1 - Spring semester

| | | |
|---|---|-----------------------|
| BMM Core Course | | 2-4 SCH |
| [EVEN YEARS: BIOC 5085 Biophysical Methods in Biology; BIOC 6036 Macromolecular Structure & Mechanism ODD YEARS: BIOC 6010 Gene Expression and Omics; BIOC 6037 Integration of Metabolic Pathways] | | |
| CSAT 5095 | Experimental Design and Analysis | 3.0 SCH |
| IBMS 6097-6BMM | Research | 2.0 SCH |
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| Choice of Elective Courses (2 SCH recommended) | | 0-2 SCH |
| | | TOTAL 12.5 SCH |

Year 2 - Fall semester

| | | |
|--|---|-----------------------|
| BIOC 0003 | Scientific Writing: Dev. & Defense of a Research Proposal | 2.0 SCH |
| CSAT 6005 | Rigor & Reproducibility | 1.0 SCH |
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| IBMS 6097-6BMM | Research | 3.5 SCH |
| Choice of Elective Courses (2 SCH recommended) | | 2.0 SCH |
| | | TOTAL 12.0 SCH |

Year 2 - Spring semester

| | | |
|--|---|----------------|
| BMM Core Course (BIOC 6036 and 5085 in odd years; BIOC 6010 and 6037 in even years) | | 2-4 SCH |
| IBMS 7001-6BMM | Qualifying Exam | 1.0 SCH |
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| IBMS 6097-6BMM | Research | 1.5 SCH |
| Choice of Elective Courses (2 – 4 SCH recommended) | | 2-4 SCH |
| | | TOTAL 12.0 SCH |

Year 3 – Fall semester

| | | |
|----------------|---|----------------|
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| IBMS 6097-6BMM | Research | 8.5 SCH |
| | | TOTAL 12.0 SCH |

Year 3 - Spring semester

| | | |
|----------------|---|----------------|
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| IBMS 6097-6BMM | Research | 8.5 SCH |
| | | TOTAL 12.0 SCH |

Year 4 – Fall Semester

| | | |
|----------------|---|----------------|
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| IBMS 6097-6BMM | Research | 5.5 SCH |
| IBMS 7099-6BMM | Dissertation | 3.0 SCH |
| | | TOTAL 12.0 SCH |

Year 4 - Spring semester

| | | |
|----------------|---|----------------|
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| IBMS 6097-6BMM | Research | 5.5 SCH |
| IBMS 7099-6BMM | Dissertation | 3.0 SCH |
| | | TOTAL 12.0 SCH |

Year 5 – Fall Semester

| | | |
|----------------|---|----------------|
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| IBMS 6097-6BMM | Research | 5.5 SCH |
| IBMS 7099-6BMM | Dissertation | 3.0 SCH |
| | | TOTAL 12.0 SCH |

Year 5 - Spring semester

| | | |
|----------------|---|----------------|
| IBMS 6090-6BMM | Seminar | 1.5 SCH |
| IBMS 7010-6BMM | Student Journal Club & Research Presentation‡ | 2.0 SCH |
| IBMS 6097-6BMM | Research† | 5.5 SCH |
| IBMS 7099-6BMM | Dissertation | 3.0 SCH |
| | | TOTAL 12.0 SCH |

†Typically, IBMS 7099-6BMM Dissertation will replace some or all SCH of IBMS 6097-6BMM Research during the last two semesters; Final Hours may be applicable for the final semester (see **Section H**). A minimum of 2 semesters of **IBMS 7099-6BMM** (Dissertation) is required for graduation. A student may begin enrolling in **IBMS 7099-6BMM** once the Dissertation Research Proposal and the Dissertation Supervising Committee membership are approved. Final hours (3.0 SCH) may be applicable for the final semester. (see **Section H**).

‡IBMS 7010-6BMM will be a continuous requirement beginning the Fall semester of the second year until the preceding semester of the dissertation defense.

