

# Molecular and Cell Biology

College of Letters and Science (<http://ls.berkeley.edu>)

Department Office: 497 Life Sciences Addition

Chairs: Richard Harland, PhD and David Raulet, PhD

Department Website: Molecular and Cell Biology (<http://mcb.berkeley.edu>)

## Overview

The teaching and research activities of the Department of Molecular and Cell Biology (MCB) concern the molecular structures and processes of cellular life and their roles in the function, reproduction, and development of living organisms. This agenda covers a broad range of specialized disciplines, such as biochemistry, microbiology, biophysics, molecular biology, genetics, genomics, bioinformatics, cell biology, developmental biology, immunology, tumor biology and neurobiology. The types of living organisms from which the departmental faculty draws its working materials are as diverse as its disciplinary specializations, ranging from viruses and microbes through plants, roundworms, annelids, arthropods, and mollusks to fish, amphibia, and mammals. The faculty of the department is organized into five divisions: Biochemistry, Biophysics, and Structural Biology; Cell and Developmental Biology; Genetics, Genomics and Development; Immunology and Pathogenesis; and Neurobiology.

## Major Requirements

The undergraduate major in molecular and cell biology is composed of five emphases that encompass the diversity of scientific interests of the department's faculty. Some students will take a curriculum that includes more molecular and structural components and others will have a more cellular and systems orientation, but the perspectives and content of all emphases overlap considerably. Students majoring in any emphasis have been highly successful in entering graduate or medical school and in other science- and health-related careers.

Details on the MCB major, its requirements and policies, as well as resources for students, are available in the MCB Undergraduate Affairs Office, 3060 Valley Life Sciences Building, or see the department's (<http://mcb.berkeley.edu>) website (<http://mcb.berkeley.edu/undergrad>) .

## Lower Division Requirements:

- *For all but BMB Biological Chemistry:* Math 10A-10B; Chemistry 1A/1AL (or Chemistry 4A), 3A/AL-3B/BL; Biology 1A/1AL-1B; and Physics 8A-8B (or Physics 7A-7B). Total lower division units: 39.
- *For BMB Biological Chemistry:* Math 10A-10B; Chemistry 1A/1AL-1B (or Chemistry 4A-4B), Biology 1A/1AL-1B; and Physics 8A-8B (or Physics 7A-7B). Total lower division units: 33. (*Note:* BMB Biological Chemistry majors must take Chemistry 112A-112B in place of Chemistry 3A/AL-3B/BL.)

## Upper Division Requirements:

**Biochemistry and Molecular Biology Major (BMB)**

- *For Biochemistry and Molecular Biology Track:* MCB C100A, 100B, 110, C110L, 140/C148, BMB elective.
- *For Biological Chemistry Track:* Chemistry 112A-112B, MCB C100A, Chemistry 130B, Chemistry 135, MCB C110L, MCB 130A/140.

## Cell & Developmental Biology Major (CDB)

- *For Medical Biology and Physiology Track:* MCB 102, 104, 136, 133L, two CDB elective Bs.
- *For Cell and Systems Biology Track:* MCB 102, 104, 130A, 133L, two elective As.

## Genetics, Genomics & Development Major (GG&D)

- *For Genetics, Genomics, and Development Track:* MCB C100A, 110, 140, 140L, GG&D elective A/B, elective B.
- *For Developmental Genetics Track:* MCB 102, 104, 141, 140L, GG&D elective A/B, GG&D elective B.

## Immunology & Pathogenesis Major (IM&P)

- *For Immunology and Pathogenesis Track:* MCB C100A, 110, 104/140, 150, 150L, IM&P elective C
- *For Infectious Disease Track:* MCB 102, 104, 150, 150L; IM&P elective A, elective B.

## Neurobiology Major

- MCB 102, 104, C160, 160L/163; NEURO elective A/B, elective B.

