



GSBS 08-10

## Basic & Biomedical Sciences Division: Program Objectives and Curriculum

The objective of the Basic & Biomedical Sciences (BBS) division is to educate researchers and teachers who will assume leadership roles in their professions. The structure of the BBS is based on the principle that graduates who choose careers in biomedical research and/or teaching will be more successful if they have obtained a solid foundation in the fundamentals of contemporary biomedical sciences. Here, knowledge and research are synonymous. Meaningful interpretation of experimental findings requires a deep appreciation of the existing body of biomedical knowledge and often, the body of knowledge requires reinterpretation in light of new findings. In the arena of biomedical research, distinctions between “textbook” or “classroom” and research-based knowledge are an artificial and unproductive separation of what is truly a scientific continuum.

The Basic & Biomedical Sciences Division seeks to:

- train biomedical scientists/educators in a specialty area with a broad background in the basic medical sciences;
- equip graduates to conduct research with direct relevance to human disease;
- prepare graduates to interact and collaborate with scientists and physicians involved in clinical investigations; and
- prepare graduates for careers as educators in schools of the health professions.

### The Core Curriculum

The program of study leading to the Basic & Biomedical Sciences PhD degree consists of an interdisciplinary core curriculum to be taken by all students and a specialization and research phase to be selected by the individual student. The core curriculum provides all students with an integral foundation in the sciences basic to medicine, emphasizing contemporary topics in molecular biophysics/biochemistry, molecular genetics, and cellular architecture and regulation. Students are also required to take an ethics course on the responsible conduct of science and a scientific writing course that teaches students how to develop research proposals.

Students should complete the core requirements in their first year, but no later than two years after admission.

### Laboratory Rotations

Students are required to participate in at least three laboratory rotations during their first year in the program. Laboratory rotations are intended to familiarize students with the principles of scientific inquiry and the concepts and techniques of several scientific fields. They allow faculty members to observe and evaluate the research aptitudes of students and permit students to evaluate the types of projects that might be developed into dissertation projects. Upon completion of each rotation, students submit a written abstract or an oral presentation on the research accomplished. The faculty sponsor grades the rotation on Pass/Fail basis and submits a written evaluation of student performance to the Dean. Each rotation is a three- or four-credit course and lasts a minimum of eight weeks if students participate full time in the laboratory, or up to a full semester if students also take courses. Two one-half rotations can be undertaken in fall or spring semesters in place of one full rotation.

Students experience faculty excellence firsthand, as they rub shoulders with:

- A Nobel Laureate who is the co-discoverer of RNA interference, the preferred method in labs throughout the world to interrupt the way genes direct the creation of proteins.
- A discoverer of the link between the immune system and type 1 diabetes, regarded as the pivotal moment in determining the disease’s origins.
- A developer of an HIV vaccine based on elements from primary virus isolates drawn from all over the world, recently tested in a clinical trial.
- A discoverer of a cancer detection technology that may predict the onset and severity of certain cancers before a tumor forms.

**Specialization**

Upon completion of the core curriculum, students request acceptance by a program to pursue advanced coursework and dissertation research. Students may enter the program with an area of specialization in mind (biochemistry & molecular pharmacology, cancer biology, cell biology, cellular & molecular physiology, immunology & virology, interdisciplinary graduate program, molecular genetics & microbiology, neuroscience), or make that decision by or before completion of the core curriculum. Advanced courses offered by each program and laboratory may be applied to the requirements for specialization upon recommendation of the program director, the student’s thesis mentor and/or Research Advisory Committee and with approval of the Dean.

**Qualifying Examination**

Prior to initiating formal research and no later than the summer semester of the second year, students are required to pass a qualifying examination. This examination is a training experience in which students must develop an original research proposal and defend their proposal before a committee representative of the area of specialization. The examination is used to evaluate the ability of students to pose meaningful scientific questions, to propose experimental methods for answering those questions, and to interpret the validity and significance of probable outcomes of these experiments. Some programs may also require students to pass a comprehensive examination in their area of specialization before taking the qualifying examination.

**Research and Advisors**

Research toward the PhD dissertation may be done under the direction of a BBS faculty member actively engaged in research in a basic or clinical science department. Students select a research advisor and research problem prior to or at the time of completion of the core and specialization curriculum. The program director recommends and the Dean approves the appointment of the research advisor.

Each student must develop a detailed research proposal that must be approved by the student’s Research Advisory Committee. The Research Advisory Committee is appointed by the Dean, taking into account the recommendations of the research advisor and the student. This committee consists of the advisor and at least two other faculty members, and, if particularly knowledgeable in the research topic, an additional member who may be appointed from the Colleges of Worcester Consortium or the University of Massachusetts at Amherst, Boston, Dartmouth or Lowell.

