

# MOLECULAR AND CELL BIOLOGY (MCB)

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## MCB 5001. Biochemistry. (5 Credits)

Metabolism of carbohydrates, lipids, amino acids, proteins, and nucleic acids, including regulation, and to the structure and function of biological macromolecules. Provides suitable preparation for advanced course work in biochemistry, biophysics, and other areas of molecular biology.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205001>)

## MCB 5002. Biochemistry Laboratory. (3 Credits)

Theory and application of modern techniques for the separation and characterization of biological macromolecules, including several types of liquid chromatography, liquid scintillation spectrophotometry and SDS polyacrylamide gel electrophoresis. Each student will carry out individual projects using selected techniques.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205002>)

## MCB 5003. Biophysical Chemistry I. (3 Credits)

An introduction to the physical chemistry of biological molecules and systems. Principal topics include biomolecular thermodynamics, kinetics, transport properties, and biomolecular structure.

**Enrollment Requirements:** Not open for credit to students who have passed MCB 3003.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205003>)

## MCB 5004. Biophysical Chemistry II. (3 Credits)

The physical chemistry of biological molecules and systems. This course will emphasize a statistical framework for understanding biomolecular phenomena. Principal topics will include electrostatics, intermolecular forces, ligand binding, and protein stability and folding.

**Enrollment Requirements:** Not open for credit to students who have passed MCB 3004.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205004>)

## MCB 5008. Techniques of Biophysical Chemistry. (3 Credits)

Theory and applications of biophysical methods for the analysis of the size, shape and interactions of proteins and nucleic acids. Topics include analytical ultracentrifugation, light scattering, X-ray scattering, calorimetry, surface plasmon resonance and single molecule approaches.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205008>)

## MCB 5010. Biological Optical Spectroscopy: Practical Applications. (2 Credits)

Practical applications of spectroscopy in biochemistry and the biological sciences. Topics include fluorescence, circular dichroism and various spectroscopic techniques with particular emphasis on biological macromolecules. Analysis of raw data and interpretation of published results will be used to define the suitability and limits of these techniques.

**Enrollment Requirements:** If student has taken MCB 5038, this course may only be taken if the content is different.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205010>)

## MCB 5012. Foundations of Structural Biochemistry. (3 Credits)

Comprehensive introduction to the molecular aspects and dynamics of structural biochemistry. Examination of nucleic acid, protein, and lipid structures including current topics in conformation and folding, enzyme kinetics, nucleic acid stability, ligand/receptor binding, and bioenergetics. Overviews of experimental strategies used to study macromolecular structure and interactions.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205012>)

## MCB 5013. Structure and Function of Biological Macromolecules. (3 Credits)

Fundamentals of protein structure, and the forces that stabilize structure. Recurrent structural motifs, molecular ancestry/homology, and insights into proteins structure evolution. Protein folding and dynamics. Structure-function correlations, and structural basis of regulation. Techniques used to investigate structure: X-ray diffraction, NMR, TEM, AFM, structure prediction, computational simulations. Advanced topics: chaperones; structural genomics; role of misfolded proteins in disease.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205013>)

## MCB 5014. Structure and Dynamics of Macromolecular Machines. (3 Credits)

Biochemical and biophysical characteristics of macromolecular assemblies starting at the atomic level and proceeding to the cellular level. Topics include ribosomes, viruses, polymerases, membrane protein assemblies and ion transporters, which will be examined through lecture, discussion, and interactive computational modules.

**Enrollment Requirements:** Open to graduate students in Molecular and Cell Biology, others with permission. Recommended preparation: a course in biochemistry or structural biology.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205014>)

## MCB 5025. Structure and Function of Biological Membranes. (3 Credits)

Overview of cell membrane structure and function based on a foundation of physical and biochemistry principles. Topics include lipid bilayers, vesicles and liposomes, cholesterol, membrane protein structure and function, transport, membrane fusion, receptors, drug/membrane interactions and membranes in cell regulation.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205025>)

## MCB 5076. Biomolecular Nuclear Magnetic Resonance Spectroscopy. (2 Credits)

Open to undergraduate students with consent of instructor. Advanced treatment of NMR spectroscopy as applied to problems in structural biology, particularly protein structure and dynamics.