BMM Course Descriptions

IBMS REQUIRED COURSES (1st year):

IBMS 5000. Fundamentals of Biomedical Sciences. 8 Credit Hours.

This core course covers the fundamentals of biochemistry, molecular biology, cell biology, organismal and systems biology, and microbiology and immunology. The course is designed for first-year graduate students matriculating into the Integrated Biomedical Sciences Program (IBMS).

IBMS 5008. Lab Rotations. 1-3 Credit Hours.

This course provides an opportunity for students to participate in research activities in the laboratories of faculty members in different disciplines to learn laboratory skills and to gain an introduction to the research fields of faculty members.

TSCI 5070. Responsible Conduct of Research. 2 Credit Hours.

This interdisciplinary course is designed to train participants in the responsible conduct of patient-oriented clinical research. Students will have the opportunity to learn to and, by the end of the course, be required to: (1) delineate a history of hallmark abuses of humans enrolled in clinical research; (2) describe the evolution of national and international codes and regulations guiding inclusion of human subjects in clinical investigations; (3) list the elements of informed consent and describe procedures and precautions for enrolling special populations into clinical investigation; (4) write a consent form in understandable language; (5) recognize different forms of scientific misconduct; (6) describe the role and processes of a peer review board to judge violations in research ethics; (7) develop strategies for self-assessment and validation of scientific objectivity in one's own research; and (8) recognize the ethical responsibilities and consequences of whistle blowing.

CSAT 5095. Experimental Design and Data Analysis. 3 Credit Hours.

The purpose of the course is to introduce experimental design and statistical analysis. The emphasis of the course will be on the selection and application of proper tests of statistical significance. Practical experience will be provided in the use of both parametric and nonparametric methods of statistical evaluation. Among the topics to be covered are: data reduction, types of distributions, hypothesis testing, scales of measurement, chi square analysis, the special case of the comparison of two groups; analysis of variance; a posteriori multiple comparisons tests, tests of the assumptions of parametric analyses, advanced forms of the analysis of variance, linear regression, and correlation analysis. This course involves the use of statistical software; therefore, access to a laptop or a computer with web access for classes and examinations is required.

CORE COURSES:

BIOC 5085. Biophysical Methods in Biology. 2 Credit Hours.

This course is required for all students enrolled in the Molecular Biophysics and Biochemistry track. The course covers modern biophysical methods for studying biological macromolecules in sufficient detail to understand the current literature. Topics to be covered include macromolecular structure determination by X-ray crystallography and NMR spectroscopy; absorbance, fluorescence, and EPR spectroscopy; circular dichroism; light scattering; mass spectrometry; and hydrodynamics, including diffusion, electrophoresis, sedimentation velocity, and sedimentation equilibrium.

BIOC 6036. Macromolecular Structure and Mechanism. 2 Credit Hours.

This course will cover the fundamentals of protein and nucleic acid structure and of enzyme catalysis. The course is required of students in the Molecular Biochemistry and Biophysics Track. Topics to be covered include: DNA and RNA structure, protein structure, protein folding, ligand binding by proteins, and enzyme catalysis.

BIOC 6037. Integration of Metabolic Pathways. 2 Credit Hours.

The course is required of students in the Molecular Biophysics and Metabolic Pathways track. The objective is to provide an understanding of the individual reactions in intermediary metabolism and how the reactions are integrated by regulatory mechanisms. Topics include carbohydrate, lipid, and nitrogen metabolism and mechanisms of regulation of individual enzymes and metabolic pathways.

BIOC 6010. Gene Expression and Omics. 2 Credit Hours.

