

GRADUATE SCHOOL OF BIOMEDICAL SCIENCES



Degree Requirements Academic Year 2015-2016

This document includes all degree requirements for programs in the Graduate School of Biomedical Sciences. A table of contents is included below.

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E. THE GRADUATE PROGRAM

1. Courses

a. Curriculum Tracks

BMB currently offers a choice of two tracks: a general (flexible) track and a biophysics track. The required coursework for each track is listed below. BMB students are required to choose one track and complete the associated coursework, which will allow them to complete the Graduate School requirement for 30 credit hours of didactic courses. Additional coursework may be elected from courses available at BCM and allied institutions of higher learning within the Texas Medical Center and the City of Houston. (Course information is available at the BCM Graduate School web site.)

All students are required to sign up every term for Seminar in Biochemistry (310-466). **Students who have obtained Permission to Write are exempted from registering for the Seminar.**

All students must register for some form of research throughout their graduate career. First year students who are rotating through labs should register for Research Rotation (310-549). Students who have joined a laboratory, but have not yet been admitted to candidacy (see below) should register for Special Projects (310-435). Students who have been admitted to candidacy should register for Dissertation Research (310-550). The number of hours for Research, when combined with the other courses, should sum to 12 hours.

BMB CURRICULUM (FLEXIBLE TRACK)

(30 hours didactic credit required)

REQUIRED COURSES (* = Non-didactic credit courses)

- Term 1 Organization of the Cell (2 hrs)
 Molecular Methods (3 hrs)
 Genetics A (2 hrs)
 **Thinking Like a Scientist* (1 hr)
 **Science as a Profession 1 (Ethics for first year students)* (0.5 hr)
 *Seminar in Biochemistry (1 hr)
 *Research Rotation

- Term 2 Cell Division (2 hrs)
 Thinking Like a Scientist (2 hrs)
 **Science as a Profession 1 (Ethics for second year students)* (0.5 hr)
 *Seminar in Biochemistry (1 hr)
 *Research Rotation

- Term 3 Macromolecules: Structure and Interactions (3 hrs)
 Gene Regulation (3 hrs)
 Thinking Like a Scientist (2 hrs)
 **Science as a Profession 1 (Ethics for third year students)* (0.5 hr)
 *Seminar in Biochemistry (1 hr)
 *Research Rotation

- Term 4 Introduction to Biostatistics (2 hrs)
 Thinking Like a Scientist (2 hrs)
 **Science as a Profession 1 (Ethics for fourth year students)* (0.5 hr)
 *Seminar in Biochemistry (1 hr)
 *Research Rotation

- Term 5 *Research Rotation

FLEXIBLE REQUIRED ELECTIVES (choose at least 7 hrs from at least 3 different areas)

GENETICS

- Term 2 Genetics B (2 hrs)
- Term 3 Mammalian Genetics (2 hrs)
- Term 4 Human Genetics (3 hrs)
- Term 4 Genetics of Animal Viruses (3 hrs) *odd years only*

DEVELOPMENT

- Term 1 Classic Developmental Biology (2 hrs)
- Term 2 Development (2 hrs)
- Term 3 Evolutionary Conservation of Developmental Mechanisms (3 hrs)
- Term 4 Neural Development (3 hrs)

IMMUNOLOGY

- Term 2 Immunology (3 hrs)
- Term 3 Immunology (1 hr)
- Term 5 Molecular Immunology (3 hrs)

NEUROSCIENCE

- Term 2 Neuroanatomy: Functional Organization of the CNS (2 hrs)
- Term 3 Neuroscience (1 hr)
- Term 3 Genetics of Neuroscience (2 hrs)
- Term 4 Neural Development (3 hrs)
- Term 4 Neurobiology of Disease (3 hrs)

DISEASE

- Term 1 Cellular & Molecular Basis of Disease (2 hrs)
- Term 2 Cancer (1 hr)
- Term 4 Pathophysiology & Mechanisms of Human Disease (3 hrs)
- Term 4 Introduction to Molecular Carcinogenesis (3 hrs)
- Term 4 Gene & Cell Therapy (2 hrs)
- Term 4 Biology of Aging & Age-Related Diseases (3hrs)

STRUCTURE & INFORMATICS

- Term 2 Bacterial Structure & Function (3 hrs)
- Term 2 ABC: Applications to Biology of Computation (2 hrs)
- Term 3 Practical Introduction to Programming for Scientists (3 hrs) *even years only*
- Term 4 Computer-Aided Discovery Methods (2 hrs)
- Term 4 Electron Cryomicroscopy for Molecules & Cells (3 hrs) *odd years only*
- Term 4 Advanced X-Ray Crystallography (3 hrs) *even years only*
- Term 4 Bioinformatics & Genomic Analysis (3 hrs)

WILD CARDS

- Term 2 Method & Logic in Molecular Biology (3 hrs)
- Term 4 Regulation of Energy Homeostasis (2 hrs)

OTHER

- Term 4 *Introduction to Scientific Writing (1 hr) (Note: ISW is NOT a didactic course; thus, will not count towards your 30 required credit hours)

BMB CURRICULUM (BIOPHYSICS TRACK)

(30 hours didactic credit required)

REQUIRED COURSES (*Non-didactic credit courses)

- Term 1 Organization of the Cell (2 hrs)
Molecular Methods (3 hrs)
Molecular Biophysics I (3 hrs) (Rice U)
**Thinking Like a Scientist (1 hr)*
**Science as a Profession (Ethics for first year students) (0.50 hr)*
**Seminar in Biochemistry (1 hr)*
**Research Rotation*
- Term 2 Molecular Biophysics II (3 hrs) (Rice U)
**Thinking Like a Scientist (2 hrs)*
**Science as a Profession (Ethics for second year students) (0.50 hr)*

- *Seminar in Biochemistry (1 hr)
- *Research Rotation
- Term 3 Gene Regulation (3 hrs)
 - *Thinking Like a Scientist (2 hrs)
 - **Science as a Profession (Ethics for third year students)* (0.50 hr)
 - *Seminar in Biochemistry (1 hr)
 - *Research Rotation
- Term 4 *Thinking Like a Scientist (2 hrs)
 - **Science as a Profession (Ethics for fourth year students)* (0.50 hr)
 - *Seminar in Biochemistry (1 hr)
 - *Research Rotation
- Term 5 *Research Rotation

FLEXIBLE REQUIRED ELECTIVES (choose 10 hours of electives, with at least 6 hours from the Biophysics List, to reach total of 30 didactic hours)

BIOPHYSICS

- Term 2 ABC: Applications to Biology of Computation (2 hrs)
- Term 2 Computational Mathematics for Biomedical Students (4 hrs)
- Term 3 Computer-Aided Discovery Methods (2 hrs)
- Term 3 Macromolecules: Structure and Interactions (3 hrs)
- Term 4 Electron Cryomicroscopy for Molecules & Cells (3 hrs) *odd years only*
- Term 4 Advanced X-Ray Crystallography (3 hrs) *even years only*

CELL BIOLOGY (This is only a partial list; check with the Program Director for other choices)

- Term 1 Genetics A (2 hrs)
- Term 1 Cellular & Molecular Biology of Disease (2 hrs)
- Term 2 Method and Logic in Molecular Biology (3 hrs)
- Term 2 Cell Division (2 hrs)
- Term 2 Cancer (1 hr)

OTHER

- Term 4 *Introduction to Scientific Writing (1 hr) (Note: ISW is NOT a didactic course; thus, will not count towards your 30 required credit hours)

BMB CURRICULUM (MSTP TRACK)
(30 hours didactic credit required)

