Biochemistry and Molecular Biology, PhD

Learning Outcomes

- Identify significant research problems through critical examination of the scientific literature.
- Develop a research proposal that uses a scientific approach to test hypotheses or accomplish research goals.
- Gain broad expertise in their chosen field and develop critical thinking and quantitative skills to independently design, acquire, and interpret experimental data.
- Effectively communicate research findings to a broad audience in written and oral formats.
- Perform all aspects of research and communication with high ethical standards.
- Preparation for career options in academia, industry, government, or other fields.

Requirements

The Doctor of Philosophy in biochemistry and molecular biology requires a minimum of 72 s.h. of graduate credit (34 s.h. of coursework and 38 s.h. of research). Students must maintain a cumulative grade-point average of at least 3.00 to earn the degree. Qualified students interested in earning the Doctor of Medicine along with the PhD may apply to the Medical Scientist Training Program, which offers a combined MD/PhD program.

Students have the opportunity to tailor their curriculum with courses that enhance their educational goals. They take a combination of graduate-level courses that include a first-year laboratory research rotation course, and seminar courses.

The PhD in biochemistry and molecular biology requires the following coursework.

Core Curriculum

Course #	Title	Hours
BMB:5261	Research Techniques	1-6
BMB:5282	Seminar	0-2
BMED:7270	Scholarly Integrity/ Responsible Conduct of Research I	0
BMED:7271	Scholarly Integrity/ Responsible Conduct of Research II	0
Biophysical chemistry coursework		3
Four molecular medicine courses		6-8
Additional courses offered by the Department of Biochemistry and Molecular Biology and other departments, as appropriate for each student		

Typical Curriculum

First Year, Fall

Course #	Title	Hours
BMB:5240	Biophysics and Advanced Biochemistry	3
BMB:5261	Research Techniques	4
BMB:5282	Seminar	1
BMED:5207	Principles of Molecular and Cellular Biology	3

First Year, Spring

Course #	Title	Hours
BMB:5261	Research Techniques	4
BMB:5282	Seminar	1
MMED:6226/ ACB:6226/ MPB:6226	Cell Cycle Control	1
MMED:6227/ ACB:6227/ MPB:6227	Cell Fate Decisions	1
Electives		

Second Year, Fall

Course #	Title	Hours
BMB:5282	Seminar	2
BMB:7292	Research Biochemistry	arr.
BMED:7270	Scholarly Integrity/ Responsible Conduct of Research I	0
Electives		

Second Year, Spring

Course #	Title	Hours
BMB:5282	Seminar	1
BMB:7292	Research Biochemistry	arr.
BMED:7271	Scholarly Integrity/ Responsible Conduct of Research II	0
Electives		

Examples of Elective Coursework

Course #	Title	Hours
BMB:3110	Biochemistry	3
BMB:4310/ BME:4310	Computational Biochemistry	3
BME:2210	Bioimaging and Bioinformatics	4
BMED:5207	Principles of Molecular and Cellular Biology	3
MMED:6220/ ACB:6220/ MPB:6220	Mechanisms of Cellular Organization	3
PCOL:5204	Basic Biostatistics and Experimental Design	1
PCOL:6225	Growth Factor Receptor Signaling	1

Additional Requirements

Laboratory Rotations

Students rotate through at least three different laboratories during their first academic year; they enroll in BMB:5261 Research Techniques. The laboratory rotations are approximately ten weeks each. At the conclusion of each rotation, a student meets with an advisory committee of three faculty members. A student is required to present the

research and training completed during that rotation. The advisory committee writes a short evaluation of the student's performance and assigns a grade for the laboratory work. The evaluation and grade become part of the student's departmental record.

Teaching

Students participate in the formal teaching programs of the department for at least one semester. First-year students as well as students who are within a year of receiving their PhD degree are usually not asked to teach. Teaching may take a variety of forms, including tutoring, leading discussions and laboratory groups, correcting examinations, preparing teaching materials, and lecturing.

Thesis Research Proposal

During the fall semester of the second year, students in collaboration with their thesis advisor prepare a detailed thesis proposal that describes the proposed research to be conducted for the dissertation as part of BMB:5282 Seminar.

Comprehensive Examination

The comprehensive examination has two parts: a written proposal and an oral defense of the proposal. The examination must be taken before June 30 of the second year.

Written Report of Comprehensive Examination

Students receive their topic by March 1 and their written examination is submitted to their committee by April 22. The written proposal should have a cover page followed by no more than 20 pages. For more information, a detailed guide is located in the Department of Biochemistry and Molecular Biology Graduate Student Manual.

Oral Presentation of Comprehensive Examination

Questions during the oral examination may come from the examination proposal, the PhD thesis proposal, or other general areas of biochemistry and molecular biology. To pass the oral comprehensive examination, students must perform satisfactorily both in defense of the examination proposal and in answering general biochemistry and molecular biology questions that are germane to the proposal or that are important for a full understanding of the proposed experiments and their interpretation.

The Fifth-Semester Seminar

After successful completion of the comprehensive examination, usually the fall semester of the third year (the fifth semester), students update and revise the written PhD thesis proposal prepared during the fall semester of the second year (prior to the comprehensive examination), and present a seminar on the thesis research to the department at one of the weekly biochemistry and molecular biology workshops.