This course covers gene expression focusing on regulation at the levels of transcription, RNA processing, transport and stability, and translation. Particular emphasis will be placed on transcriptional control mechanisms including: RNA polymerases, chromatin remodeling, methylation and other epigenetic modifications, families of transcription factors including their DNA binding properties, protein-protein interaction domains, trans-activation mechanisms, regulation by ligand binding, phosphorylation and other signaling mechanisms and nuclear-cytoplasmic transport; posttranscriptional mechanisms including: mechanisms of RNA splicing, nuclear-cytoplasmic transport of RNA, RNA localization and targeting, RNA stability; and translational control.

ELECTIVE COURSES:**BIOC 6033. Cell Signaling Mechanisms. 2 Credit Hours.**

This course covers the molecular mechanisms of action of various extracellular mediators including hormones, neurotransmitters, growth factors, cytokines, etc., and cell signaling events. Several areas will be discussed including: (1) mechanisms of mediator synthesis; (2) interaction of mediators with specific receptors; (3) modulation by mediators of various second messenger systems including cyclic nucleotides, inositol phospholipids, calcium, protein phosphorylation, ion flux, etc.; and (4) intra- and intercellular mechanism for regulating mediator action.

BIOC 6035. Drug Design and Discovery. 2 Credit Hours.

This course covers state-of-the-art approaches to the discovery and design of drugs - from small molecules to peptides - as well as drug delivery vehicles, with a strong emphasis on structure-based approaches. Topics to be covered will include the following: high-throughput screening, fragment based drug discovery, protein: protein and protein: ligand interactions, use of nuclear magnetic resonance (NMR), surface plasmon resonance (SPR) and fluorescent methods in drug discovery, virtual (in silico) screening, peptides and peptidomimetics, structure based drug design, and use of macromolecular assemblies as drug delivery vehicles and as targets for drug therapy.

BIOC 6043. Structure and Function of Membrane Proteins. 2 Credit Hours.

This is a course targeted at students within any of the Graduate Tracks. The objective is to provide a broad view, allowing for in depth consideration in selected areas, of the structure and diverse functions of proteins within a membrane environment. Specific topics covered will include: ion selective channels, large membrane pores, membrane transporters, membrane pumps, and membrane receptors. The format of the course will be didactic lecture followed by student presentations of relevant topics.

IBMS COURSES (YEARS 2 – 5):**IBMS 6090-6BMM. Seminar. 1.5 Credit Hour.**

This course is required of all students in the IBMS program, except for those who have signed up for Final Hours. Students are required to attend a minimum of 16 seminars per semester and to complete a requirement to demonstrate their attendance and participation. To fulfill the minimum number of seminars, students may include seminars offered by disciplines other than their own in which they are enrolled. However, to enroll, students should obtain permission from the course Section Director affiliated with the appropriate discipline. Some students who have not declared a discipline, and have obtained the approval of their academic advisor and the Senior Associate Dean of the GSBS, may sign up for [IBMS 6090-6BMM](#). A list of seminars from all disciplines will be posted on the Graduate School website. Each Section Director will determine, for the relevant IBMS-6090 section, the policy for tracking student's attendance and participation in seminars.

IBMS 6097-6BMM. Research. 0.5-12 Credit Hours.

This course consists of independent, original research under the direction of a faculty advisor. All students are required to meet with their research supervising committees at least once per semester. Students who have not declared a discipline should sign up for [IBMS 6097-6BMM](#).

IBMS 7010-6BMM. Student Presentation and Journal Club. 1-2 Credit Hours

Student Presentation - Students are given credit for attending student presentations in BMM as well as in other graduate programs or disciplines (IMGF, IBMS, etc.). Students are required to give a research update or dissertation proposal presentation once per year.

Journal Club - Students must attend journal club gatherings of the BMM Discipline to fulfill this requirement.

Grading in IBMS 7010-6BMM - To receive a satisfactory grade, students must attend a total of 12 presentations (journal club and/or student presentations) and give at least one presentation (journal club or research presentation) each semester. Students must keep track of their attendance and send documentation to the course director near the end of the semester.

