Molecular Physiology and Biophysics

Chair
- Kevin P. Campbell

Executive associate chair
- W. Scott Moye-Rowley

Graduate degrees: M.S. in molecular physiology and biophysics; Ph.D. in molecular physiology and biophysics

Faculty: http://www.physiology.uiowa.edu/faculty.shtml
Web site: http://www.physiology.uiowa.edu/

The Department of Molecular Physiology and Biophysics offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. It participates in interdisciplinary graduate programs, including the Medical Scientist Training Program, a joint M.D./Ph.D. program offered by the Graduate College and the Carver College of Medicine, and it provides instruction in molecular physiology and biophysics for M.D., D.D.S., and other health professions students. The department also conducts a co-op exchange, a vigorous training program that gives undergraduate students the opportunity to develop as independent researchers in preparation for graduate studies.

The department’s principal research areas include cell biology, genetics, endocrinology, neuroscience, and membrane physiology and biophysics. The unifying theme is the understanding of signal transduction mechanisms involved in regulating function at the cellular and molecular levels.

Graduate Programs of Study

- Master of Science in molecular physiology and biophysics
- Doctor of Philosophy in molecular physiology and biophysics

Graduate study in molecular physiology and biophysics provides students with fundamental knowledge of life processes at molecular, cellular, and integrative levels of biological function. It also imparts knowledge of modern research skills applicable to contemporary problems.

Students may enter the graduate program through the direct admission pathway or the Medical Scientist Training Program (MSTP). Potential students are encouraged to directly contact individual faculty to discuss research possibilities or the appropriateness of these mechanisms to their individual circumstances.

Master of Science

The Master of Science program in molecular physiology and biophysics requires a minimum of 30 s.h. beyond the bachelor’s degree and is offered with and without thesis. Thesis students complete laboratory research and write a thesis that fulfills the requirements of the Graduate College (see the Manual of Rules and Regulations of the Graduate College). Nonthesis students complete a library research report and take a written examination on the research report area and the graduate program in physiology.

University of Iowa research assistants may pursue an M.S. in molecular physics and biophysics while continuing to work in their research laboratories. Research assistants interested in the M.S. program must submit a letter of support from their supervisor.

Doctor of Philosophy

The Doctor of Philosophy program in molecular physiology and biophysics requires a minimum of 72 s.h. beyond the bachelor’s degree. The core curriculum includes graduate-level courses in cell biology, molecular biology, human physiology, and neurophysiology. Advanced electives, offered by the Department of Molecular Physiology and Biophysics and other departments, cover a wide range of topics, including receptors and signal transduction, and developmental neurophysiology.

After successful completion of required course work and the comprehensive examination, students devote full time to thesis research, which culminates in preparation of a doctoral dissertation and its defense in a final oral exam.

Admission

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations of the Graduate College. They must have a bachelor’s degree from an accredited institution, with an undergraduate major in one of the biological, chemical, physical, mathematical, or engineering sciences; one or more years of course work in biology, physics, biochemistry, and calculus; and a cumulative science g.p.a. of at least 3.00. They also must submit acceptable verbal, quantitative, and analytical scores on the Graduate Record Examination (GRE) General Test.

With existing support of an identified faculty mentor, students also may apply for admission directly to the Department of Molecular Physiology and Biophysics. Because this program has no mechanism for performing research rotations, it is only appropriate for students who have identified a particular faculty member in the department willing and able to serve as their thesis advisor. Candidates for this mechanism typically have existing research experience with the faculty member who will be supporting them (through undergraduate research, summer research, work as a research associate, research collaborations, etc.).

To be considered, applicants must have a faculty member in the Department of Molecular Physiology and Biophysics write a letter to the director of graduate studies summarizing strengths for candidacy. The letter also must state the willingness of the faculty member to serve as the thesis advisor and acknowledge full financial responsibility for the student during the entirety of their graduate training. Applicants will subsequently be asked to submit official transcripts, GRE scores, and names of three references.

Students interested in a joint M.D. and Ph.D. degree from the University of Iowa typically start in the Medical Scientist Training Program. Admission is extremely competitive; please refer to MSTP for specific application requirements and deadlines.

Financial Support

All full-time students receive financial aid in the form of tuition and stipend support from the Department of

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Financial Support

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Molecular Physiology and Biophysics. Support is renewed annually based on satisfactory progress in meeting degree requirements.