REQUIRED COURSES (* = Non-didactic credit courses)

- Term 1 Molecular Methods (3 hrs)
 - Genetics A (2 hrs)
 - **Thinking Like a Scientist* (1 hr)
 - **Science as a Profession 1 (Ethics for first year students)* (0.5 hr)
 - *Seminar in Biochemistry (1 hr)
 - *Research Rotation
- Term 2 Cell Division (2 hrs)
 - Thinking Like a Scientist (2 hrs)
 - **Science as a Profession 1 (Ethics for second year students)* (0.5 hr)
 - *Seminar in Biochemistry (1 hr)
 - *Research Rotation
- Term 3 Macromolecules: Structure and Interactions (3 hrs)
 - Gene Regulation (3 hrs)
 - Thinking Like a Scientist (2 hrs)

*Science as a Profession 1 (Ethics for third year students) (0.5 hr)

*Seminar in Biochemistry (1 hr)

*Research Rotation

Term 4 Introduction to Biostatistics (2 hrs)

Thinking Like a Scientist (2 hrs)

*Science as a Profession 1 (Ethics for fourth year students) (0.5 hr)

*Seminar in Biochemistry (1 hr)

*Research Rotation

Term 5 *Research Rotation

ELECTIVES (9 hrs) Medical school coursework will substitute for all elective requirements according to the table below.

Medical School Course	# of lectures	Graduate School Course	# of lectures	GSBS Transfer Credit
Core concepts (Foundations Basic to the Science of Medicine)	20	Organization of the Cell (220-501)	15	2 term hrs
Hematology/Oncology	19	Cancer (220-508)	5	1 term hr
Neuroscience (Nervous System)	51	Neuroscience (220-511)	5	1 term hr
Immunology	40	Immunology (220-512)	5	1 term hr
Immunology	40	Immunology (344-423)	21	3 term hrs
Core Concepts (term 1)	11			
Core Concepts (term 2) Foundations Basic to the Science of Medicine: Cardiovascular-Respiratory- Renal System	41	Human Physiology I Human Physiology II	48 for both	6 term hrs for both
	27			
Core Concepts (term 3) Foundations Basic to the Science of Medicine: Gastrointestinal System, Metabolism System, Endocrine System and Reproductive System (GIMNER)	11			
Nervous System (terms 5 & 6)				

b. Thinking Like a Scientist (First Year BMB Curriculum)

Term 1: Entering research

The goal of this term is to develop skills so that you can make the most of your individual rotation experiences. Topics that we will cover include (i) understanding why you are here and setting goals for graduate school; (ii) making an individual development plan; (iii) landing and navigating rotations that further your professional goals; (iv) using the library's resources to find the literature you need; (v) using the "framing funnel" to understand and evaluate papers; (vi) making connections between papers and what you already know; (vii) organizing and remembering the papers that you read; (viii) learning the basic principles of scientific writing; and (ix) finding out how research grants are written, reviewed, and funded. In this course, you will participate in group discussions and prepare several documents for yourself, including an individual development plan.

Clinical Scientist Training Program

services research). All these programs have international reputations for excellence in their areas. We will utilize these resources as an ongoing and important component of our program. All elective courses are selected by the scholar and mentor, and proposed to the Program Director. They must be approved by the Program Director for the program to recognize the course(s) as part of the scholar's official credit hours toward the degree, and to cover any tuition costs.

The specific required cognates will vary according to scholars' interests and needs. For example, research with specific emphasis in epidemiology, biostatistics, and health services research may require additional courses available at the UT School of Public Health. Or, a student pursuing a career in Outcomes Research would be required to take a number of additional courses at the UT School of Public Health. For other scholars it might be necessary to take a combination of courses from affiliated institutions together with courses offered at BCM. In any case, didactic requirements and elective courses will be prescribed upon a scholar's matriculation based on the scholar's proposed research and career plans.

Degree and Certificate Requirements

M.S. track:

- Complete 60 term-hours of credit. Baylor has five terms, and students earn 12 hours of credit per term. The hours are earned through formal courses, together with research time. Included in the 60 credit hours should be 30 hours of required and elective courses proposed by the mentor and approved by the Thesis Research Advisory Committee (See below for definition and composition of the Thesis Research Advisory Committee). These courses must be graded, or be one of the two approved by the Graduate School as pass/fail.
- Write a K23 grant proposal.
- Pass the Qualifying Examination. This is an examination based on the student's K-23 grant proposal, which is developed during the first year of the program. The student will be expected to answer questions about his/her research, and about the content of the courses taken so far. This exam is usually conducted at the start of the second year of the program. After passing this exam, the student is ready to conduct the research in preparation for writing a thesis.
- After completing the qualifying exam and the 30 graded credit hours, the student is "entered into candidacy" for the degree. This means that the student is in full-time research mode.
- Complete the proposed research
- Submit a thesis, which may be developed from the student's published and submitted manuscripts (in accordance with Graduate School of Biomedical Sciences policies), with appropriate introduction and concluding sections, to the Final Examination Committee (See below for definition and composition of the Final Examination Committee).
- Pass the final exam focused on the thesis.
- [this is stated as 60-term hours above]There is a maximum time to graduate of 4 years, not including leaves of absence
- "Permission to write" is not required.
- A public thesis defense is not required.

Ph.D. track:

- Complete 180 term-hours of credit. Baylor has five terms, and students earn 12 hours of credit per term. The hours are earned through formal courses, together with research

time. Included in the 180 credit hours should be 30 hours of core, required and elective courses proposed by the mentor and approved by the Thesis Advisory Committee. These courses must be graded, or be one of the two approved by the Graduate School as pass/fail.

- Write a K23 grant proposal.
- Pass the Qualifying Examination. This is an examination based on the student's K-23 grant proposal, which is developed during the first year of the program. The student will be expected to answer questions about his/her research, and about the content of all the courses taken so far. This exam is usually conducted at the start of the second year of the program. After passing the exam the student is ready to conduct the research in preparation for writing a thesis.
- Complete the proposed research.
- Submit a thesis, which may be developed from the student's published and submitted manuscripts (in accordance with Graduate School of Biomedical Sciences policies), with appropriate introduction and concluding sections, to the Final Examination Committee.
- Pass the Final Examination on the thesis.
- Submit a bibliography of submitted and published manuscripts generated as a result of participation in the program.
- Except under unusual circumstances, there is a maximum time to graduation of 7 years
- "Permission to write" is required
- A public thesis defense is required

Certificate of Added Qualification (CAQ) students:

The requirements are the same as for the degree students in their first year, with these exceptions:

1. Students are not required to take any courses other than: Fundamentals of Clinical Investigation, Clinical Investigation for the Career Scientist, and Seminar.
2. Students may take additional courses at BCM or UT School of Public Health.

Candidacy (MS and PhD Tracks)

Upon successful completion of all course requirements and the qualifying exam, a student may be admitted to candidacy. For the PhD, admission to candidacy must be approved at least nine (9) months prior to the expected date of graduation. The "Admission to Candidacy Form" will require approval of the Director of the CSTP and the Dean of the Graduate School.

STUDENT ADVISORY COMMITTEES (All Degree Students (i.e., M.S. and Ph.D. tracks))

Advisory Committee for First Year Students

The Director, Co-Director and Associate Director serve as "temporary advisor" for the first year graduate students. They counsel the graduate students through the early phase of their graduate program. They meet with the first year graduate students prior to registration for the first term and again during the second term. They ensure that students register for required courses and make suggestions for elective courses.