D. EVALUATION OF ACADEMIC PROGRESS

Students of the IBMS Graduate Program are required to present their work to their Dissertation Committee at least once per semester to allow for regular assessment and monitoring of their research progress. In addition, each trainee is required to present a formal seminar, first for approval of the student's Dissertation Research Proposal, and then annual research updates as part of IBMS 7010. Furthermore, trainees are expected to apply for individual pre-doctoral fellowship awards.

E. QUALIFYING EXAMINATION

IBMS 7001-6BMM (Qualifying Examination) 1.0 SCH

Objective: The primary objective of the Qualifying Examination (QE) is to determine if a student has met programmatic expectations with regards to:

1. Scientific reasoning and knowledge commensurate with his/her training stage; and
2. Problem-solving skills and ability to develop experimental strategies for testing specific hypotheses. Successful completion of the QE is required for Advancement to Candidacy and continuation in the IBMS Ph.D. program.

QE Oversight Committee: Assembly of examination committees and coordination of all QEs will be the purview of the Oversight Committee, consisting of two BMM faculty appointed to two-year terms.

QE Committee: The QE Committee will consist of three faculty members chosen by the QE Oversight Committee from the BMM Discipline (at least two) or another discipline in the IBMS Program. One additional faculty member may be recruited for specific expertise. A member of the Oversight Committee will serve as the Chair of the QE Committee. While Dissertation Mentors may attend oral defenses, they are not a member of the QE Committee and may only speak when invited to do so by the Committee Chair.

The Discipline leadership has the following responsibilities:

1. To provide clear instructions to students regarding the expectations and process of the examination.
2. To appoint the QE Oversight Committee, which will assemble each QE Committee with the appropriate composition and expertise.
3. To render oversight ensuring all QEs are conducted in an impartial manner with uniform standards being applied in each case.

Timeline: The QE will be administered during the Spring semester of Year 2 (4th semester overall). Any deviation from this schedule must be approved by the Discipline DEC. A student who delays taking the QE in the appropriate semester will receive a grade of Incomplete (I).

Student Proposal: A relevant, unresolved biomedical problem will be identified by the student and approved by the QE Committee. The QE proposal must be based on an original idea conceived by the student and must not duplicate any aim in his/her mentor's active or pending grants, but otherwise can be related to the student's thesis work. No later than January 31st, the student will submit a two-page synopsis of his/her proposal with

Project Title, name of Supervising Professor, and consisting of an Abstract (300 words or fewer), Background and Significance, and Specific Aims, with 10 to 15 references in the *Cell Press* citation style. The synopsis will be single-spaced and in either Arial 11 or Times 12 pt. font with 0.75-inch margins in all directions. A short statement from the student to the QE Committee clarifying the relationship between the proposal and the Supervising Professor's research must accompany the synopsis.

The QE Committee will have one week to review the proposal synopsis and either approve or return it to the student for revisions. Detailed written comments from the QE Committee must be provided to the student if revisions are requested. The student may meet with any of the committee members to seek advice. The length of time for revisions is to be determined by the QE Committee Chair in consultation with committee members.

Once permission for proposal writing is granted, the student will have four weeks to assemble the proposal (Arial 11 or Times 12 pt. font with 0.75-inch margins), which will comprise of the following sections:

Title Page - title; name of candidate; graduate program and discipline

Abstract (300 words or fewer) – significance of research problem, objectives, and brief summary of approach.

Research Plan - (maximum 10 single-spaced pages excluding references)

1. **Specific Aims** (½ -1 page) - The overall hypothesis and objective of the proposal should be clearly stated. Propose no more than three specific aims to address the questions posed.
2. **Background** (up to 2 pages) - Describe the work of others that has led to the overall hypothesis. Identify the knowledge gaps that remain and the significance of filling these gaps.
3. **Experimental Design** (remaining pages) - Describe experimental strategies designed to accomplish each of the specific aims. Possible pitfalls to the proposed design and alternative experimental strategies should be noted. Regarding methods, sufficient detail should be provided to allow the reader to critically evaluate the experimental approach chosen. However, lengthy descriptions of common methods (e.g., details concerning the formulation of phosphate-buffered saline or the performance of SDS-PAGE) are to be avoided.
4. **References** (no more than 100; **NOT** counted toward the page limit of the Research Plan) - Citations should be numbered consecutively as they appear in the text and will follow the *Cell Press* style.

