Molecular and Cell Biology (MCB)

mcb.uconn.edu

5001. Biochemistry

Five 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. Graduate students with considerable laboratory experience may arrange to take only the lecture portion of this course as Biology: MCB 5896 with consent of instructor.

5002. Biochemistry Laboratory

Three credits. Prerequisite: Instructor consent.

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.

5003. Biophysical Chemistry I

Three credits. Not open for credit to students who have passed MCB 3003.

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

5004. Biophysical Chemistry II

Three credits. Not open for credit to students who have passed MCB 3004.

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

5008. Techniques of Biophysical Chemistry

Three 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.

5010. Biological Optical Spectroscopy: Practical Applications

Two credits. If student has taken MCB 5038, this course may only be taken if the content is different.

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.

5012. Foundations of Structural Biochemistry

Three 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.

5013. Structure and Function of Biological Macromolecules

Three 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.

5014. Structure and Dynamics of Macromolecular Machines

Three credits. Prerequisite: Open only to Molecular and Cell Biology graduate students, others with consent. Recommended preparation: a course in biochemistry or structural biology.

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.

5015. X-ray Structure Analysis

Three credits. Prerequisite: Instructor consent.

The determination of three-dimensional atomic-level structure by diffraction methods. Small-angle solution scattering. Protein crystallography.

5025. Structure and Function of Biological Membranes

Three 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.

5034. Human Metabolism and Disease

Two credits.

A thorough analysis of the inter-relationships of metabolic pathways in connection with human health and disease, including inherited metabolic diseases and the role of hormones in metabolic pathways.

5038. Techniques in Structural Biology

(Also offered as MEDS 5338.) Two credits. Prerequisite: Instructor consent. May be repeated for a total of eight credits.

A short course to introduce graduate students and selected undergraduates to modern techniques in structural biology. Each course offering covers a specific technique: NMR, computational and graphical analysis of biomolecules, X-ray crystallography, analytical ultracentrifugation, spectroscopy, calorimetry, and others.

5076. Biomolecular Nuclear Magnetic Resonance Spectroscopy

Two credits. Recommended preparation: courses in biochemistry, organic chemistry, and physical chemistry.

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.

5077. Practicum in NMR Spectroscopy

One credit. Prerequisite: Instructor consent. Recommended preparation: MCB 5076 or 2000 or 3010.

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

5080. Frontiers in Microbiology

One credit. Prerequisite: Instructor consent. May be repeated for a total of five credits.

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.

5099. Graduate Seminar in Biochemistry

One credit. May be repeated for a total of two credits. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).

5200. Cell Biology of the Mammalian Secretory Apparatus

Three credits. Prerequisite: Instructor consent.

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.

5217. Biosynthesis of Nucleic Acids and Proteins

Three 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.

5219. Developmental and Regenerative Biology

Three credits. Prerequisite: Instructor consent. Not open for credit to students who have passed MCB 3219 or 4219.

Principles of animal embryonic development and regeneration with emphasis on the cellular and molecular basis of pattern formation and cell differentiation in a variety of model organisms. Relevance to human development, disease and therapeutic applications will be emphasized.

5240. Virology

Three credits.

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

5243. Molecular Analysis of Development

Three credits.

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

5250. Techniques in Cellular Analysis

Three credits. Prerequisite: Open only to Molecular and Cell Biology graduate students. Recommended preparation: a course in cell biology.

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.

5255. Cellular and Molecular Immunology

Two credits. Prerequisite: Instructor consent. May be repeated for a total of eight 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.

5280. Advanced Cell Biology

Three credits.

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

5299. Current Topics in Cell Biology

Variable (1-2) credits. Prerequisite: Instructor consent. May be repeated for a total of eight credits.

Discussion of papers from recent literature. Topics include cytoskeletal function, cell motility, gene expression, and signal transduction, with special focus on their relationship to development, the immune system, and cancer.

5426. Genetic Engineering and Functional Genomics

Three 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.

5427. Laboratory Techniques in Functional Genomics

One credit. Prerequisite: Instructor consent. May be repeated for a total of seven credits.

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.

5428. Theory and Practice of Forensic Identification Methods

One credit. Prerequisite: Instructor consent. May be repeated for a total of eight credits.

Advanced consideration of the theory, practice, and analysis of various techniques used in forensic identification strategies. Taught as a series of stand-alone, "executive format" modules with each focused on a different methodology and consisting of hands-on laboratory combined with lectures and data analysis, problem solving, and/or case studies.