Thesis Research Advisory Committee

Major Thesis Advisor: Every degree student enters the program with a chosen mentor/advisor, who is designated the "Major Thesis Advisor". The student may spend one term in a "Research Rotation," but he/she must submit an Appointment of Major Advisor and Compact form during the first term. The Major Thesis Advisor together with the student is responsible for maintaining

Developmental Biology

2015 Graduate Program Curriculum

Developmental Biology students are required to take all of the required courses with a grade of B or better and an additional 6 hours of elective credits, totaling at least **31 didactic hours**. Additional quantitative electives are highly recommended. (D) – denotes didactic courses

Students are encouraged to continue their education throughout graduate training and may consider auditing courses of interest (without earning credit hours) provided they have agreement from the course director.

	Course #	Course Title	Credits	Course Director
REQUIRED in YEAR 1:				
Term 1				
	GS-DB-402	Classical Developmental Biology	2 (D)	
	GS-GS-501	Organization of the Cell	2 (D)	Pedersen/Sifers
	GS-GS-502	Molecular Methods	3 (D)	Weigel
	GS-GS-503	Genetics A	2 (D)	Herman/Dierick
	GS-GS-514	Ethics - Year 1	0.5	Bertuch
Term 2				
	GS-GS-504	Genetics B	2 (D)	Zhou
	GS-GS-505	Cell Division	2 (D)	Ira/Chang
	GS-GS-506	Development	2 (D)	Groves
	GS-GS-508	Cancer	1 (D)	Pangas
	GS-DB-466	Seminar in Developmental Biology	1	Groves
Term 3				
	GS-DB-422	Evolutionary Conservation of Developmental Mechanisms	3 (D)	Bellen
		Gene Regulation	3 (D)	Cooper
		Neuroscience	1 (D)	Jankowsky
	GS-DB-466	Seminar in Developmental Biology	1	Groves
Term 4				
	GS-DB-403J	Neural Development	3 (D)	Arenkiel/Sillitoe
	GS-DB-425	Topics in Development	3 (D)	Maletic-Savatic/Wythe
	GS-GS-521	Introduction to Biostatistics <i>*A different quantitative course may be substituted upon Director's approval.</i>	2 (D)	Minard
	GS-DB-466	Seminar in Developmental Biology	1	Groves
REQUIRED in YEAR 2:				
Term 2				
	GS-GS-515	Ethics - Year 2	0.5	Bertuch
	GS-DB-466	Seminar in Developmental Biology		Groves
Term 3				
	GS-DB-466	Seminar in Developmental Biology	1	Groves
Term 4				
	GS-DB-466	Seminar in Developmental Biology	1	Groves
REQUIRED in YEARS 3-4:				
Year 3, Term 3: Ethics 3, GS-GS-516				
Year 4, Term 3: Ethics 4, GS-GS-517				
Years 3-4, Terms 1-4: Seminar in Developmental Biology, GS-DB-466				

1. Required Courses

1.1.Students shall pass the following courses before being Admitted to Candidacy.

1.2.Students shall pass the following courses before being Admitted to Candidacy.

Term	Course Title (credits)
1	<i>Organization of the Cell</i> (2)
	<i>Molecular Methods</i> (3)
	<i>Genetics A</i> (2)
	<i>Logic and Presentation of Problem-Solving Science</i> (1)
	<i>Research Rotation</i> (3)
	<i>Journal Club</i> (1)*
	<i>Seminars in Immunology Research</i> (1)
2	<i>Introduction to Immunology</i> (3)
	<i>Cell Division</i> (2)
	<i>Logic and Rhetoric of Writing Science</i> (1)
	<i>Journal Club</i> (1)
	<i>Research Rotation</i> (3)
	<i>Seminars in Immunology Research</i> (1)
3	<i>Regulation of Immune Response</i> (3)
	<i>Gene Regulation</i> (3)
	<i>Macromolecules: Structure & Function</i> (3)
	<i>Research Rotation</i> (3)
	<i>Journal Club</i> (1)
	<i>Seminars in Immunology Research</i> (1)
4	<i>Molecular Immunology</i> (3)
	<i>Introduction to Biostatistics (GS-GS-521)</i> (2)
	<i>Logic and Rhetoric of Writing Proposals</i> (1)
	<i>Journal Club</i> (1)
	<i>Seminars in Immunology Research</i> (1)
5	<i>Clinical Aspects of Immunology</i> (3)
	<i>Journal Club</i> (1)
	<i>Seminars in Immunology Research</i> (1)

1.2.1. **Exceptions:** Students may request a waiver for courses for which they have had an equivalent. Students may transfer graduate level course credits to fulfill part of the requirement of thirty didactic credits. Waivers and transfers are subject to approval by the Curriculum and Progression Committee, the Program Director, and the Dean of the Graduate School of Biomedical Sciences.

VI. THE GRADUATE PROGRAM

A. Curriculum

Courses: The Integrative Molecular and Biomedical Sciences Graduate Program offers each student an individualized curriculum covering advanced topics in molecular biology, genetics, biochemistry, cell biology, virology, immunology, and many other courses offered by participating departments. Only the designated core courses (see IMBS Curriculum), IMBS Director's Course, the IMBS seminar course, and the years 1-4 Ethics courses are required for all students. Upon registration, each first year student will meet with the IMBS co-director in charge of curriculum to design the year's curriculum taking into consideration the student's interests as well as previous exposure to the subject matter. Students must complete 30 term hours (and pass the Qualifying Exam, see below) prior to admission to candidacy by the Graduate School. At least 24 of the required 30 term hours must come from courses that assign a letter grade; 6 term hours may come from the approved pass/fail category of didactic courses.

Reading course: The purpose of Reading GS-MB-548 is for the student to undertake a study of specific areas of interest under the tutelage of faculty members selected by the student in order to establish personal contact. This course is offered every Term and is optional.

Research Rotations: The purpose of research rotations is to expose students to the actual research environment of the selected faculty's laboratory, and to help them choose a major thesis advisor. Beginning with the first Term, first year graduate students are required to register for GS-MB-549: Research Rotation. Each one-hour of credit corresponds roughly to three hours per week devoted to the laboratory. A student must register for at least three rotations. These rotations must be taken with different faculty members in the Program in order to take full advantage of the diversity of IMBS faculty research areas and disciplines. At the end of each rotation, the faculty member must submit a written evaluation of the student's performance. This report will be made available to the PSC.

Any student who receives more than two grades of C or lower in core courses may be recommended for dismissal from the Graduate School by the IMBS program. Any student who takes a course for the second time and earns a grade of C or lower may be recommended for dismissal from the Graduate School by the IMBS program. Students must successfully complete all required core courses prior to taking the qualifying exam.

B. The Qualifying Exam

The purpose of the Qualifying Exam is to determine the student's eligibility for admission to candidacy toward a Ph.D. degree. The Exam will test the student's knowledge of cell and molecular biology, discipline of the resident department, capability for original thought, and ability to approach research problems scientifically. The examination will take place during the Fall of the student's second year of study unless it is postponed due to non-completion of the 30 didactic hours. Second year students will be informed of the date of the examination by Term 5 of their first year.

Students must complete the 30 didactic hours before taking the qualifying exam. Before the exam, students are required to submit the Graduate School form entitled "Qualifying Examination Date" to the Graduate School.

C. Thesis and Defense of Thesis

Students in the IMBS Program will follow the Graduate School guidelines for the preparation and completion of their thesis.

Defense of Thesis- The rules and regulations regarding the dissertation have been formalized by the Graduate School. The regulations are listed in the Graduate School Policy Handbook and are to be followed.