The QE Committee will have two weeks to evaluate the submitted proposal and will either approve the proposal for oral defense or request revisions. Detailed written comments from the QE Committee must be provided to the student if revisions are requested. The student may meet with any of the committee members to seek advice. The length of time for revisions is to be determined by the QE Committee Chair in consultation with Committee Members.

Oral Defense: The student will give a short 30 min presentation consisting of approximately 10 slides. QE Committee members will take turn to ask questions during or after the student presentation. Questions will test the soundness of experimental rationale and design, student's ability to explain the significance of the proposed studies, and general knowledge covered in the student's IBMS courses. The oral examination will be concluded within two hours.

Grading: Upon passing the QE, a grade of Satisfactory (S) or of Honors (H) will be posted on the Registrar's grade site. There may be cases where the QE committee may ask the student to complete a task (e.g. reading assignment or course work) in order to correct a deficiency in knowledge before receiving a satisfactory grade (conditional pass). In this case, specific instructions and a deadline will be provided to the student.

In the event that a student fails the QE, a grade of Unsatisfactory (U) or of Incomplete (I) may be posted. Only a single retake of the examination will be permitted. The timeline for the QE retake will be determined by the QE Committee, but should occur prior to the start of classes in the third year of study. If a student successfully passes the QE retake, the grade of "I" will be changed to Satisfactory (S). The student will not be eligible for honors (H) in this case.

If a student fails the QE a second time, a grade of Unsatisfactory (U) will be posted. The report from the QE Committee to the Discipline leadership should include an opinion of whether the student should be dismissed from the program by the Dean of the GSBS, or that a transfer into a Master's level degree track is to be considered, along with a clear specification of what would be expected to complete the MS degree.

F. DISSERTATION PROPOSAL

Students will assemble their dissertation proposal for review and approval and for presentation to the University community in a seminar format within the Fall Semester of the third year.

Proposal Format: The Dissertation Proposal follows the same format of the Qualifying Examination Proposal (see **Section E**), with the main differences being that:

1. the dissertation proposal will be prepared with input from the Supervising Professor, and
2. the proposal topic may be related to aims in the Supervising Professor's grant awards or applications. It will include the student's results to support the underlying hypothesis and the feasibility of the proposed studies. A timeline for completion of the proposed studies should be provided at the end of the Research Plan.

Dissertation Committee: It will consist of four internal members and one external member, as follows:

1. The Supervising Professor.
2. An IBMS Graduate Faculty with primary BMM affiliation.
3. An IBMS Graduate Faculty with primary or secondary BMM affiliation.
4. An IBMS Graduate Faculty with primary affiliation in a discipline other than BMM.
5. A qualified external member who holds no faculty appointment at the UTHSA. The role of this external member is normally restricted to being the reader of the student's thesis to ensure that it satisfies a high standard of scholarship. The external member will attend the final dissertation defense, in person if possible, or by video conference if necessary.