The initial proposal may be the research proposal presented as the successful “Qualifying Examination” proposal. In this instance, the Qualifying Examination Committee may evolve into the student’s Research Advisory Committee. The student presents annual progress reports and proposed follow-up research until the

|                        | YEAR 1 (September through August) |   |   |                   |                |   |              |   |               |                    |   |   | YEAR 2 (September through August) |            |   |   |                |        |   |   |   |   |   |   |  |
|------------------------|-----------------------------------|---|---|-------------------|----------------|---|--------------|---|---------------|--------------------|---|---|-----------------------------------|------------|---|---|----------------|--------|---|---|---|---|---|---|--|
|                        | S                                 | O | N | D                 | J              | F | M            | A | M             | J                  | J | A | S                                 | O          | N | D | J              | F      | M | A | M | J | J | A |  |
| <b>Core Curriculum</b> | Biochemistry                      |   |   | Molecular Biology |                |   | Cell Biology |   |               | Scientific Writing |   |   |                                   |            |   |   |                |        |   |   |   |   |   |   |  |
| <b>Advanced Topics</b> |                                   |   |   |                   | January - June |   |              |   | June - August |                    |   |   | September - January               |            |   |   | January - June |        |   |   |   |   |   |   |  |
| <b>Research</b>        | Lab Rotation                      |   |   | Lab Rotation      |                |   | Lab Rotation |   |               | Pre-thesis         |   |   |                                   | Pre-thesis |   |   |                | Thesis |   |   |   |   |   |   |  |
| <b>Mentoring</b>       |                                   |   |   |                   |                |   |              |   |               |                    |   |   | Qualifying Examination            |            |   |   |                |        |   |   |   |   |   |   |  |
|                        | Lab Principal Investigators       |   |   |                   |                |   |              |   |               |                    |   |   | Principal Investigator            |            |   |   |                |        |   |   |   |   |   |   |  |
|                        | Student Mentors                   |   |   |                   |                |   |              |   |               |                    |   |   | Qualifying Examination Committee  |            |   |   |                |        |   |   |   |   |   |   |  |
|                        | Faculty Advisor                   |   |   |                   |                |   |              |   |               |                    |   |   |                                   |            |   |   |                |        |   |   |   |   |   |   |  |



## Summary of Basic & Biomedical Sciences Requirements

The following requirements, including cross-disciplinary courses described below, apply to all BBS students. Specific requirements for specialization are detailed in Graduate Programs, Courses and Faculty Research Interests, beginning on page 15. Graduate directors are responsible for overseeing these aspects of their programs.

### 1. Core Curriculum

All first-year students must take:

- Biomedical Sciences Block I
- Biomedical Sciences Block II
- Biomedical Sciences Block III
- Responsible Conduct of Science
- Laboratory rotations (three full rotations)
- Scientific Writing

### 2. Specialization

- Advanced and elective courses and rotations to be selected within guidelines set by the program of specialization. One, 2- or 3-credit advanced topics course must be taken in spring of Year 1
- Thesis research

Total credits: 90

### 3. Qualifying Examination

- Presentation and defense of an original research proposal

### 4. Final Examination

- Presentation and defense of the research dissertation

### 5. Teaching Requirement

- Demonstration of teaching skills in a research seminar or course lecture format

*Note: Information regarding requirements for the Program in Clinical & Population Health Research can be found on the program's Web site:  
[www.umassmed.edu/gsbs/cphr](http://www.umassmed.edu/gsbs/cphr)*

### Preparation for Qualifying Exam

Students are required to register for this course in the spring semester of the academic year in which they are to pass their Qualifying Examination. The course coordinator will be the student's Graduate Program Director. Students will register for the course in the spring semester even if they have already passed the exam in the prior semester. If the student successfully completes the exam by the end of the spring semester, they will receive a grade of Pass. If the student has not yet successfully completed the exam by the end of the spring semester, they will receive a grade of Incomplete. This will be changed to Pass once the exam is passed. This course must be passed before the beginning of the next academic year.

### Responsible Conduct of Scientific Research

Required for all students, this course provides participants the opportunity to explore some of the ethical, legal and social issues involved in the responsible conduct of scientific research in the 21st century. Sessions will include discussions of cases and/or exercises of institutional and national policies, and short presentations by faculty, administrators, postdoctoral fellows and students.

### Scientific Writing

Required for all students, this course instructs students in the skills of developing scientific research proposals.

### Laboratory Rotation

All programs offer laboratory rotations as individual courses within their programs. Laboratory rotations are defined periods of research experience under the direction of a faculty member. They are intended to familiarize the student with concepts and techniques in several areas of research and to assist the student in evaluating research laboratories and projects that might be developed into a dissertation project.

The student will participate in an ongoing research project, gain familiarity with concepts underlying the research, acquire a working knowledge of techniques used in research, and write a report and present an oral summary of the results of the research.

### Thesis Research Advisory Committee (TRAC) Meeting

All graduate students are required to have at least one TRAC meeting each academic year. After passing their Qualifying Examination and selection of their TRAC, students are required to register for this course each spring semester until their dissertation advisory committee is formed. The course coordinator will be the student's Graduate Program Director. Students will register for the course in the spring semester even if they have already had a TRAC meeting in the fall semester of that academic year. If the student has a TRAC meeting by the end of the spring semester, they will receive a grade of Pass. If the student has not yet had a TRAC meeting in the current academic year, they will receive a grade of Incomplete. This will be changed to Pass once the meeting has been held. This course must be passed before the beginning of the next academic year.

### Pre-qualifying Research

This course is for students who have selected a program and thesis advisor but who have not yet passed their Qualifying Examination.

### Thesis Research

Students register for Thesis Research after passing a Qualifying Examination. They will take Thesis Research each semester until they have accumulated 90 credits.