D. Leave of Absence

A student who seeks a leave of absence must submit a completed Leave-of-Absence Form and an LOA Clearance Form to the IMBS Program Director prior to the start of the leave. Requests approved by the Program Director are submitted for approval to the Dean. A leave of absence may be granted for a period of up to one year and shall be permanently noted on the student's transcript. The Program does not permit a leave of absence extending beyond one year, and will not grant extended leaves for non-health reasons. A student who does not enroll as a full-time graduate student for the term following the leave of absence shall be considered to have withdrawn from the Program.

A request from the student for an extension of the leave within the one-year permissible period must be submitted in writing to the Program Director for approval by the Dean no later than the beginning of the term in which the original leave will expire. When a leave of absence is granted to a student with incomplete grades, the Promotions Committee determines whether or not to extend the time allowed for completing course requirements.

E. Requirements for IMBS Students

The following items are required of all IMBS students enrolled in the Program, in addition to the overall requirements of the Graduate School of Biomedical Sciences. Failure to meet these Program requirements may result in a failing grade in the IMBS Seminar Course (GS-MB-466).

- Attendance and participation at the annual IMBS Research Conference.
- Attendance and participation in the IMBS Seminar Course (GS-MB-466). Each student is allowed a maximum of five unexcused absences from CMB seminar per academic year with no more than two absences per term. If a student misses more than two seminars per term without a compelling excuse, the student will receive a marginal pass for the term, requiring 2 subsequent terms of Pass to be removed from academic warning.
- Presentation of a scheduled seminar in the IMBS Seminar Course (GS-MB-466) on an annual basis for students 2nd year and above. Students 6th year and above and having Permission To Write (PTW) are excused from presenting a seminar but are required to attend the IMBS seminars up until their dissertation defense date.
- Annual submission of an abstract for the Graduate Student Symposium unless the student is in their first year of study, second year without a defined project, or has been exempted from this requirement by one of the Program Directors. Third year and above students are required to present a poster.
- Annual submission of an updated biosketch for review by the IMBS Steering Committee following the provided NIH T32 format. The biosketch update is due every year in July.
- Attendance at Faculty Talks (first-year students).

- (1) If they desire a degree from this department, they must select a new Major Thesis Advisor. This should be done as soon as possible so the new advisor can counsel the student during preparation for the qualifying examination.
- (2) The student may elect to withdraw from the Molecular & Cellular Biology program and follow the advisor if the advisor's circumstances permit.
- (b) Student Who Has Been Admitted To Candidacy for the Ph.D. The student elects to remain a member of the MCB Graduate Program and receive the Ph.D. from Baylor.
 - (1) The student may elect to follow the thesis advisor in order to complete thesis research.
 - (i) The student must appoint a local advisor from MCB faculty. The departmental requirement of 3 primary MCB faculty on the Thesis Advisory Committee remains in force.
 - (ii) The resigning faculty advisor may become a Remote Advisor and then remains a member and chair of the Thesis Advisory Committee and continues to serve as the operational preceptor for the student.
 - (iii) Evidence must be provided to the Graduate School and MCB that the new institution accepts the student in an appropriate category and provides appropriate facilities and physical resources to continue thesis research. Proof must also be provided that the student will receive a stipend/living allowance and insurance coverage from the new institution which is comparable to that provided at Baylor.
 - (iv) The student must inform the Graduate School of his intent to complete research off-campus by completing the Remote Student Form. (See GSBS Article 8.3. Remote Student Status). In addition, the student must provide the Graduate School with a new address and all the information requested in (iii). The student will continue to register each term and submit status reports.
 - (v) **The student is required to return at least once a year for a meeting with the Advisory Committee at Baylor College of Medicine (i.e., in Houston) and continue to provide semi-annual progress reports on his/her thesis research.** MCB and the Graduate School at Baylor College of Medicine continue to monitor the student's progress toward the Ph.D.
 - (vi) The final thesis is defended at Baylor College of Medicine.
- (2) If the student is unable to complete thesis research under the guidance of the Major Thesis Advisor, e.g., the advisor is moving to a situation without a graduate program, the advisor is retiring from research, etc., the student must select a new Major Thesis Advisor. The student is not penalized for the interruption in the degree program; the student is given every assistance towards the rapid completion of the Ph.D. program.

ARTICLE VI THE GRADUATE PROGRAM

The graduate program leading to a Ph.D. in Molecular & Cellular Biology (MCB) is designed as a four to six year program with a maximum of seven years to complete the degree.

A. Degree Requirements – Coursework

1. Service Curriculum

Students must satisfactorily complete (grade of B or better) the courses outlined below **before** taking the Qualifying Examination in MCB.

Graduate School Service Curriculum - Year 1

GS-GS-501	Organization of the Cell+
GS-GS-502	Molecular Methods
GS-GS-503	Genetics A
GS-GS-504	Genetics B <i>or</i> GS-GS-506 Development
GS-GS-505	Cell Division
GS-GS-509	Gene Regulation
GS-GS-518	Macromolecules: Structure and Interactions
GS-GS-514	Ethics-Year 1

Graduate School Service Curriculum Year 2

GS-GS-515	Ethics-Year 2
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Students must satisfactorily complete the courses outlined below **after** taking the Qualifying Examination in MCB:

Graduate School Service Curriculum Year 3

GS-GS-516	Ethics-Year 3
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2. Department

GS-CB-425	Cellular Signaling
GS-CB-461	Cells, Tissues and Organs+
GS-CB-466	Seminar in Molecular & Cellular Biology**
GS-CB-465	Introduction to Research and Research Proposals

+ MD/PhD students are not required to take GS-GS-501 Organization of the Cell or GS-CB-461 Cells, Tissues and Organs.

** Student must be in good academic standing including with respect to completing GS-CB-466 Seminar in Molecular & Cellular Biology to be eligible to take the qualifying exam.

3. Elective Courses

Students are required to take at least 3 elective courses in addition to the service curriculum. Each elective course is required to be 2 - 3 credit hours, using specific grading criteria (not seminars, special topics or journal clubs). Students must complete these courses prior to defense of their dissertation. It is recommended that students take as many of these courses as possible in their first year in the program.

The following courses offered by MCB are **recommended**:

GS-CB-426	Integrated Microscopy
GS-CB-468	Regulation of Energy Homeostasis (12/06/12)
GS-CB-470J	Neuroanatomy (11/18/03)
GS-CB-406	Reproductive Biology
GS-CB-457J	Introduction to Molecular Carcinogenesis
GS-CB-459J	Bioinformatics and Genomic Analysis
GS-CB-462J	Concepts of Learning & Memory

The following courses are also **approved** for elective credit:

GS-GS-427	ABC: Applications to Biology of Computation (09/25/12)
GS-GS-508	Cancer*
GS-GS-511	Neuroscience*
GS-GS-512	Immunology*
GS-GS-521	Introduction to Biostatistics
GS-MB-430	Biology of Aging & Age Related Disease (2/26/09)
GS-IM-423	Immunology (10/6/08)
GS-GE-421	Mammalian Genetics (12/19/06)
GS-GE-403	Gene and Cell Therapy
GS-PY-430	Human Physiology I
GS-PY-431	Human Physiology II (1/7/2010)
GS-TB-405	Translational Breast Cancer Research (10/12/06)
GS-TB-403	Biostatistics for Translational Researchers (12/7/06)

* All three courses are required to equal one elective

B. Seminar in Molecular & Cellular Biology (GS-CB-466)

Seminar in Molecular & Cellular Biology (GS-CB-466) is offered first and fourth term of each academic year. Each graduate student in MCB is required to successfully complete four (4) terms of Seminar (GS-CB-466) for one (1) hour of credit per term. This requirement should be completed during each student's first two years in the program. Attendance is mandatory. Student must be in good academic standing including with respect to completing GS-CB-466 Seminar in Molecular & Cellular Biology to be eligible to take the qualifying exam. A student missing more than one class will receive a failing grade. Special cases may be appealed to the Director of the MCB Graduate Program and the STAC Faculty Advisor. Students who fail to complete all requirements for the Qualifying Examination in the first two years of graduate school must continue to register for Seminar (GS-CB-466) until all requirements for the exam are completed.

