

Molecular Medicine

Director

- Matthew J. Potthoff (Neuroscience and Pharmacology)

Faculty: <https://medicine.uiowa.edu/mcb/faculty>

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The Molecular Medicine Program provides interdisciplinary training in the concepts and methodologies fundamental to the investigation of biological processes and molecular mechanisms that relate to human disease.

The program provides the curriculum for the molecular medicine subprogram for the Doctor of Philosophy in biomedical science. It is a sequence of required and elective coursework, which provides students with broad exposure to areas, including molecular biology, cell biology, biochemistry, and integrative sciences. The curriculum ensures comprehensive exposure to conceptual and experimental aspects of molecular and cellular biology and of translational studies. Sufficient flexibility is provided so that students can adapt the program to allow specialization in their own area of interest. See the Ph.D. in biomedical science (molecular medicine subprogram) in the Graduate College section of the Catalog.

Faculty members are involved in a variety of research projects involving molecular and cellular biology and molecular medicine.

Programs

Graduate Program of Study

Major

- Doctor of Philosophy in Molecular and Cellular Biology

Students interested in doctoral studies in molecular medicine should apply under the umbrella program in Biomedical Science (select molecular medicine subprogram). Direct application to the Ph.D. in molecular and cellular biology is not currently being considered.

Facilities

Training is conducted primarily in laboratories and teaching facilities of the Carver College of Medicine Stead Family Department of Pediatrics and the Departments of Anatomy and Cell Biology, Biochemistry and Molecular Biology, Internal Medicine, Microbiology and Immunology, Molecular Physiology and Biophysics, Neurology, Neuroscience and Pharmacology, Obstetrics and Gynecology, Ophthalmology and Visual Sciences, Otolaryngology—Head and Neck Surgery, Pathology, Psychiatry, Radiation Oncology, and Surgery; and the College of Liberal Arts and Sciences Departments of Biology and Chemistry. Faculty laboratories and central research facilities available to students provide access to the most up-to-date research equipment.

Courses

Molecular Medicine Courses

MMED:3310 Practical Data Science and Bioinformatics 3 s.h.

Understanding how to access large biological data sets and use them to answer biological questions is an important skill for researchers; immersive introduction to computational handling of data; how to access and analyze publicly available data; critically evaluate data quality and analysis in context of measuring gene expression; basic coding in R/RStudio, plotting and data display, fitting and regression, statistical inference, statistical models, downloading and data wrangling; basic introduction to machine learning (clustering); for students with no computational background. Prerequisites: BIOL:1411 with a minimum grade of C- and BIOL:1412 with a minimum grade of C-. Requirements: college algebra. Recommendations: BMB:3110, or BMB:3120 and BMB:3130, or other upper-level life sciences courses. Same as BMB:3310, CBIO:3310.

MMED:5270 Pathogenesis of Major Human Diseases 3 s.h.

Critical analysis of pathogenesis models in a series of major human diseases; clinical presentation, analysis of cellular and molecular events leading to the disease, discussion of key papers. Offered spring semesters of even years. Same as IGPI:5270, PATH:5270.

MMED:6220 Mechanisms of Cellular Organization 3 s.h.

Current understanding of basic cell biological processes; key experiments that led to guiding insights; mechanisms that cells use for compartmentalization and how those mechanisms are regulated; biogenesis of major organelles (e.g., mitochondria, peroxisomes, nucleus, secretory/endocytic membrane system); functions of cytoskeleton in cell motility, organelle motility, and cell division. Prerequisites: BMB:3130. Same as ACB:6220, MPB:6220.

MMED:6225 Growth Factor Receptor Signaling 1 s.h.

Mechanisms of signaling by growth factors; cytokines and related molecules that regulate cell proliferation, development, differentiation, and survival; emphasis on molecular mechanisms of signaling, relevance of these signaling processes to various human diseases. Same as ACB:6225, MPB:6225, PCOL:6225.

MMED:6226 Cell Cycle Control 1 s.h.

Cell cycle regulation, DNA damage-dependent cell cycle regulation, redox-dependent cell cycle regulation, cellular senescence. Same as ACB:6226, MPB:6226.

MMED:6227 Cell Fate Decisions 1 s.h.

Cellular fate decisions including signal integration, terminal differentiation in development, mechanisms of embryonic stem cell gene regulation/cellular reprogramming, cell death paradigms, and cell death in development and cancer. Same as ACB:6227, MPB:6227.

MMED:6230 Pathogenesis of Metabolic and Cardiovascular Disorders 3 s.h.

Students focus on metabolic and cardiovascular diseases—the leading cause of morbidity and mortality in the United States; introduction to major subclasses of metabolic and cardiovascular diseases, definition of pathogenesis and clinical features of diseases, and exploration of methodologies used to study diseases; course format includes lecture, critical examination of literature, and demonstration of experimental models.

MMED:6250 Mechanisms of Parasitism Journal Club **1 s.h.**

Reviews of recent publications in molecular parasitology research and thesis research by training grant or journal club students; for students pursuing graduate thesis research in microbiology or a related discipline. Same as MICR:6250.

MMED:6260 Methods for Molecular and Translational Medicine **1 s.h.**

Basic and advanced scientific techniques used to integrate biological questions in molecular and translational medicine; particularly useful for comprehensive exam preparation.

MMED:6270 Pathogenesis of Cardiovascular Disorders **3 s.h.**

Students focus on cardiovascular diseases—the leading cause of morbidity and mortality in the United States; introduction to major subclasses of cardiovascular diseases, definition of pathogenesis and clinical features of diseases, and exploration of methodologies used to study diseases; format includes lecture, critical examination of literature, and demonstration of experimental models.

MMED:6280 Critical Thinking in Molecular Medicine **1 s.h.**

Opportunity to work closely with participating faculty to gain skill in critical reading of research literature and facility in presenting material to an audience. Requirements: advanced graduate standing.

MMED:7290 Seminars in Molecular Medicine **1 s.h.**

Research findings in molecular biology. Requirements: molecular and cellular biology graduate standing.

MMED:7305 Molecular Medicine Research **arr.**

Requirements: molecular and cellular biology graduate standing.

MMED:7310 Translational Medicine Education Rounds **1 s.h.**

Students obtain clinical insights into their area of specialty in biomedical research through selection of a clinical mentor to complement the expertise of their research mentor; clinical mentors provide students with case studies, clinical scenarios, and physician shadowing opportunities which may allow students to gain new perspectives and insight into applications of biomedical research. Requirements: enrollment in Molecular Medicine Program, completion of rotations, and selection of a research mentor.

MMED:8115 Molecular Physiology **4 s.h.**

Principles of human physiology, organ systems, cell function. Offered fall semesters.