**Enrollment Requirements:** Recommended preparation: courses in biochemistry, organic chemistry, and physical chemistry.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205076>)

## MCB 5077. Practicum in NMR Spectroscopy. (1 Credit)

Hands-on training in heteronuclear NMR spectroscopy of biomolecules. Topics include protein folding, protein dynamics, binding of ligands to proteins, and protein structure determination.

**Enrollment Requirements:** Instructor consent required. Recommended Preparation: MCB 5076 or MCB 2000 or MCB 3010.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205077>)

**MCB 5080. Frontiers in Microbiology. (1 Credit)**

Current topics in microbiology including research advances, impact of microorganisms on the environment and society, their role in health and disease, and applications of microbiological research in academic, government and industrial settings.

May be repeated for a total of 5 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205080>)

**MCB 5200. Cell Biology of the Mammalian Secretory Apparatus. (3 Credits)**

Critical reading of the primary literature focusing on how eukaryotic cells synthesize and traffic secretory and membrane proteins. Emphasis on effectiveness of data presentation in papers.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205200>)

**MCB 5217. Biosynthesis of Nucleic Acids and Proteins. (3 Credits)**

Mechanisms of protein and RNA synthesis in prokaryotes and eukaryotes. Topics such as RNA processing, gene splicing, and control of protein and RNA synthesis are discussed.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205217>)

**MCB 5240. Virology. (3 Credits)**

Biological, biochemical, genetic, and physical characteristics of viruses, with an emphasis on molecular and quantitative aspects of virus-cell interactions.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205240>)

**MCB 5243. Molecular Analysis of Development. (3 Credits)**

An analysis of the mechanisms of morphogenesis and differentiation with special emphasis on molecular aspects.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205243>)

**MCB 5250. Techniques in Cellular Analysis. (3 Credits)**

Examination of methodologies used to address cell biological questions: how they work, how they synergize, their advantages and disadvantages. Topics include detection and measurement of protein activities and interactions, molecular genetic manipulation of gene expression and protein function, determination of cellular localization and in vivo functional assays.

**Enrollment Requirements:** Open to graduate students in Molecular and Cell Biology, others with permission. Recommended preparation: a course in cell biology.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205250>)

**MCB 5255. Cellular and Molecular Immunology. (2 Credits)**

Genetic, biochemical, and cellular control of the immune system, addressing such topics as antigen recognition, immune regulation, stress and immunity, apoptosis, and signal transduction.

May be repeated for a total of 8 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205255>)

**MCB 5280. Advanced Cell Biology. (3 Credits)**

Integrative approach to the study of eukaryotic cell biology emphasizing structure, function, and dynamics of the cytoskeleton, membrane, and extracellular matrix.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205280>)

**MCB 5284. Current Topics in Cell and Developmental Biology. (1 Credit)**

Reading and discussion of papers from the recent literature. Topics include cytoskeletal function, cell motility, gene expression, and signal transduction, with special focus on their relationship to development, host-pathogen interactions, the immune system, and cancer. May be repeated for a total of six credits.

May be repeated for a total of 6 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205284>)

**MCB 5426. Genetic Engineering and Functional Genomics. (3 Credits)**

Methods and applications of genetic engineering, including gene manipulation and transfer techniques in prokaryotes and eukaryotes. Emphasis on the application of recombinant DNA technology in the elucidation of gene function. Recent technological developments in molecular genetics and the societal issues related to these developments will also be addressed. Students will prepare a grant application or other written assignment.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205426>)

**MCB 5427. Laboratory Techniques in Functional Genomics. (1 Credit)**

Molecular biological techniques utilized in gene discovery and in the functional characterization of genes in animal development. Taught as a series of short modules, each focusing on a different set of techniques. With a change of content, this course may be repeated for credit.