5429. Theory and Practice of High Throughput Sequence Analysis

Two credits. Prerequisite: Instructor consent. May be repeated for a total of 16 credits.

Advanced training in experimental design, sample preparation, quality control, high throughput sequence acquisition and analysis of data sets for a variety of genomics applications. Taught as a series of modules with each focused on a different aspect of the practice of next-generation genome analysis.

5430. Analysis of Eukaryotic Functional Genomic Data

Three credits. Prerequisite: Instructor consent.

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.

5432. Molecular and Genetic Approaches to Developing Systems

Two credits.

Topics of current interest in developmental biology are presented with related developmental and genetic background information.

5445. Genome Dynamics and Epigenetics

Three 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.

5452. Problems in Genetics of Eukaryotes

Three credits.

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

5454. Molecular Aspects of Genetics

Two credits. May be repeated for a total of eight credits.

Integration of the biological effects, molecular structure, expression, and evolution of genes and genomes.

5471. Current Topics in Molecular Evolution and Systematics

One credit. May be repeated for a total of four credits.

Current concepts, ideas and techniques in the field of molecular evolution, and theoretical problems peculiar to the phylogenetic analysis of molecular data.

5472. Computer Methods in Molecular Evolution

Three credits.

Practical aspects of molecular data analyses. Databank searches, sequence alignments, statistical analyses of sequence data. Parsimony, distance matrix, and spectral analysis methods. Students compile and analyze a data set of their choice.

5480. Frontiers in Applied Genomics

One credit. Prerequisite: Instructor consent. May be repeated for a total of four credits.

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

5490. Industrial Insights

Variable (1-2) credits. Prerequisite: Instructor consent. May be repeated for a total of 12 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.

5491. Professional Development Seminar

One credit. Prerequisite: Open only to Molecular and Cell Biology M.S. students. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).

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

5499. Current Topics in Genetics

Variable (1-2) credits. May be repeated for a total of four credits. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).

Intensive reading and discussion of current topics in genetics.

5616. Experiments in Bacterial Genetics

Three credits. Prerequisite: Instructor consent.

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.

5621. Molecular Biology and Genetics of Prokaryotes

Three credits. Prerequisite: Instructor consent. Recommended preparation: a course in general microbiology.

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

5631. Sequence-based Microbial Community Analysis

Three credits. Prerequisite: Open to graduate students in Molecular and Cell Biology, others by permission.

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.

5670. Theory and Practice of Laboratory Techniques in Microbiology

Variable (1-2) credits. Prerequisite: Instructor consent. May be repeated for a total of five 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.

5671. Advanced Theory and Practice of Laboratory Techniques in Microbiology

Variable (1-2) credits. Prerequisite: Instructor consent. May be repeated for a total of 10 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.

5672. Applied Bioinformatics

Variable (1-2) credits. Prerequisite: Instructor consent.

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.

5679. Microbial Physiology

Three credits. Prerequisite: Instructor consent.

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

5681. Mechanisms of Bacterial Pathogenicity

Three credits. Prerequisite: Instructor consent.

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

5699. Seminar in Microbiology

One credit. May be repeated for a total of 12 credits. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).

Discussion of current topics in microbiology.

5801. Scientific Writing and Project Development for MCB Graduate Students

Two credits. Prerequisite: Open only to Molecular and Cell Biology Ph.D. students.

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.

5893. Special Topics in Cellular and Molecular Biology

Variable (1-2) credits. May be repeated for a total of two credits. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).

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

5895. Independent Study

One credit. Prerequisite: Instructor consent. May be repeated for a total of four credits.

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.

5896. Investigation of Special Topics

Variable (1-6) credits. Prerequisite: Instructor consent. May be repeated for a total of 24 credits.

Advanced study in a field within Molecular and Cell Biology.

5899. Graduate Seminar

One credit. May be repeated for a total of three credits. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).

5900. Professional Writing and Communication Skills

One credit. Prerequisite: 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.

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

5910. Responsible Conduct in Research

One credit. Prerequisite: Open to graduate students in Molecular and Cell Biology, others by permission. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).

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

6000. Rotations in MCB Laboratories

Three credits. Prerequisite: Open only to Molecular and Cell Biology graduate students. Students taking this course will be assigned a final grade of S (satisfactory) or U (unsatisfactory).

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.

6897. Research

Variable (1-6) credits. Prerequisite: Instructor consent. May be repeated for a total of 24 credits.

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