Procedure:

1. At the beginning of the Fall Semester of the third year, the student and his/her Supervising Professor will assemble the Dissertation Committee for review and approval by the BMM Executive Committee.
2. The student will schedule toward the end of the semester a date for public presentation of the dissertation proposal.
3. The student will schedule a Dissertation Committee meeting three or more weeks prior to the public presentation.
4. The dissertation proposal will be submitted to the Supervising Professor at least 3 weeks prior to the Dissertation Committee meeting, to allow time for mentor and student to work together to revise the proposal.
5. The student will distribute the dissertation proposal to committee members at least one week before the committee meeting is held.
6. The student will meet with the Dissertation Committee to receive feedback. During this meeting, the student will request committee members to complete the "Evaluation of Research Progress by Research Supervising Committee" form.
7. With guidance from the Supervising Professor, the student will revise the proposal to address any concerns of committee members.
8. One week prior to the public presentation, the student will submit the signed evaluation forms and the dissertation proposal to the BMM Discipline Director (cc'ing the BMM Program Coordinator and the Course Director of IBMS 7010).

9. The student will orally present the Dissertation Proposal to BMM students and faculty to receive feedback.
10. Following the public presentation, the student will initiate the Dissertation Proposal Approval process in IMPACT.

G. DISSERTATION SUPERVISING COMMITTEE MEETINGS

As part of the IBMS 6097-6BMM Research course, students are required to meet with their Dissertation Supervising Committee (DSC) once per semester to receive feedback. Following the public presentation of the Dissertation Proposal, students will provide a one-page synopsis of their research progress once every Fall Semester (i.e. every other committee meeting) to committee members prior to the committee meeting. Students will distribute a printout (or electronic version) of their PowerPoint presentation at or immediately after the committee meeting, and will collect signed evaluation forms to submit to the Discipline Director (cc'ing the BMM Program Coordinator) before the end of each semester.

H. DISSERTATION SUBMISSION AND DEFENSE

The following procedure should be followed when the Dissertation Supervising Committee (DSC) grants a student permission to write and defend his/her dissertation.

Writing the Dissertation

The Supervising Professor should notify the Discipline Director, in writing, that a student has been given permission to write the dissertation. The dissertation must conform to the style and format guidelines of the GSBS. These guidelines are made available from the Associate Dean of Student Affairs by way of mandatory dissertation training. Without evidence of this training, the dissertation will not be accepted by the GSBS.

Once the Supervising Professor approves the dissertation draft, it is to be submitted to members of the DSC, who will have three weeks to provide written feedback. In the event that two or more members judge that the dissertation is not suitable for defense, appropriate changes must be made to address the concerns raised. Once the dissertation is judged to be suitable for defense, the student must submit a Request for Final Oral Examination (via the IMPACT website), together with all of the appropriate signatures indicating approval, to the Office of the GSBS Dean. Copies of this form, plus dissertation abstract and vita, must be received by the Dean's Office at least two weeks before the dissertation defense date.

The dissertation defense must occur no later than the end of April for the Ph.D. degree to be conferred in May in order to allow the student to be presented at the May Graduation Ceremony.

For further information regarding graduation timelines, procedures, and forms, please visit the GSBS website for further instructions and details here:

<https://www.uthscsa.edu/academics/biomedical-sciences/student-life/graduation>

Registration for Final Hours

Normally, 12 credit hours per semester are needed for students to maintain their full-time status. During a student's last semester, while finishing and defending his/her dissertation, a student may register for 3 credit hours, referred to as "Final Hours". This accords a student the one-time opportunity for fewer credit hours to reduce tuition costs while still maintaining full-time status. It is expected, however, that students on Final Hours continue to attend the usual journal clubs and seminars.

Final Hours may be taken only once. Therefore, if a student does not defend and graduate in the semester wherein Final Hours are taken, he/she must resume enrolling for 12 credit hours in subsequent semesters.

Defense of Dissertation

Public Seminar: The student will present a public, 50-minute seminar of his/her research accomplishments. An announcement to the University community of the Dissertation Defense will be distributed by the Office of the GSBS Dean so that all interested persons may attend the seminar. The candidate will field questions from members of the audience who are not on the DSC.

Closed-door Defense: Following the public seminar, the candidate will meet with the DSC in a closed-door session for an oral examination of the dissertation research. The committee members will vote on the candidate's success to defend the dissertation research and will record their vote by signing and submitting the online Report on the Final Oral Examination. A recommendation to grant the Ph.D. degree is forwarded to the Graduate Faculty Council for its consideration.

