Molecular and Cellular Biology

Director
• Frederick Domann (Pathology/Radiation Oncology/Surgery)

Graduate degree: Ph.D. in molecular and cellular biology
Faculty: http://molcellbio.grad.uiowa.edu/faculty/directory
Web site: http://molcellbio.grad.uiowa.edu

The Molecular and Cellular Biology Program provides interdisciplinary training in the concepts and methodologies fundamental to the investigation of biological mechanisms at the molecular level. Faculty members are involved in a variety of research projects related to gene expression and regulation.

Graduate Program of Study
• Doctor of Philosophy in molecular and cellular biology

Doctor of Philosophy
The Doctor of Philosophy program in molecular and cellular biology requires a minimum of 72 s.h. of graduate credit. The program is sufficiently flexible to accommodate students with a wide range of backgrounds in the biological and physical sciences. Entering students are expected to have a solid background in science, including introductory biology and chemistry, organic chemistry, physical chemistry, calculus, genetics, and biochemistry. Students can remedy deficiencies in particular areas by taking appropriate course work during the first year of graduate study.

The curriculum consists of a sequence of required, core, and elective courses that provide didactic training in molecular and cellular biology and that ensure comprehensive exposure to concepts and experimental methodologies in the field. Students engage in laboratory research immediately upon enrollment and progress rapidly to original thesis projects that lead to a Ph.D.

Because of the diversity of biological research problems that can be pursued by employing molecular and cellular approaches, the program provides options for specialization in particular areas of interest.

The Ph.D. in molecular and cellular biology requires the following course work.

**DIDACTIC COURSE WORK**

All of these:

- MCB:6215 Transcription and Multi-Functional Regulation by RNA 1 s.h.
- MCB:6217 Epigenetics, Cancer, and Mouse Models of Disease 1 s.h.
- MCB:6220 Mechanisms of Cellular Organization 3 s.h.
- BISC:5204 Biostatistics for Biomedical Research 1 s.h.
- Electives (courses preapproved by advisor) 18 s.h.

These, if recommended by the advisor:

- BIOC:7251 Introduction to Protein Structures 1 s.h.
- BISC:5201 Fundamentals of Gene Expression 1 s.h.
- BISC:5203 Fundamentals of Dynamic Cell Processes 1 s.h.

**SEMINARS AND PROFESSIONAL DEVELOPMENT**

All students take both of these:

- MCB:7290 Seminars in Molecular and Cellular Biology 1 s.h.
- GRAD:7270 Principles of Scholarly Integrity 1 s.h.

Precomprehensive students take this each semester:

- MCB:6280 Topics in Molecular and Cellular Biology 1 s.h.

Postcomprehensive students take this each semester:

- Journal club of the student’s choice 1 s.h.

**THESIS RESEARCH AND DISSERTATION**

After successfully completing the comprehensive examination, usually at the end of the second year of graduate study, students advance to candidacy for the Ph.D. degree. They devote their time to completing thesis research and writing their Ph.D. dissertation. Upon successful completion of all requirements, including the dissertation and its oral defense, students are awarded a Ph.D. in molecular and cellular biology.

**Admission**

For application materials and information about graduate training in molecular and cellular biology, contact the Molecular and Cellular Biology Program or visit its web site. Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations of the Graduate College.

**Financial Support**

Graduate students in the Molecular and Cellular Biology Program receive stipends and tuition support from institutional and extramural sources, including University of Iowa fellowships and graduate research assistantships, and training grants from the National Institutes of Health.

**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, Internal Medicine, Microbiology, Molecular Physiology and Biophysics, Neurology, Obstetrics and Gynecology, Ophthalmology and Visual Sciences, Otolaryngology—Head and Neck Surgery, Pathology, Pharmacology, Physical Therapy and Rehabilitation Science, Psychiatry, and Radiation Oncology; 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**

- MCB:6215 Transcription and Multi-Functional Regulation by RNA 1 s.h.
Principles and techniques for investigating mechanisms of controlling eukaryotic gene expression; basic genome organization, chromatin structure, transcription, RNA processing, translation; cloning methods, use of electronic sequence databases, footprinting, chromatin immunoprecipitation, in vivo and in vitro transcription assays, DNA microarray analysis, information retrieval. Prerequisites: BISC:5201.

**MCB:6217 Epigenetics, Cancer, and Mouse Models of Disease** 1 s.h.
Epigenetic mechanisms of transcriptional control; regulation of chromatin structure and its relation to disease; fundamental concepts in cancer; mouse models for understanding the molecular basis for human disease; based on research publications. Prerequisites: BISC:5201.

**MCB: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: BIOC:3130. Same as MPB:6220, ACB:6220.

**MCB: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. Recommendations: BISC:5201 and BISC:5203. Same as MPB:6225, ACB:6225.

**MCB:6226 Cell Cycle Control** 1 s.h.
Cell cycle regulation, DNA damage-dependent cell cycle regulation, redox-dependent cell cycle regulation, cellular senescence. Recommendations: BISC:5201 and BISC:5203. Same as ACB:6226, MPB:6226.

**MCB:6227 Cell Fate Decisions** 1 s.h.

**MCB:6240 Inflammatory Cell Signaling and Targeted Cancer Therapy** 1 s.h.
Introduction to topics in important cancer signaling pathways; promises and challenges of targeted cancer therapy; emphasis on current fundamental topics in cancer cell signalings; how altered protein ubiquitination/deubiquitination, constitutive activation of proteins kinases, and transcription factors underpin uncontrollable proliferation and survival of cancer cells in tumor microenvironment; translation of knowledge to targeted cancer therapy; promotion of critical thinking. Recommendations: MCB:6225 and MCB:6227 and BIOC:5243.