The Fourth-Year Workshop

In the fourth year, during fall or spring, students are asked to present at one of the weekly departmental workshops. The presentation is based on their research.

The Fifth-Year Retreat

The Department of Biochemistry and Molecular Biology holds a yearly retreat where students and faculty present their current research. Students in their fifth year may be asked to give an oral presentation at the retreat.

Final Examination

The five-member PhD thesis committee serves as an advisory body for the preparation of the thesis. This committee meets with students to review the material that is expected to be incorporated into the thesis. Although meetings of the candidates with the committee should be yearly, the candidates, thesis advisor, or the committee can request a meeting at any time. A final draft of the thesis must be given to all members of the committee two weeks before the final examination. The final examination takes the form of a seminar presented to the department. This presentation is announced according to Graduate College policy. Questions, comments, and discussion then follow. After the seminar, candidates meet with their committee for the final thesis defense. The PhD is not awarded until the thesis is signed. In some cases, revisions may be required.

Combined Programs

PhD/MD

Students may work toward the Doctor of Medicine degree and a PhD in biochemistry and molecular biology in a combined degree program offered by the Department Biochemistry and Molecular Biology and the Carver College of Medicine. Applicants must be admitted to both programs before they may be admitted to the combined degree program. See the Medical Scientist Training Program (Carver College of Medicine) in the catalog.

Admission

Applicants must have a baccalaureate degree from a regionally accredited U.S. college or university, or an equivalent degree from another country as determined by Admissions. Those who apply must have an undergraduate grade-point average of at least 3.00. Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations on the Graduate College website.

Appropriate preparation includes one-year, college-level courses in organic and physical chemistry, biology, physics, and mathematics through calculus. Students are expected to have had one or more introductory courses in biochemistry.

Career Advancement

Graduates have secured a variety of career positions, including in academic institutions and the government, and as scientists, physicians, lecturers, and science educators. Some go on to pursue postdoctoral or additional training, and others land jobs in business and industry.

Academic Plans

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Biochemistry and Molecular Biology, PhD

Course	Title	Hours
Academic Career		
Any Semester		
72 s.h. must be graduate level coursework; graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website. [a, b]		
Graduate College program GPA of at least 3.00 is required. [c]		
	Hours	**0**
First Year		
Fall		
BMB:5240	Biophysics and Advanced Biochemistry	3
BMB:5261	Research Techniques [d]	4
BMB:5282	Seminar	1
BMED:5207	Principles of Molecular and Cellular Biology	3
Elective course [e]		1
	Hours	**12**
Spring		
BMB:5261	Research Techniques [d]	4
BMB:5282	Seminar	1
MMED:6226	Cell Cycle Control [e]	1
MMED:6227	Cell Fate Decisions [e]	1
Elective course [e]		3
Elective course [e]		1
	Hours	**11**
Second Year		
Fall		
BMB:5282	Seminar	2
BMB:7292	Research Biochemistry	4
BMED:7270	Scholarly Integrity/Responsible Conduct of Research I	0
Biophysical chemistry course [e]		3
Molecular medicine course [e]		3
	Hours	**12**
Spring		
BMB:5282	Seminar	1
BMB:7292	Research Biochemistry	6
BMED:7271	Scholarly Integrity/Responsible Conduct of Research II	0
Molecular medicine course [e]		1 - 3
Elective course [e]		3
Exam: Doctoral Comprehensive Exam [f]		
	Hours	**11-13**
Third Year		
Fall		
BMB:7292	Research Biochemistry	6
Fifth-Semester Seminar Presentation		
	Hours	**6**
Spring		
BMB:7292	Research Biochemistry	6
	Hours	**6**
Fourth Year		
Any Semester		
Fourth-Year Workshop Presentation		
	Hours	**0**
Fall		
BMB:7292	Research Biochemistry	6
	Hours	**6**
Spring		
BMB:7292	Research Biochemistry	6
	Hours	**6**
Fifth Year		
Any Semester		
Fifth-Year Retreat		
	Hours	**0**
Fall		
BMB:7292	Research Biochemistry	1
Prospectus Defense		
	Hours	**1**
Spring		
GRAD:6003	Doctoral Final Registration	1
Exam: Doctoral Final Exam [g]		
	Hours	**1**
	Total Hours	**72-74**

a Students are also required to complete at least one semester of formal teaching experience as a TA.

b Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.

c Graduate College program GPA is comprised of all courses that are approved degree requirements. If a student takes more than the minimum required number of semester hours to complete the degree, but all courses taken are eligible to count toward the degree, those courses will be included in the Graduate College program GPA.

d During the first academic year, students register for BMB:5261 and rotate through three different laboratories (approximately ten weeks each) unless they have satisfied this requirement in part by previous equivalent research experience. At the end of each laboratory rotation, the student will prepare a written report and present an oral summary of the research project to the Rotation Advisory Committee.

e Work with faculty advisor to determine appropriate graduate elective coursework and sequence.

f The comprehensive examination has two parts: a written proposal and an oral defense of the proposal. The examination must be taken before June 30 of the second year.

g Dissertation defense.