Graduate students who have completed the required four (4) terms of Seminar (GS-CB-466) may elect to register for this course in subsequent terms.

C. Other Courses

Students are counseled by the Student Temporary Advisory Committee (STAC) regarding the core curriculum and electives in order to better meet the needs and experience of the entering student. The GEC will review and make recommendations concerning the transfer of credits on the content and quality of the courses previously taken, as reflected by the course outline and required textbook or references, and the student's performance, as reflected by a grade of B or better (or equivalent).

D. Elective Coursework

Additional course/credit requirements for the degree are determined by students in consultation with their respective Major Thesis Advisors and Thesis Advisory Committees. Coursework may be selected from curricula available at Baylor College of Medicine and allied institutions of higher learning within the academic community.

Molecular and Human Genetics

Changes in the Major Thesis Advisor and/or the Thesis Research Advisory Committee membership must be approved by the Dean. Appointments are made upon written request. The Graduate School form, Request for Appointment of Student's Advisory Committee, must be re-filed in the Graduate School Office.

VI. PROGRAM DESCRIPTION

A. Required Courses

The program provides didactic training in a variety of areas of Genetics.

Required courses include:

Organization of the Cell (2 hrs)
Molecular Methods (3 hrs)
Genetics A (2 hrs)
Ethics – Year 1 (1 hr)
Method and Logic in Molecular Biology (3 hrs)
Genetics B (2 hrs)
Gene Regulation (3 hrs)
Mammalian Molecular Genetics (2 hrs)
Human Genetics (3 hrs)
Introduction to Biostatistics (2 hrs)
Seminars in Molecular & Human Genetics (3 terms)
Student Research Seminars (4 terms)
A minimum of three Laboratory Rotations (Research Rotations)

Typically, students would complete the required courses, and a minimum of 3 lab rotations (8 weeks each) by the end of the fifth term.

Requirements may be waived by the Graduate Education Committee based on the student's background in various subject areas. Students may petition the GEC for such waivers. Seminars in Molecular & Human Genetics is a required course for all first and second-year students.

B. Elective Courses

Students are required to complete a minimum of 60 term hours of course work, of which 30 term hours must be in courses that either have a letter grade assignment or are specifically designated by the Graduate School as “approved pass/fail” graded courses (e.g. Method and Logic in Molecular Biology and Research Design). Please note that completion of the required courses above will satisfy 22 of the 30 hours; therefore, a minimum of 8 course hour of electives will be required for students entering in 2014. Selection of elective courses will be made in consultation with the thesis advisor or the Director of the Graduate program.

Highly recommended electives include:

Cell Division (recommended elective)
Development
Cancer
ABC-Applications to Biology of Computation
Neuroscience
Immunology
Computer-Aided Discovery Methods
Practical Introduction to Programming for Scientists
Macromolecules: Structure and Function
Gene and Cell Therapy
Concepts of Learning & Memory
Bioinformatics & Genomic Analysis

Biology of Aging & Age Related Diseases
Research Design
Computer-Aided Discovery Methods

Transfer of credit for work completed at another university or in another advanced program may be requested. No more than 60 term hours (30 semester) may be submitted for transfer. Transfer credit can only be granted for courses receiving a grade based on performance on an examination. No research or seminar credit will be transferred. Requests for transfer must be approved by the Director of Graduate Studies and the GEC for first year students, or the Major Advisor and the student's thesis committee for more senior students. Subsequently, the request is sent to the Promotions Committee of the Graduate School for final decision on acceptance.

C. Laboratory Rotations

Laboratory rotations (Research Rotations) are to be conducted in a minimum of three different laboratories. Students who wish to petition for a reduction in the number of required rotations may submit a written request for review by the GEC. Incoming students who work full-time for a minimum of four weeks in the lab of a faculty member participating in the MHG Graduate Program may count that work as a research rotation. To request approval for summer work to count as a rotation, the student should submit a written request to the GEC.

Laboratory rotation (Research Rotation) credit hours are considered course hours by the Graduate School and contribute to the total of 60 credit hours that are required for graduation. Students should expect to spend approximately 3 hours per week per credit hour in the laboratory during a rotation. The rotation period ends when classes end at the beginning of the study period before exams. Students and faculty should discuss the work schedule of the student, the class time and course load. The specific issue of time off for studying for mid-term and final examinations should be addressed at the time the student is considering doing a rotation in the lab. Major departmental events such as the annual retreat are very important for the students and rotation demands should not compromise their ability to attend these activities.

The grade of Pass/Fail is given for a rotation. The students should discuss with the faculty how they will be evaluated and should meet to evaluate the student's progress during the rotation period at various points (for example 2 to 3 weeks after the rotation starts, after mid-term and at the end). One of the major purposes of the rotation is to permit students to explore various experimental systems and laboratory settings in order to better select a thesis advisor. If a faculty member is unable to take a student for the coming year for thesis research, the student should be advised of this situation.

Because the terms are only 8-10 weeks in length, the academic demands are high, and many of the students are inexperienced in laboratory work, much of the "education" of the rotation is likely to be introducing students to the overall goals of the laboratory's research and instruction in basic laboratory skills.

It is expected that the faculty will make no commitments or request a commitment from a student prior to the completion of three rotation periods. The students need the opportunity to explore various labs without the pressure of "losing out" for a position in a particular lab that has more than one student interested.

D. Seminars and Retreats

1. Faculty Research Presentations: In the first term, faculty will meet with students to briefly describe their research interests. This activity is not a course and no credit is received; nevertheless it is an integral part of the training program. It is a particularly valuable way for students to learn about research activities of the department and to select future rotation sponsors and potential thesis sponsors.

2. Departmental Seminars: Participation and attendance at the departmental seminars and retreats are an important part of graduate training. Student attendance is expected throughout this term as a graduate student and should be strongly encouraged by the faculty preceptor.

VII. TYPICAL PROGRAM IN MOLECULAR AND HUMAN GENETICS

First Term	Credit Hours
Organization of the Cell	(2)
Molecular Methods	(3)
Genetics A	(2)
Student Research Seminar	(1)
Research Rotation	(3)
Second Term	
Genetics B	(2)
Method and Logic in Molecular Biology	(3)
Ethics – Year 1	(1)
Student Research Seminar	(1)
ABC-Applications to Biology of Computation (elective)	(2)
Cancer (elective)	(1)
Cell Division (recommended elective)	(2)
Development (elective)	(2)
Research Rotation	(1-6)
Third Term	
Gene Regulation	(3)
Mammalian Molecular Genetics	(2)
Seminars in Molecular & Human Genetics	(1)
Student Research Seminar	(1)
Macromolecules Structure and Function (elective)	(3)
Neuroscience (elective)	(1)
Immunology (elective)	(1)
Quantitative Genetics (elective – offered even years only)	(2)
Practical Introduction to Programming for Scientists (elective – offered even years)	(2)
Research Rotation	(2-5)
Fourth Term	
Human Genetics	(3)
Introduction to Biostatistics	(2)
Seminars in Molecular & Human Genetics	(1)
Student Research Seminar	(1)
Gene and Cell Therapy (elective)	(2)
Computer-Aided Discovery Methods (elective)	(2)
Concepts of Learning & Memory (elective)	(3)
Bioinformatics & Genomic Analysis (elective)	(3)
Biology of Aging & Age Related Diseases (elective)	(3)
Research Design (elective)	(3)
Research Rotation	(1-4)
Fifth Term	
Seminars in Molecular & Human Genetics	(1)
Research Rotation	(11)