May be repeated for a total of 7 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205427>)

**MCB 5430. Analysis of Eukaryotic Functional Genomic Data. (3 Credits)**

Construction and implementation of computational pipelines that integrate available bioinformatics tools to perform processing, analysis and quality control of eukaryotic functional genomics datasets from ChIP-seq, RNA-seq and other high throughput sequencing approaches. No programming experience required.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205430>)

**MCB 5445. Genome Dynamics and Epigenetics. (3 Credits)**

An examination of the mechanisms of eukaryotic genome function and dynamics. Topics include, but are not limited to, chromatin organization, chromosome structure and function, and nuclear architecture.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205445>)

**MCB 5446. 3D Genome in Development, Disease, and Evolution. (3 Credits)**

The principles underlying 3D genome organization and function in multicellular organisms. Emphasis on genomics and imaging approaches such as single-cell and spatial omics. Topics include genome organization and gene regulation in normal and disease states, development, and evolution.

**Enrollment Requirements:** Instructor consent required. Background in genetics (MCB 2410 or equivalent) and cell biology (MCB 2210 or equivalent).

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205446>)

**MCB 5452. Problems in Genetics of Eukaryotes. (3 Credits)**

Consideration of such problems as chromosomal organization, mechanisms of meiotic drive, epigenetic inheritance, chromosome distribution, and transposable elements in model genetic organisms.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205452>)

**MCB 5480. Frontiers in Applied Genomics. (1 Credit)**

Current topics in genomics research including ethics, impacts on society, and applications in academic and industrial settings.

May be repeated for a total of 4 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205480>)

**MCB 5484. Current Topics in Genetics and Genomics. (1 Credit)**

Reading and discussion of papers from the recent literature.

May be repeated for a total of 6 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205484>)

**MCB 5490. Industrial Insights. (1-2 Credits)**

Research and development, regulation, intellectual property protection, and production of commercial services and products from the vantage point of the genomics, biotechnology, and pharmaceutical industries.

May be repeated with a change in topic.

May be repeated for a total of 12 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205490>)

**MCB 5491. Professional Development Seminar. (1 Credit)**

Speakers from industry, government agencies, universities and non-profits provide advice about career paths, business models, hiring and employment opportunities.

**Enrollment Requirements:** Open only to graduate students in the MCB Professional Science Masters programs.

May be repeated for credit

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205491>)

**MCB 5616. Experiments in Bacterial Genetics. (3 Credits)**

Experiments in bacterial genetics emphasizing genetic manipulations using modern techniques for mutant isolation, DNA characterization and cloning. These include the use of transposons, DNA isolation, restriction analysis, gel electrophoresis, PCR and DNA sequencing. Each student conducts an independent project.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205616>)

**MCB 5621. Molecular Biology and Genetics of Prokaryotes. (3 Credits)**

Molecular genetics of bacteria, archaeobacteria, and their viruses. Transcription and replication of DNA, transformation, transduction, conjugation, genetic mapping, mutagenesis, regulation of gene expression, genome organization.

**Enrollment Requirements:** Recommended preparation: a course in general microbiology.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205621>)

**MCB 5625. Horizontal Gene Transfer, From Mechanisms to Outcomes. (3 Credits)**

How quorum sensing, natural transformation and biofilm formation collectively control and bias horizontal gene transfer (HGT) in prokaryotes. The contribution of HGT to prokaryotic evolution via, for example, adaption to environments, generation of metabolic pathways, and how separate lineages are formed.

**Enrollment Requirements:** Instructor consent; not open to students who have passed MCB 5895 when offered as Horizontal Gene Transfer in Prokaryotes.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205625>)

**MCB 5631. Sequence-based Microbial Community Analysis. (3 Credits)**

Overview of current computational methods for analyzing sequence-based microbial community data including amplicon-based, shotgun metagenomics and metatranscriptomics methods. Students will analyze published data or their own datasets.

**Enrollment Requirements:** MCB graduate students only.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205631>)

**MCB 5670. Theory and Practice of Laboratory Techniques in Microbiology. (1-2 Credits)**

Trains participants in techniques, experimental design, sample preparation, quality control, and analysis of data encountered in microbiology laboratories. Taught as a series of modules with each focused on a different technique. With a change of content, may be repeated for credit.

May be repeated for a total of 5 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205670>)

**MCB 5671. Advanced Theory and Practice of Laboratory Techniques in Microbiology. (1-2 Credits)**

Advanced training in microbiology related technologies such as next-generation sequencing and other "omic" techniques including experimental design, sample preparation, library preparation, quality control, analysis of large data sets and processing of large number of samples will be covered. The course is taught as a series of modules with each focused on a different technique. With change of content, may be repeated for credit.