## Honors Program

The MCB honors program offers exceptional senior students recognition for outstanding academic achievement and excellence in research. To graduate with honors in the major, students must:

1. Complete at least two credited semesters of research including four to eight units of MCB H196
2. Have a cumulative Berkeley grade point average (GPA) of at least 3.3 in all work completed at UC Berkeley
3. Have at least a 3.5 GPA in the MCB major requirements, or 3.5 in MCB upper-division courses
4. Present their research in an approved forum, such as an MCB symposium, the Undergraduate Poster Session, or other scientific meeting
5. Write an honors thesis approved by an MCB faculty sponsor

Additional information on the honors program is available in the Undergraduate Affairs Office and on the department's website (<http://mcb.berkeley.edu/undergrad/major/honors-program/honors>) .

## Graduate Program

The department offers a program of graduate study leading to the PhD in molecular and cell biology. This program provides advanced training in the research methods and concepts of the study of the molecular structures and processes of cellular life. The training is intellectually focused, but at the same time offers unusually wide opportunities for varied disciplinary specialization. Undergraduate preparation for admission to the program should correspond to one of the two plans of the departmental undergraduate major detailed above. All students working for the PhD will be required to serve as a graduate student instructor for two semesters during the first three years.

Students seeking detailed information about such matters as admission, curriculum, and sources of financial support should go to the MCB website (<http://mcb.berkeley.edu/grad>) or contact the department by mail at Graduate Affairs Office, Department of Molecular and Cell Biology, University of California, Berkeley, 299 Life Sciences Addition #3200, Berkeley, CA 94720-3200. E-mail: [mcbgao@berkeley.edu](mailto:mcbgao@berkeley.edu).

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## Research Facilities

**The Cancer Research Laboratory** is a research institute on the Berkeley campus that carries on a research, teaching, and service program designed to foster interdepartmental participation in cancer research. Some of the Department of Molecular and Cell Biology faculty are also members of the Cancer Research Laboratory. The central research program represents a multidisciplinary approach to an understanding of the mechanism of neoplastic transformation using a variety of systems. Graduate student and postdoctoral research programs are supported in various areas of tumor biology, biochemistry, cell biology, endocrinology, genetics, immunology, molecular biology, and tumor virology. The Cancer Research Laboratory also operates five research facilities:

1. Flow Cytometry Facility for fluorescence activated cell sorting and analysis
2. Molecular Imaging Facility with two-photon microscopes for image analysis
3. Proteomic Mass Spectrometry Facility
4. Immunology DNA Microarray Consortium
5. Gene Targeting Facility for construction of transgenic and chimeric mice

Instrumentation in the facilities is operated by highly trained staff, and training is offered in methods and techniques associated with each facility. For more information, go to this website (<http://crl.berkeley.edu/?q=crl>) . (<http://biology.berkeley.edu/crl>)

**The Functional Genomics Laboratory at Berkeley** was established to allow Berkeley scientists to exploit profound technological advances in the field of genomics. These advances, which include the sequencing of entire genomes of selected model systems and the ability to survey genome-wide patterns of gene expression, now allow the dissection of biological processes at unprecedented levels of detail. In particular, this research facility provides the infrastructure, technologies, and computational resources for the performance of DNA microarray experiments, which allow the analysis of mRNA expression from tens of thousands of genes at a time. The Functional Genomics Laboratory currently possesses all the equipment necessary for conducting DNA microarray experiments, including thermal cyclers, fluidics robots, microarray printing robots, laser scanning microscopes for microarray scanning, an Affymetrix workstation and scanner, and dedicated computers for data analysis and storage of informatics databases. For more information, go to this website (<http://qb3.berkeley.edu/qb3/fgl>) . (<http://microarrays.berkeley.edu>)

**The Robert D. Ogg Electron Microscope Laboratory** is an instructional and research unit of the College of Letters and Science. It houses equipment for transmission electron microscopy (TEM) and scanning electron microscopy (SEM). The staff is skilled not only in the operation and maintenance of instruments but in standard and most specialized techniques of sample preparation. Qualified undergraduates and graduate students, postdoctoral associates, faculty, and research staff in biological and physical sciences, once trained, may make arrangements for use of the instruments in research. Instruction is provided in the form of both

classes and individual training. Training is provided as MCB 481B and/or 481C. Registered students and faculty are not charged for training. Nominal charges are made for use of the laboratory for individual research work. With permission from the director, non-UC personnel can be accepted for training or laboratory use. Equipment can be used outside normal hours. The laboratory provides demonstrations of the electron microscope and preparative techniques for on-campus classes and can make special arrangements for tour groups. For more information, go to this website (<http://em-lab.berkeley.edu/EML>) .