II PROGRAM REQUIREMENTS

A. CREDIT REQUIREMENTS FOR THE Ph.D. DEGREE

1. The Ph.D. degree requires satisfactory completion of 135 term hours.
 - a. A minimum of 60 term hours of course work is required of which 12 graded hours must be taken outside the student's department (special projects are counted as course work hours excluding the 12 required outside the department). 30 term hours of graded coursework must be completed prior to standing for the Qualifying Exam.
 - b. The remaining 75 term hours may be course work, special projects or dissertation research.
 - c. Students must be enrolled for at least 12 term hours per term, five terms per year. Students wishing to take more than 17 hours per term must obtain written permission from their advisor and have the approval of the Dean. Students will receive notification from the Graduate School when on-line registration is open and when registration is due. Late registration is subject to a \$25.00 late fee.

B. COURSE WORK

1. Required Courses

Didactic

Service Course 502 - Molecular Methods (Term 1)

Service Course 501 - Organization of the Cell (Term 1)

Physiology 430 - Human Physiology I (Term 2)

Physiology 415 - Cell Physiology (Term 2)

Physiology 431 - Human Physiology II (Term 3)

Service Course 518 – Macromolecules: Structure and Interactions (Term 3)

Genetics 407 - Basic Biostatistics (Term 4)

Non-didactic

Service Course 513 - Science as a Profession (Term 1)

Service Course 514 - Science as a Profession-Ethics-Year 1 (Term 1)

Service Course 515 - Science as a Profession-Ethics-Year 2 (Term 2)

Service Course 516 - Science as a Profession-Ethics-Year 3 (Term 3)

Physiology 413 - Grant Writing Skill (2 year-Term 2)

Physiology 465- Transmembrane Signaling (Term 4)

(Each Year, All Terms)

Physiology 549 - Research Rotation (All Terms, 1st year)

Physiology 435 - Special Project (All Terms, 2nd year)
Physiology 466 - Seminar in Molecular Physiology (All Terms)
Dissertation – (After Admitted into Candidacy)

After the completion of first year in the program, students must have completed the required 60 course term hours including all required courses. Graduate students must make a grade of "B" or better in all required course work. If a grade of "C" is made in a required course, the course must be retaken. If a grade "C" is made a second time, the student will be subject to dismissal from the program. If a grade of "F" is made in any required course, the student will be subject to dismissal from the program.

Required courses may be waived upon request by the student. The student must submit evidence of having achieved a passing grade (A or B) on a graduate level course or courses with similar content. Such evidence should include a transcript and a course syllabus. The request will be reviewed by the Graduate Education Committee. Any of these courses may be waived at the discretion of the Graduate Education Committee.

Students must attempt to complete the required 30 didactic hours by the end of term 5.

2. Recommended Elective Courses

Service Course 503 - Genetics A (Term 1)
Service Course 504 - Genetics B (Term 2)
Service Course 505 - Cell Division (Term 2)
Service Course 506 - Development (Term 2)
Service Course 509 - Gene Regulation (Term 3)
Service Course 511 - Neuroscience (Term 3)
Neuroscience 444 - Brain Imaging from Cell to System (Term 3)
Neuroscience 462J - Concepts of Learning and Memory (Term 4)
Cellular Biology 425-Cellular Signaling (Term 4)

Students will need prior approval from the Graduate Education Committee to take courses that will conflict with the Seminar Series schedule.

C. SEMINAR SERIES

The Seminar Series consist of three types of seminars: Departmental Faculty, Postdoctoral/ Students and Dissertation.

1. Departmental Seminars Lunch with the Speaker
The seminar coordinator will send an email soliciting students to attend lunch with the speakers.
2. Seminar Attendance

APPENDIX A

Areas of Competence Department of Molecular Virology and Microbiology

AREA OF COMPETENCE	REQUIRED COURSE TO FULFILL COMPETENCE	ELECTIVE COURSES THAT CAN SATISFY COMPETENCE*
Fundamental Microbiology	388-401 General Virology 388-417 Bacterial Structure and Function	
Basic Immunology	344-423 Immunology I	
Biochemistry	220-507 Macromolecules: Structure and Interactions	
Molecular Biology	220-501 Organization of the Cell 220-502 Molecular Methods 220-503 Genetics A 220-509 Gene Regulation	220-505 Cell Division 220-523 Method & Logic in M.B.
<u>Advanced Virology</u>		
Tumor Virology		388-457J Introduction Molecular Carcinogenesis
Viral Replication & Gene Expression		388-458 Replication & Gene Expression in Viral Systems
Viral Genetics		388-411 Genetics of Animal Viruses
Viral Pathogenesis		388-459 Viral Pathogenesis 388-450 Infection & Immunity
Viral Epidemiology		388-426 Epidemiology of Infection
Viral Methods/Techniques		370-407 Biostatistics 220-522 Research Design
<u>Advanced Microbiology</u>		
Microbial Replication & Gene Expression	388-417 Bacterial Structure and Function	
Microbial Genetics		388-416 Genetics of Bacteria
Microbial Pathogenesis		388-450 Infection & Immunity U.T. Microbial Path. Course
Microbial Epidemiology		388-426 Epidemiology of Infection
Microbial Methods/Techniques		370-407 Biostatistics 220-522 Research Design

* Other electives can provide content for areas of competence. Those electives shown are those most frequently taken by MVM students.

APPENDIX B

Standard Graduate Curriculum Department of Molecular Virology and Microbiology

NUMBER	COURSE	REQUIRED OR ELECTIVE	YEAR OFFERED	CREDITS
TERM 1 (AUGUST – OCTOBER)				
220-501	Organization of the Cell	Required	Every	2
220-502	Molecular Methods	Required	Every	3
220-503	Genetics A	Required	Every	2
388-549	Research Rotation	Required	Every	Variable
388-410	Literature Reports	Required	Every	1
388-466	Seminar	Required	Every	1
TERM 2 (OCTOBER – DECEMBER)				
388-410	General Virology	Required	Every	4
388-417	Bacterial Structure and Function	Required	Every	3
344-423	Immunology I	Required	Every	3
388-549	Research Rotation	Required	Every	Variable
388-410	Literature Reports	Required	Every	1
388-466	Seminar	Required	Every	1
220-506	Cell Division	Elective	Every	2
TERM 3 (JANUARY – MARCH)				
220-507	Macromolecules: Structure & Interactions	Required	Every	2
220-509	Gene Regulation	Required	Every	3
388-549	Research Rotation	Required	Every	Variable
388-410	Literature Reports	Required	Every	1
388-466	Seminar	Required	Every	1
TERM 4 (MARCH – MAY)				
388-549	Research Rotation	Required	Every	Variable
388-410	Literature Reports	Required	Every	1
388-466	Seminar	Required	Every	1
220-522	Research Design	Elective	Every	3
388-411	Genetics of Animal Viruses	Elective	Odd	3
388-416	Genetics of Bacteria	Elective	Even	3
388-426	Epidemiology of Infection	Elective	Even	3
388-457J	Introduction to Molecular Carcinogenesis	Elective	Every	4
388-458	Replication & Gene Exp. in Viral Systems	Elective	Odd	3
388-459	Viral Pathogenesis	Elective	Even	3
TERM 5 (MAY – JULY)				
388-549	Research Rotation	Elective	Every	Variable
388-450	Infection and Immunity	Elective	Every	4
370-407	Biostatistics	Elective	Every	3

In general all of the required courses are taken during the first year of residence. Electives that do not fit in year one are generally completed in the second year.

places the thesis work in its proper context and discusses the implications of the work and important future directions. The Methods and Results chapters may be a compilation of the in press and published thesis work.