The student is deemed to have failed the dissertation defense when two or more DSC members register a negative vote. In this case, the DSC will submit a recommendation regarding possible corrective action; COGS will consider the recommendation and determine what action to be taken.

Approval of Dissertation

After the oral defense, if extensive revisions of the dissertation are required, the Supervising Professor will withhold his/her signature on the Approval Page until all of the necessary changes are made. Each member of the DSC will be given the option to review these revisions prior to certification of the final document by the Supervising Professor. Once the Approval Page is signed by all DSC members, the student should submit the signed form, via the Discipline Director, to the IBMS COGS. Even if the student passes the Dissertation Defense, the final version of the dissertation must be approved by the DSC before COGS will consider a recommendation that the degree be awarded.

If the DSC votes unanimously for approving the dissertation and defense, the Discipline Director may forward that recommendation to the IBMS COGS without a formal vote of the DEC. However, if there is a dissenting vote within the DSC to deny the approval of the dissertation and/or defense, the Discipline Director must call a meeting of the DEC to discuss and resolve the issues in question.

Once all procedural requirements are met, the COGS chair-signed approval forms are forwarded to the GSBS Dean. The Dean's signature and approval by the Graduate Faculty Council (GFC) of the GSBS are required before the degree can be awarded.

I. **BMM Faculty (Includes primary, secondary, and affiliated faculty)**

| Name | Department | Discipline |
|------------------------|---|---------------------------|
| Gupta, Yogesh | GCCRI and Biochemistry and Structural Biology | BMM / CB / MIM |
| Ivanov, Dmitri N. | Biochemistry and Structural Biology, Micro., Immuno., & Mol. Gen. | BMM / CB |
| Jiang, Jean | Biochemistry and Structural Biology | BMM / CB |
| Lafer, Eileen | Biochemistry and Structural Biology | BMM / NS |
| Libich, David | GCCRI and Biochemistry and Structural Biology | BMM / CB / BA |
| Nicholson, Bruce | Biochemistry and Structural Biology, Physiology | BMM / CB |
| Serwer, Phil | Biochemistry and Structural Biology | BMM / MIM |
| Shapiro, Mark | Cellular & Integrative Physiology | BMM / NS / P&P |
| Shiio, Yuzuru | GCCRI and Biochemistry and Structural Biology | BMM / CGM |
| Sousa, Rui | Biochemistry and Structural Biology | BMM / BA |
| Sung, Patrick | Biochemistry and Structural Biology | BMM / CB |
| Venkatachalam, Manjeri | Pathology | BMM / CB / CGM |
| Weintraub, Sue | Biochemistry and Structural Biology | BMM |
| Zhao, Weixing | Biochemistry and Structural Biology | BMM / CB |

II. Other Faculty who list BMM as their 2nd & includes secondary, and other affiliations

| Name | Department | Discipline |
|---------------------|---|----------------------|
| Davey, Robert A. | Texas Biomedical Research Institute (TBRI) Out of state | MIM / BMM |
| Jeske, Nathaniel A. | Oral & Maxillofacial Surg | NS / P&P / BMM |
| Kurmasheva, Raushan | Molecular Medicine, GCCRI | CB / CGM / BMM / P&P |
| McHardy, Stanton | UTSA – Chemistry | MIM / BMM / P&P |
| Musi, Nicholas | Med - Diabetes | BA / BMM |
| Olivier, Michael | Molecular Medicine | CGM / BMM / BA |
| Weiss, David | Cellular & Integrative Physiology | NS / P&P / BMM |
| Yew, P. Renee | Molecular Medicine | CGM / CB / BMM / BA |
| Zang, Mengwei | Barshop/Molecular Medicine | BA / CGM / BMM / P&P |

J. Timeline

Year in Graduate School