Other specialized research facilities include those for x-ray crystallography, nuclear magnetic resonance studies, large-scale fermentation, tissue culture, and DNA sequencing.

**The Berkeley Screening Center** is a campus-wide facility enabling Berkeley researchers to perform high-throughput genetic and chemical screens. The BSC provides automation, including automated image-acquisition, microscopy, and high-throughput liquid handling technology; support for screen execution and analysis; bioinformatic tools; and siRNA libraries targeting *Drosophila*, mouse, and human genomes, kinomes, and ubiquitinomes.

**MCELLBI 15 Current Topics in the Biological Sciences 2 Units**

**Department:** Molecular and Cell Biology

**Course level:** Undergraduate

**Term course may be offered:** Spring

**Grading:** Letter grade.

**Hours and format:** 2 hours of Lecture and 1 hour of Discussion per week for 15 weeks.

**Prerequisites:** Suitable for freshmen who plan to major in a biological science.

Students in this course will critically examine modern methods of biological investigations and their social implications. Relevant literature will be used to present basic biological concepts that address the cultural, technological and health aspects of current topics in the biological sciences. Designing and evaluating scientific questions will be stressed.

Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes. Instructor: Matsui

**MCELLBI C31/L & S C30X Big Ideas in Cell Biology 3 Units**

**Department:** Molecular and Cell Biology; Letters and Science

**Course level:** Undergraduate

**Term course may be offered:** Spring

**Grading:** Letter grade.

**Hours and format:** 2 hours of Lecture and 1 hour of Discussion per week for 15 weeks.

An introduction for students who do not intend to major in biology but who wish to satisfy their breadth requirement in Biological Sciences. Some major concepts of modern biology, ranging from the role of DNA and the way cells communicate, to interactions of cells and creatures with their environment, will be discussed without jargon and with attention to their relevance in contemporary life and culture.

Instructor: Wilt

**MCELLBI 32 Introduction to Human Physiology 3 Units**

**Department:** Molecular and Cell Biology

**Course level:** Undergraduate

**Terms course may be offered:** Fall and summer

**Grading:** Letter grade.

**Hours and format:** 3 hours of Lecture and 1 hour of Discussion per week for 15 weeks. 6 hours of Lecture and 2 hours of Discussion per week for 8 weeks.

**Prerequisites:** One year high school or college chemistry.

A comprehensive introduction to human cell biology. The course will concentrate on basic mechanisms underlying human life processes, including cells and membranes; nerve and muscle function; cardiovascular, respiratory, renal, and gastrointestinal physiology; metabolism, endocrinology, and reproduction.

Instructors: Machen, Ball

**MCELLBI 32L Introduction to Human Physiology Laboratory 2 Units**

**Department:** Molecular and Cell Biology

**Course level:** Undergraduate

**Terms course may be offered:** Fall and summer

**Grading:** Letter grade.

**Hours and format:** 1 hour of Lecture and 3 hours of Laboratory per week for 15 weeks. 2 hours of Lecture and 6 hours of Laboratory per week for 8 weeks. 2 hours of Lecture and 8 hours of Laboratory per week for 6 weeks.

**Prerequisites:** 32 or may be taken concurrently.

Experiments and demonstrations are designed to amplify and reinforce information presented in 32. Exercises include investigations into the structure and function of muscle, nerve, cardiovascular, renal, respiratory, endocrine, and blood systems.

Instructor: Ball

**MCELLBI 41 Genetics and Society 3 Units**

**Department:** Molecular and Cell Biology

**Course level:** Undergraduate