Biomedical Science, MS

Learning Outcomes

Students will:

- demonstrate expertise in foundational aspects of molecular and cellular biology, particularly in a human biomedical context;
- develop hypotheses and experimental methods that can be used to explore questions in molecular biology;
- apply knowledge of biomedical science to human disease through translational research paradigms;
- describe fundamental techniques, statistical methods, and core principles of rigor and reproducibility in biomedical science;
- describe the range of career pathways in the sciences for the biomedical PhD;
- develop proficiency in reading and interpreting scientific literature; and
- develop skills in written and oral communication of scientific work.

Cancer Biology

Students will:

- master foundational knowledge in cancer biology and demonstrate in-depth knowledge in their area of emphasis;
- understand and apply the scientific method, design experiments, and conduct research utilizing team-based collaboration, knowledge of current literature, and current laboratory methods;
- gain an appreciation of clinical management and therapeutic approaches to treat cancer;
- develop advanced skills in scientific writing and oral presentations in order to effectively communicate research progress and goals;
- exhibit and foster the highest ethical standards in the areas of education, publication, and scientific inquiry; and
- publish at least one first-author paper and write a grant application.

Cell and Developmental Biology

Students will:

- master foundational knowledge in cellular and developmental biology;
- engage in designing and executing experiments to test scientific hypotheses;
- critically evaluate scientific findings;
- communicate scientific findings effectively to diverse audiences;
- exhibit and foster ethics in the areas of education, publication, and scientific inquiry; and
- become an effective teacher of the biological sciences.

Molecular Medicine

Students will gain knowledge in:

- tracks for specialized coursework—demonstrate broad-based understanding of one of three tracks selected by students in their second year of studies (metabolic disorders, cardiovascular biology, or molecular and cellular medicine);
- oral and written presentation of scientific data—demonstrate proficiency in scientific writing as evidenced by external fellowship application requirement; organize, defend, and communicate ideas effectively in scientific oral presentations and settings; opportunities to present posters, full-length seminar presentations, short-form data blitzes, lay audience elevator pitches; comprehensive exam; on-topic or off-topic NRSA-style research proposal that is orally defended to a comprehensive exam committee comprised of subject-matter experts; scientific editing and research communication core; and service promoted to students to get one-on-one instruction in scientific editing, focused especially on grant writing;
- experimental design—instruction on experiment design provided by their mentor, experiences in the critical thinking course, and in the basic biostatistics and experimental design course;
- proficiency in research—three laboratory rotations before affiliating to a lab, conduct research in a responsible and ethical manner, carry out an in-depth research project, and contribute intellectually and technically to all parts of its development, execution, and analysis; and
- professional skills development—journal clubs, a course in critical thinking, and career development series.

Molecular Physiology and Biophysics

Students will:

- acquire knowledge and respect for principles of biomedical research ethics.
- demonstrate a basic knowledge of physiology and biophysics that will serve as the foundation for the student's academic, scholarly, and research endeavors;
- exhibit the necessary practical, methodological, and technical expertise to perform original experimental work in an area of physiological research;
- gain professional skills required for successful academic or research-based careers, including skills in publishing, grant writing, presentation, and teaching; and
- acquire knowledge and respect for principles of biomedical research ethics.

Requirements

The master of science (MS) in biomedical science with subprograms in cancer biology, cell and developmental biology, molecular medicine, and molecular physiology and biophysics requires 60 s.h. of graduate credit. Students must earn a Graduate College program grade-point average of at least 3.00.

There is no direct admission to the MS in biomedical science. Students interested in biomedical science are considered for PhD admission only. Students in the cancer biology, cell and developmental biology, molecular medicine, and molecular physiology and biophysics subprograms have the option to earn a master’s degree on the way to earning the PhD. To do so they must obtain signed approval from their mentor and committee prior to setting the date of their PhD comprehensive exam. Students must pass a master’s final exam. Per Graduate College policy, the doctoral comprehensive exam may be recorded for the master’s final exam.

Visit the PhD in biomedical science in this section of the catalog for information about the PhD degree program.

Common Required Courses

Students in all subprograms are required to take BMED:7888 Biomedical Science Research in the first year, once in the fall semester and once in the spring semester. The total required credit from this course varies based on the student's subprogram.

Students in all subprograms complete the following coursework.

Course #	Title	Hours
All of these:		
BMED:5207	Principles of Molecular and Cellular Biology	3
BMED:5208	Topics in Principles of Molecular and Cellular Biology	1
BMED:7270	Scholarly Integrity/ Responsible Conduct of Research I	0
BMED:7271	Scholarly Integrity/ Responsible Conduct of Research II	0
BMED:7777	Biomedical Science Seminar (taken twice for 1 s.h. each)	2
MMED:6260	Methods for Molecular and Translational Medicine	1
PATH:5270/ IGPI:5270/ MMED:5270	Pathogenesis of Major Human Diseases	3
PCOL:5204	Basic Biostatistics and Experimental Design	1
PHAR:6504	Mastering Reproducible Science	1

First Year Program Electives

In the first year, students take two courses that subsequently count toward subprogram requirements.

Medical Scientist Training Program

Students in the Medical Scientist Training Program (MSTP) may substitute the following 31 s.h. from MD coursework toward the MS in biomedical science. Although the mechanisms of health and disease courses total more than 20 s.h. in the MD curriculum, students may apply 5 s.h. from each course to the MS.