May be repeated for a total of 10 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205671>)

**MCB 5672. Applied Bioinformatics. (1-2 Credits)**

Computational analysis of biological datasets. Lecture will cover background and theory. In the computer lab, sample data will be used to perform bioinformatics analysis. The course is taught as a series of modules with each focused on a different aspect.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205672>)

**MCB 5679. Microbial Physiology. (3 Credits)**

Topics in microbial cell organization, growth, and intermediary metabolism with emphasis on specialized physiological adaptations.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205679>)

**MCB 5681. Mechanisms of Bacterial Pathogenicity. (3 Credits)**

An in-depth examination of several host-parasite relationships as models of disease states.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205681>)

**MCB 5699. Seminar in Microbiology. (1 Credit)**

Discussion of current topics in microbiology.

May be repeated for a total of 12 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205699>)

**MCB 5799. Independent Study. (1 Credit)**

A reading course for those wishing to pursue special work in biology. It may also be elected by undergraduate students preparing to be candidates for degrees with distinction. May be repeated for a total of four credits.

**Enrollment Requirements:** Instructor consent.

May be repeated for a total of 4 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205799>)

**MCB 5801. Scientific Writing and Project Development for MCB Graduate Students. (2 Credits)**

Instruction in the practice of scientific writing through group discussions and peer review during preparation of an application to the NSF Graduate Research Fellowship Program. Group discussions in related aspects of graduate student project development.

**Enrollment Requirements:** Open only to Molecular and Cell Biology Ph.D. students.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205801>)

**MCB 5884. MCB Research in Progress. (1 Credit)**

Presentations by graduate students, post-doctoral fellows, and other MCB personnel focusing on their current research projects.

May be repeated for a total of 3 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205884>)

**MCB 5895. Special Topics in Molecular and Cell Biology. (1-4 Credits)**

Advanced study in a field within Molecular and Cell Biology. Credits and hours by arrangement. Prerequisites and recommended preparation vary. May be repeated for a total of 24 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205895>)

**MCB 5900. Professional Writing and Communication Skills. (1 Credit)**

Professional communication skills focused on jobs in industry. Hands-on practice in writing resumes and interviewing.

**Enrollment Requirements:** Open only to Molecular and Cell Biology and Mathematics Professional Science Master's (PSM) students and Molecular and Cell Biology Professional Master's (PM) students.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205900>)

**MCB 5910. Responsible Conduct in Research. (1 Credit)**

Core principles pertaining to responsible conduct in research are covered through case studies, readings and classroom instruction.

**Enrollment Requirements:** Open to graduate students in Molecular and Cell Biology.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205910>)

**MCB 5984. MCB Invited Seminar. (1 Credit)**

Selected topics in cellular and molecular biology presented by invited speakers.

May be repeated for a total of 3 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%205984>)

**MCB 6000. Rotations in MCB Laboratories. (3 Credits)**

Provides entering Ph.D. students with research experience in three different laboratory settings during the first semester of graduate studies to assist with the selection of a mentor for their degree. Students are expected to participate in laboratory meetings, journal clubs, bench work, and other activities as defined by each of three host faculty members.

**Enrollment Requirements:** Open only to Molecular and Cell Biology Ph.D. students.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%206000>)

**MCB 6001. Introduction to Molecular and Cell Biology Research. (3 Credits)**

Introduction to general areas of research for Ph.D. students in Molecular and Cell Biology; includes specific laboratory research opportunities, laboratory skills and professional development.

**Enrollment Requirements:** Instructor consent; open to Ph.D. and thesis M.S. students in Molecular and Cell Biology.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%206001>)

**MCB 6002. MCB Faculty Research. (1 Credit)**

Department faculty present seminars describing their research interests to help incoming Molecular and Cell Biology Ph.D. graduate students choose laboratories for rotations.

**Enrollment Requirements:** Open to Thesis M.S. and Ph.D. students in Molecular and Cell Biology.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%206002>)

**MCB 6897. Research. (1-6 Credits)**

Conferences and laboratory work covering selected fields of Molecular and Cell Biology.

May be repeated for a total of 24 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=MCB%206897>)