The Reporting member of the thesis advisory committee is responsible for monitoring how well these Benchmarks are being met and for notifying the Graduate Program Steering Committee of potential problems as soon as they become evident. If sufficient resources and mentoring are being provided and the graduate student continues to fall behind, then a remediation plan with clear guidelines must be developed. Failure by the student to correct the problem can result in the thesis project being terminated by the Graduate Program Steering Committee with or without a terminal master's degree, depending upon the actual progress made. If insufficient resources or mentoring are being provided then a remediation plan must be developed. Failure to correct the problem can be grounds for removal of the mentor from the Training Faculty.

6.2 Curriculum

The Graduate Program leading to the Ph.D. in Neuroscience is designed as a five-year program. It is anticipated that the student entering with a majority of the background course work could complete all formal course work in two years or less. The graduate curriculum in Neuroscience is flexible to meet the wide-ranging interests of those wishing to pursue such a field of study while at the same time providing a strong foundation in a number of core areas. The required courses for the Ph.D. in Neuroscience are:

Term 1

Organization of the Cell (GS-GS-501)
Electrical Signaling in the Brain (GS-NE-448)
Neuroscience Lab I (GS-NE-449)
Brain Cell Biology (GS-NE-451)
Ethics - Year 1 (GS-GS-514)

Term 2

Anatomy & Development of the Nervous System (GS-NE-430)
Neuroscience Lab II (GS-NE-450)
Analyses of Neuronal Function (GS-NE-431)
Computational Methods in Neuroscience I
Journal Club

Term 3

Neural Systems I (GS-NE-433)
Genetics of Neuroscience (GS-NE-441)
Computational Methods in Neuroscience II (elective)
Journal Club

Term 4

Neural Systems II (GS-NE-434)
Neurobiology of Disease (GS-NE-422)
Introduction to Biostatistics (GS-GS-521)
Journal Club

Students in the Graduate Program in Neuroscience are also required to take at least 5 hours of didactic course electives. The electives may be chosen from the following list of Neuroscience courses or from other appropriate courses at Baylor, Rice University or University of Texas Health Sciences. The PA and/or DGS can give students information to help them choose elective courses.

Cellular Neurophysiology	(GS-NE-464)
Computational Methods in Neuroscience II	
Concepts of Learning and Memory	(GS-NE-462J)
Development Brain Disorders	(GS-NE-437)
Fundamentals of Human Neuroimaging	(GS-NE-400)
Introduction of fMRI	(GS-NE-439)
Neural Development	(GS-NE-470J)
Physiology of the Visual System	(GS-NE-424)
Theoretical Neuroscience: Cells, Circuits and Systems	(GS-NE-426)
Theoretical Neuroscience: Learning, Perception and Cognition	(GS-NE-443)

6.3 Credit Hours

A total of 180 credit hours are required for the Ph.D. in Neuroscience with a minimum of 60 of those hours as course work (includes Special Projects, Research Rotation, Seminar and Readings and other courses). A minimum of *31 credit hours* of didactic course work (26 hours of core requirements and 5 elective hours) requiring a final exam must be completed prior to admission to candidacy.

31 term hours of this requirement must be from courses which either:

- 1) have a letter grade assignment (“letter graded” courses) and be graded A-F by objective criteria, or
- 2) are designated by the Curriculum Committee as “approved pass/fail” graded courses (excluding seminars and journal clubs).

6.4 Seminars

The Department of Neuroscience sponsors a variety of seminars and meetings. All graduate students are **expected** to attend the Neuroscience seminars, the Rush Record Forum. In addition, all students are **expected** to attend at least one of the journal clubs offered by members of the Department.

6.5 Appoint Major Advisor

The primary responsibility for choosing a mentor resides with the Graduate Student. The Graduate Program Director must approve the mentor selection, but otherwise the Department’s primary role is to identify for students a list of potential mentors from which they can choose. If a student needs to replace a mentor, for any reason, the Department will assist the student in identifying a new mentor, but again the primary responsibility resides with the Graduate Student. Failure to identify a mentor is grounds for dismissal from the program.

V. COURSE OF STUDY

Curriculum

Required Courses – Students should complete the required courses and a minimum of 4 lab rotations by the end of the fifth term of the first year.

FIRST TERM

MOLECULAR METHODS (3 HRS)
ORGANIZATION OF THE CELL (2 HRS)
SCIENCE AS A PROFESSION – ETHICS (1 HR)
ROTATION (VARIABLE HRS)

SECOND TERM

CANCER (1 HR)
IMMUNOLOGY (3 HR)
ROTATION (VARIABLE HRS)

THIRD TERM

GENE REGULATION (3 HRS)
MACROMOLECULES: STRUCTURE AND INTERACTIONS (3 HRS)
ROTATION (VARIABLE HRS)

FOURTH TERM

GENERAL PHARMACOLOGY (3 HRS)
ROTATION (VARIABLE HRS)

FIFTH TERM

DRUG DISCOVERY (2 HRS)

Elective Courses - Students are required to complete a minimum of 60 term hours of course work, of which 30 term hours must be in courses that either have a letter grade assignment or are specifically designated by the Graduate School as “approved pass/fail” graded courses (e.g. Method and Logic in Molecular Biology and Research Design). Selection of elective courses will be made in consultation with the Pharmacology Graduate Program Committee.

The following courses are approved by the Pharmacology Graduate Program Committee as electives:

FIRST TERM

CELLULAR AND MOLECULAR BIOLOGY OF DISEASE (2 HRS)
COMPUTATIONAL MOLECULAR BIOPHYSICS & STRUCTURAL BIOLOGY (6 HRS)
METHOD & LOGIC IN MOLECULAR BIOLOGY (3 HRS)
GENETICS A (2 HRS)

SECOND TERM

CELL DIVISION (2 HRS)
GENETICS B (2 HRS)

THIRD TERM

COMPUTER-AIDED DISCOVERY METHODS (2 HRS)

FOURTH TERM

BIOINFORMATICS & GENOMIC ANALYSIS (3 HRS)

BIostatISTICS FOR TRANSLATIONAL RESEARCHERS (3 HRS)

CELLULAR SIGNALING (3 HRS)

INTRODUCTION TO MOLECULAR CARCINOGENESIS (3 HRS)

INTRODUCTION TO STATISTICAL COMPUTING & MODELING (3 HRS)

PRACTICAL INTRODUCTION TO PROGRAMMING FOR SCIENTISTS (3 HRS)

FIFTH TERM

PROTEOMICS & FUNCTIONAL GENOMICS (3 HRS)

Faculty Research Presentations – Each faculty member is given the opportunity to make a short presentation to the first year students describing their overall research program. These are informal talks and should last only around 20 minutes. Two faculty members will present once a week for during the First Term. Attendance is mandatory for first year students.

Research Rotations - The primary goals for the research rotations are twofold: First, rotations allow new students to become familiar with research conducted in the laboratories of Pharmacology faculty members. Second, rotations allow students to familiarize themselves with laboratory procedures, approaches and a variety of research projects.

The student will select their Major Thesis Advisor primarily based on these rotations. All students are required by the department to complete four rotations in the first four terms. Students will select laboratories of professors with primary or secondary appointment in the Department of Pharmacology for rotation. At the fifth term, students will either choose their lab of study for their thesis work or participate in one more rotation.