Research

Faculty research interests in the Department of Molecular Physiology and Biophysics encompass molecular and cellular endocrinology, cellular and developmental neurophysiology, and membrane structure and function. Within these, there are multiple areas of interest, including hormone receptors, reproductive endocrinology, signal transduction, regulation of gene expression, synaptic transmission, neuronal differentiation, membrane ion channels, regulation of excitability, and cardiovascular electrophysiology and regulation. Experimental models currently being investigated include rodents, yeast, Drosophila, and cultured cell lines from a variety of species.

Facilities

Two floors of the Bowen Science Building are devoted to research and teaching in the Department of Molecular Physiology and Biophysics. Department faculty members also occupy laboratory facilities in the Medical Education Research Facility, Pappajohn Biomedical Discovery Building, and the Carver Biomedical Research Building. In addition to specialized equipment in faculty research laboratories, the department provides equipment for fluorescence microscopy, isotope analysis, cell culture, and molecular biology. It also has access to the University network and the multimedia education facilities. Additional resources are available at the Hardin Library for the Health Sciences.

Courses

**MPB:4199 Research, Independent Study**
Arr.
Recommendations: closed to molecular physiology and biophysics graduate students.

**MPB:4753 Developmental Neurobiology**
3 s.h.
Neuronal induction and nervous system patterning; neurogenesis, axon and dendrite outgrowth and targeting; synapse formation, specificity, refinement; mechanisms of neuronal cell death; myelination; neural stem cells; introduction to cellular, molecular, and genetic techniques in studies of neural development. Prerequisites: BIOL:2753. Corequisites: BIOL:3253. Requirements: grade of B- or higher in BIOL:2753 or graduate standing. Same as BIOL:4753, NSCI:4753.

**MPB:5153 Graduate Physiology**
4 s.h.
Principles of human physiology, organ systems, cell function. Offered fall semesters. Requirements: grades of C- or higher in BIOL:1411 and CHEM:2210 and CHEM:2220, and graduate standing.

**MPB:5180 How the Brain Works**
1 s.h.
Brief, integrated look at how the brain works, based on recent neuroscience research; how the brain's biochemistry, anatomy, and physiology change constantly due to interaction with physical, emotional, and social environments; does the world we see around us exist outside the brain; does the mind exist; is emotion necessary for learning and memory; are we born with pre-existing circuits and codes in the brain for language, recognition of faces, and other complex behaviors; can aging of the brain be delayed; approach relevant for sciences, humanities.

**MPB:5200 Medical Physiology Online**
4 s.h.
Fundamental principles of cellular membranes, muscle, sensory organs, motor neurological systems, autonomic nervous systems, cardiovascular, pulmonary, renal, gastrointestinal, endocrine, and reproductive systems; interdependence of organ systems to maintain a normal physiological state using clinical correlates as applied to humans; basic physiological principles that establish a solid foundation for future pathophysiological and pharmacological concepts. Recommendations: medical, dental, physician assistant, nurse anesthesia, physical therapy, or graduate standing.

**MPB:5211 Biophysics of Excitable Membranes**
3 s.h.
Selected electrophysiological and biophysical topics from published research. Prerequisites: HHP:3500.

**MPB:5240 Physiology Workshop**
1 s.h.
Presentations by faculty, postdoctoral fellows, graduate students, and scientists.

**MPB:5342 Biosciences Critical Thinking and Communication**
2 s.h.
Selected papers and oral and written presentations tied to students' research rotations; introductory seminar. Same as BISC:5265, BIOL:5270.

**MPB:6209 Steroid Receptor Signaling**
1 s.h.
Structure-function relationship and genomic and nongenomic actions of the steroid hormone receptor family; basis for actions of novel new ligands on these receptors. Offered spring semesters. Same as PCOL:6209, NSCI:6209.

**MPB: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 MCB:6220, ACB:6220.

**MPB: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 MCB:6225, ACB:6225.

**MPB: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 MCB:6226, ACB:6226.

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

**MPB:6265 Neuroscience Seminar** 0-1 s.h.
Research presentations. Offered fall and spring semesters. Same as PSY:6265, ACB:6265, NSCI:6265, BIOL:6265.

**MPB:6302 Research Physiology and Biophysics** arr.
Requirements: molecular physiology and biophysics graduate standing.

**MPB:7402 Thesis** arr.
Requirements: molecular physiology and biophysics Ph.D. candidacy.

**MPB:8115 Human Physiology for Dental Students** 4 s.h.
Principles of human physiology, organ systems, cell function. Offered fall semesters. Requirements: grades of C- or higher in BIOL:1411, CHEM:2210, and CHEM:2220; and D.D.S. enrollment.