MOLECULAR, CELLULAR AND DEVELOPMENTAL BIOLOGY - DOCTOR OF PHILOSOPHY (PHD)

Areas of Study

Opportunities for graduate study and original research leading to the PhD degree are available in a variety of areas. The department does not offer a terminal, stand-alone master's degree program. Students enrolled in the doctoral program may earn their master's degree if they decide to leave the program after completing 30 hours of graduate coursework and the PhD oral and written comprehensive examination.

Molecular Biology

Includes gene regulation, virology, nucleic acid-protein interactions, chromosome structure and function, chromosome replication, microbial diversity, human genome structure, RNA structure and catalysis.

Cell Biology

Includes cytoskeleton, biophysical cytology, vacuole assembly, analysis of yeast spindle pole bodies and vertebrate centrosomes, synthesis and secretion of glycoproteins and polysaccharides, defense responses in plants and 3-D high resolution reconstruction, biogenesis of mitochondria and chloroplasts, energy metabolism, assembly of membrane protein complexes, cell cycle regulation and checkpoints and signal transduction.

Developmental Biology

Covers mechanisms and regulation of morphogenesis and cell growth, genetic control of development, molecular genetics of embryogenesis, sex determination, ras proteins and vulval development and programmed cell death in nematodes, molecular genetics of *Drosophila* neurobiology, developmental genetics of *Drosophila* and *Caenorhabditis*, neural development in mice, transgenic mice and muscle development and function.

Genetics

Includes genetics of human disease, complex traits, mouse development and invertebrate development.

Requirements

Admission Requirements

The graduate program of the Department of Molecular, Cellular and Developmental Biology is sufficiently flexible to accommodate students with a wide range of training. Students with bachelor's degrees in any of the biological, biochemical or physical sciences are encouraged to apply.

Degree Requirements

A minimum of 30 credit hours of courses numbered 5000 and above, plus 30 credit hours of doctoral thesis, are required. Specific courses depend on the student background and field of specialization.

The faculty of the department offers a variety of courses to help graduate students acquire knowledge in the various areas of study. Further, students are required to work in four different laboratories to broaden their education and to help them identify the field of greatest interest for their thesis work.

Advisory Committee

An advisory committee, appointed upon entrance, develops an appropriate curriculum based in part on the student's background. A written preliminary exam consists of a series of courses and exams administered during the first year.

Qualifying Exam

A comprehensive qualifying exam administered at the beginning of the spring semester of the second year includes a written research proposal and an oral defense of the proposal that emphasizes breadth and depth of knowledge as well as an ability to communicate and synthesize facts into a coherent scientific argument.

Thesis

The principal elements in graduate training are defining a thesis problem, investigating this problem with a coherent piece of research that constitutes a substantial contribution to knowledge, and writing a report on this work in the form of peer-reviewed journal articles and a thesis submitted to a departmental committee for approval. Thesis research must result in at least one peer-reviewed research article with the candidate as first or co-first author. After completion of the thesis, each candidate for the PhD degree is required to take a final oral examination on the thesis and related topics, and to present a public seminar.

Teaching

Generally, each candidate for the PhD degree does two semesters of apprentice teaching. This obligation is usually met during the student's first year of graduate study.

Learning Outcomes

By the completion of the program, students will be able to:

- Demonstrate a broad knowledge of theory and research across several sub-disciplines.
- Demonstrate in-depth knowledge of one area of expertise.
- Follow ethical guidelines for working in the field.
- Effectively communicate and present research results to professional audiences orally and in writing.
- Make an original and substantial research contribution to the field.

The graduate program in Molecular, Cellular, and Developmental Biology (MCDB) is designed to provide students with diverse opportunities for acquiring a strong foundation in areas of modern biology and applying it toward the generation of new knowledge through research.

PhD Learning Outcomes

- Demonstrate a broad knowledge of theory and research across several sub-disciplines.
- Demonstrate in-depth knowledge of one area of expertise.
- Learn and follow ethical guidelines for working in the field.
- Effectively communicate and present research results to professional audiences via writing and speaking.
- Make an original and substantial research contribution to the field.

Assessment Plan

- Pass core course and written exams, or equivalent from other programs.
- Complete a written research proposal and pass comprehensive oral exam in second year.
- Take the Responsible Conduct of Research course at least once during the PhD course of studies.
- Meet with your Thesis Committee at least annually starting in third year.
- Present dissertation research to the department at least annually.
- Defend thesis.

Annual Assessment Report

Thesis committee worksheets (1-2 per student per year)