Research Rotation credit hours are considered course hours (370-549) by the GSBS and contribute to the total of 60 credit hours that are required for graduation. For every credit hour of laboratory rotation for which a student is enrolled, they are expected to work a minimum of 3 hours per week in the laboratory. Some rotations may require more effort for limited periods of time (evenings or weekends). However, students are NOT expected to be full-time laboratory personnel.

In order to make the best of the research rotation for both the student and the faculty, they should meet before the rotation begins. If the faculty member will not be the direct supervisor for experimentation, the laboratory supervisor must be present at this meeting and understand the guidelines and requirements for the student's lab rotation. Both the faculty member and student should discuss and sign the Goals for Research Rotation Form and submit it to the PGP Director. The form will go into the student's program file. The form is due by the end of the first week of rotation.

The rotation period ends when classes end at the beginning of the study period preceding exams. At that time, the student and the faculty member should meet again. In consultation with the faculty member, the student is to write a one-page description of the rotation. This will be attached to the Evaluation of Research Rotation Form (from PGP) which is filled out

Structural and Computational Biology and Molecular Biophysics

Curriculum is designed to meet the specific needs of students with B.S. degrees in biology, math, physics, chemistry, computer science, or engineering. The overall philosophy of the course requirements is to prepare the students in both the specialized areas of research and cell and molecular biology. All classes must be completed with a grade of B or better.

Note: Courses at Baylor College of Medicine (BCM) are scheduled in eight-week terms. Courses at the University of Houston (UH), Rice University (Rice), and The University of Texas – Houston Health Science Center (UTHSC) are based on 16-week semesters.

- Advanced Topics in SCBMB (GS-SB-430) Terms 1, 2, 4 - Cr: 1 each term: Fridays, Noon-1pm
- Method and Logic (GS-GS-523) Term 2 – Cr: 3: Tuesdays/Thursdays, 10:00-Noon
- Molecular Biophysics (Bios 551) Fall Semester at Rice – Cr: 3 each Terms 1 & 2
- Seminar in Computational Biol (GS-SB-404) Fall and Spring semesters at Rice - Cr: 1 ea semester: Fridays, 4-5pm
- Computational Mathematics for Quantitative Biomedicine (GS-SB-401) Term 1-2- Cr: 8: Tuesdays/Thursdays, Noon-2pm
- Science as a Profession-Ethics (GS-GS-514), Term 1 - Cr: .5: See GSBS website for schedule
- Structural Basis of Human Diseases (GS-SB-423J) Term 4 - Cr: 1: Thursdays, Noon-1pm
- Research Design (GS-GS-522), Term 4 – Cr: 3: Tuesdays, 1:15-4pm
- A computational course at Rice or UH (upon Director's approval) – 1 semester
- Electives:
 - Any course in the Graduate School Service Curriculum
 - Electron Cryomicroscopy for Molecules and Cells (GS-SB-410), Term 4 – Cr: 3 (taught odd years only): Thursdays, 9-10:30am
 - Advanced X-ray Crystallography (GS-SB-403), Term 4 - Cr: 3 (taught even years only): Mondays/Wednesdays, 2-4pm
 - Practical Introduction to Programming (GS-SB-406), Term 3 – Cr: 3: Mondays/Wednesdays, 10:30-Noon
 - Computer-Aided Discovery Methods (GS-SB-405), Term 3– Cr: 2: Wednesdays/Fridays, 10:00-Noon
 - Courses offered at Rice, UH, or UTH as approved by the Directors (must be 500 level or above)

The following is an example of coursework for a first-year student:

- TERM 1** Advanced Topics in SCBMB (GS-SB-430)
Science as a Profession (GS-GS-514)
Molecular Biophysics (BIOC 551)
Seminar in Computational Biology (BIOC 592)
Research Rotation (GS-SB-549)
Computational Mathematics for Quantitative Biomedicine (GS-SB-401)
1 or 2 Electives
- TERM 2** Advanced Topics in SCBMB (GS-SB-430)
Computational Mathematics for Quantitative Biomedicine (GS-SB-401)
Method and Logic (GS-GS-523)
Molecular Biophysics (BIOC 551)
Seminar in Computational Biology (BIOC 592)
Research Rotation (GS-SB-549)
1 or 2 Electives
- TERM 3** Seminar in Computational Biology (Bios 592)
Research Rotation (GS-SB-549)
1 or 2 Electives
- TERM 4** Advanced Topics in SCBMB (GS-SB-430)
Research Design (GS-GS-522)
Structural Basis of Human Diseases (GS-SB-423J)
Seminar in Computational Biol (BIOC 592)
Research Rotation (GS-SB-549)
Elective
- TERM 5** Research Rotation (GS-SB-549)
Elective

APPENDIX D

Standard Graduate Curriculum – Year 1 Program in Translational Biology and Molecular Medicine

The academic calendar for the Program in Translational Biology and Molecular Medicine is divided into five terms of nine weeks each. In the first year, each term is followed by a one-week break. Course work is required in the following subjects:

- Molecular Methods
- Genetics
- Human Physiology
- Immunology
- Gene Regulation
- Cellular and Molecular Biology of Disease
- Method & Logic of Translational Biology
- Pathophysiology & Mechanisms of Human Disease
- Animal Models of Human Disease
- Introductory Biostatistics for Translational Research
- Proteomics and Functional Genomics or Cells Tissues & Organs
- Ethics, Conduct & Practical Aspects of Clinical Research

First year students also participate in laboratory rotations and the Bench-to-Bedside journal club. In general, all required courses are taken in the first year of residence.

TBMM Graduate Curriculum - Year 2 and above

In the 2nd year of the TBMM program, students begin their **Thesis Research Projects**, engage in **Leadership training** and work on their **Clinical Projects**. The goal of the Clinical Projects, which are focused on the area of each student's thesis project, is to provide students with direct observation of clinical medicine in practice in an in-patient or out-patient setting, and with practical knowledge regarding the methodologies by which patient encounters are systematically transformed into useful research data. Typically the mentor for this rotation is the student's clinical co-mentor. Clinical projects include: exposure to clinical medicine, attendance at clinical meetings such as diagnostic consensus conferences or clinical research meetings and exposure to at least one clinical research project.

In general, all the required courses are taken in the first year of residence. Electives that do not fit in year one are generally completed in the second year.

In addition, TBMM students are required to complete human and animal trainings in BRAIN.

Human

“Biomedical Research – Basic/Refresher, Basic Course”

- a. Complete The Integrity Assurance Statement before beginning the course
- b. Belmont Report and CITI Course Introduction
- c. History and Ethical Principles
- d. Basic Institutional Review Board (IRB) Regulations and Review Process
- e. Informed Consent
- f. Social and Behavioral Research for Biomedical Researchers
- g. Records-Based Research
- h. Genetic Research in Human Populations
- i. Research With Protected Populations - Vulnerable Subjects: An Overview
- j. FDA-Regulated Research
- k. Conflicts of Interest in Research Involving Human Subjects
- l. The IRB Member Module - "What Every New IRB Member Needs to Know"
- m. Baylor College of Medicine

Animal

- “CCM Mandates and Guidelines”
 - a. Guide to the Care and Use of Laboratory Animals
 - b. Public Health Service policy on humane care and use of laboratory animals
- “BCM USDA Covered Species: Mandates and Guidelines”
 - a. Animal Welfare Act regulations
 - b. Public Health Service policy on humane care and use of laboratory animals
 - c. Pain recognition and alleviation in laboratory animals