Course #	Title	Hours
ACB:8101	Medical Gross Human Anatomy	5
MED:8123	Foundations of Cellular Life	5
MED:8124	Mechanisms of Health and Disease I	5
MED:8133	Mechanisms of Health and Disease II	5
MED:8134	Mechanisms of Health and Disease III	5
MED:8223	Mechanisms of Health and Disease IV	5
MSTP:8514	Grant Writing Basics: A Focus on Predoctoral Applications	1

Subprograms

Cancer Biology

In addition to the common required courses, the cancer biology subprogram requires the following coursework.

Course #	Title	Hours
All of these:		
CBIO:5500	Topics in Cancer Biology (taken twice for 1 s.h. each)	2
CBIO:6000	Seminar: Cancer Research (taken twice for 1 s.h. each)	2
CBIO:6500	Research in Cancer Biology	arr.
CBIO:7000	Clinical Connections	1
CBIO:7001/ FRRB:7001	Molecular and Cellular Biology of Cancer	3
CBIO:7500	Crafting a Scientific Proposal	1

Cell Development Biology

In addition to the common required courses, the cell and developmental biology subprogram requires the following coursework.

Course #	Title	Hours
All of these:		
ACB:5206	Graduate Research in Cell and Developmental Biology	arr.
ACB:5224	Graduate Seminar in Cell and Developmental Biology (taken twice for 1 s.h. each)	2
ACB:6220	Mechanisms of Cellular Organization	3
ACB:6237	Critical Thinking in Biochemistry and Molecular Biology	1
ACB:6238	Critical Thinking in Genetics	1
ACB:6239	Critical Thinking in Cell Biology	1
ACB:6248	Critical Thinking in Development	1
ACB:6249	Critical Thinking in Cellular Physiology	1
FRRB:7001	Molecular and Cellular Biology of Cancer	3

Molecular Medicine

In addition to the common required courses, the molecular medicine subprogram requires the following coursework.

Molecular Medicine Core Courses

Course #	Title	Hours
All of these:		
MMED:6280	Critical Thinking in Molecular Medicine (taken four times for 2 s.h. each)	4
MMED:7290	Seminars in Molecular Medicine (taken twice for 1 s.h. each)	2

MMED:7305	Molecular Medicine Research	arr.
MMED:7310	Translational Medicine Education Rounds (taken twice for 1 s.h. each)	2
MMED:8115	Molecular Physiology	4

Molecular Medicine Track Courses

Students in the molecular medicine subprogram complete courses for one of the following tracks.

Cardiovascular Biology Track

Course #	Title	Hours
Both of these:		
MMED:6230	Pathogenesis of Metabolic and Cardiovascular Disorders	3
Elective coursework		3

Metabolic Disorders Track

Course #	Title	Hours
All of these:		
BMB:7254	Metabolism I	1
BMB:7255	Metabolism II	1
MMED:6230	Pathogenesis of Metabolic and Cardiovascular Disorders	3

Molecular and Cellular Medicine Track

Course #	Title	Hours
This course:		
MMED:6220	Mechanisms of Cellular Organization	3
3 s.h. from these:		
MMED:3310	Practical Data Science and Bioinformatics	3
MMED:6226/ ACB:6226/ MPB:6226	Cell Cycle Control	1
MMED:6227	Cell Fate Decisions	1
PCOL:6225	Growth Factor Receptor Signaling	1

Molecular Physiology and Biophysics

In addition to the common required courses, the molecular physiology and biophysics subprogram requires the following coursework.

Course #	Title	Hours
Both of these:		
MPB:5153	Graduate Physiology	4
MPB:6302	Research Physiology and Biophysics	arr.
3 s.h. from these:		
GENE:6150	Genetic Analysis of Biological Systems	3
MMED:6226/ ACB:6226/ MPB:6226	Cell Cycle Control	1
MMED:6227/ ACB:6227/ MPB:6227	Cell Fate Decisions	1
MPB:6220/ ACB:6220/ MMED:6220	Mechanisms of Cellular Organization	3
NSCI:5653/ BIOL:5653/ PSY:5203	Fundamental Neurobiology I	3
PCOL:6225	Growth Factor Receptor Signaling	1

Graduate Education

Graduate education prepares students with advanced knowledge and skills in specialized fields. At the University of Iowa, the Graduate College advocates for student-centered graduate education and supports equitable application of rules and policies across graduate programs.

Academics

University of Iowa graduate credentials are regulated by policies and requirements found in the Graduate College Manual of Rules and Regulations. This includes minimum grade-point average (GPA) requirements for academic standing and degree conferral. The Graduate College sets the minimum requirement. Individual graduate programs may establish higher GPA requirements.

Admissions

Graduate student applicants must meet admission requirements for both the Graduate College and the program to which they have applied. University of Iowa graduate admission requirements are published by the Graduate College and on the Graduate Admissions website.

Financial Support

Graduate students might be eligible for financial support. Several contingencies apply, including degree program and award type, satisfactory progress toward degree, satisfactory completion of all duties related to an appointment, and availability of funding. Graduate students should inquire directly with their program for more information about funding availability. The Graduate Student Employment Standards govern the employment relationship between the University of Iowa and all graduate teaching and research assistants in all matters except wages, which are covered by an existing collective bargaining agreement or the conditions of an applicable federal grant.