

Biochemistry and Molecular Biology Courses (BMB)

BMB Courses

This is a list of courses with the subject code BMB. For more information, see Biochemistry and Molecular Biology (Carver College of Medicine) in the Catalog.

BMB:3110 Biochemistry

3 s.h.

One-semester survey of basic concepts in modern biochemistry and molecular biology; emphasis on application of biochemical concepts to human metabolism; appropriate for students who plan to pursue a career in health care or want an overview of biochemistry as a discipline. Requirements: one year each of college-level biology and chemistry. Recommendations: one semester of organic chemistry.

BMB:3120 Biochemistry and Molecular Biology I

3 s.h.

Physical and chemical foundations of biochemistry, structure of biological molecules, catalysis, transport, and oxidative reactions in biology; first of two-semester sequence that concludes with BMB:3130. Requirements: two semesters of general chemistry and one of organic chemistry. Recommendations: BIOL:1411, BIOL:1412, and an additional organic chemistry course.

BMB:3130 Biochemistry and Molecular Biology II

3 s.h.

Molecular principles of photosynthesis and biosignaling; metabolism of lipids, amino acids, and nucleic acids; DNA replication, transcription, and protein translation; team-taught, didactic lecture style; second of a two-semester comprehensive biochemistry sequence. Prerequisites: BMB:3120 with a minimum grade of C-.

BMB:3140 Experimental Biochemistry

2 s.h.

Use of modern instruments and techniques to fractionate, identify, and characterize constituents of biochemical systems. Prerequisites: BMB:3120 with a minimum grade of C-. Requirements: two semesters of general chemistry and one semester of organic chemistry.

BMB:3150 Development of Senior Research Project

2 s.h.

Preparation for biochemistry majors pursuing a senior research project in BMB:4999; communicating technical information through writing and speaking; presenting scientific journal articles and writing experimental protocols; developing detailed proposal for one-year senior research project. Prerequisites: BMB:3120 or BMB:3140 or BMB:3130. Requirements: biochemistry major, and junior or senior standing.

BMB:3310 Practical Data Science and Bioinformatics

3 s.h.

Understanding how to access large biological data sets and use them to answer biological questions is an important skill for researchers; immersive introduction to computational handling of data; how to access and analyze publicly available data; critically evaluate data quality and analysis in context of measuring gene expression; basic coding in R/RStudio, plotting and data display, fitting and regression, statistical inference, statistical models, downloading and data wrangling; basic introduction to machine learning (clustering); for students with no computational background. Prerequisites: BIOL:1411 with a minimum grade of C- and BIOL:1412 with a minimum grade of C-. Requirements: college algebra. Recommendations: BMB:3110, or BMB:3120 and BMB:3130, or other upper-level life sciences courses. Same as CBIO:3310, MMED:3310.

BMB:3800 Biochemistry Teaching Practicum

arr.

Training for qualified junior or senior undergraduates majoring in biochemistry or a related field to contribute to undergraduate courses; interns may hold review sessions, offer regular office hours, draft questions for homework or exams, assist in proctoring exams, assist students in a laboratory setting, and help with course implementation; guidance from the faculty director and instructors in each course; interns are expected to work approximately three hours per week for each semester hour of credit earned. Requirements: completion of a course covering the same or equivalent material with a grade of B or higher, and must arrange for a short interview with the appropriate course director prior to registration.

BMB:3993 Undergraduate Biochemistry Research

arr.

Preparation for BMB:4999; directed research with a biochemistry faculty member; experience in an active biochemistry research lab, learning and performing experiments relevant to current projects in that lab, including exposure to scientific literature; arranged in advance by student and biochemistry faculty member.

BMB:4240 Biophysics and Advanced Biochemistry

3 s.h.

Principles and experimental approaches used to study macromolecular structure, stability, and function; ligand binding and macromolecular interactions; enzyme kinetics and mechanisms; X-ray crystallography and NMR spectroscopy; single molecule and other biophysical approaches. Prerequisites: BMB:3120 and BMB:3130 with a minimum grade of C-. Requirements: one year of biochemistry. Recommendations: physical chemistry course and one semester of calculus.

BMB:4241 Biophysical Chemistry I

3 s.h.

Principles and experimental approaches used to study structure and function of biological macromolecules; protein structure, stability, and dynamics; macromolecular interactions; common biophysical methods. Prerequisites: BMB:3120 with a minimum grade of C- and BMB:3130 with a minimum grade of C-. Requirements: one year of biochemistry. Recommendations: physical chemistry course and one semester of calculus.

BMB:4242 Biophysical Chemistry II

3 s.h.

Principles and experimental approaches used to study structure and function of biological macromolecules; ligand binding and enzyme catalysis; X-ray crystallography; NMR spectroscopy. Prerequisites: BMB:3120 with a minimum grade of C- and BMB:3130 with a minimum grade of C-. Requirements: one year of biochemistry. Recommendations: physical chemistry course and one semester of calculus.

- BMB:4310 Computational Biochemistry** 3 s.h.
Introduction to biomolecular modeling and computer simulation techniques; biomolecular structure and molecular driving forces; principles of structural optimization and conformational sampling; applications to biomolecular phenotypes; scripting and molecular visualization in PyMol, setting up and running molecular dynamics simulations using VMD and NAMD, performing refinement of X-ray diffraction data sets using Phenix, and executing Poisson-Boltzmann electrostatic calculations using APBS. Prerequisites: (MATH:1560 or MATH:1860) and CHEM:1120. Recommendations: BMB:3110 or BMB:3120. Same as BME:4310.
- BMB:4999 Advanced Undergraduate Biochemistry Research** arr. 4 s.h.
Advanced directed research with a biochemistry faculty member; work on an individualized research project relevant to research goals of that lab; learning related scientific literature and presentation of research results; arranged in advance by student and biochemistry faculty member and taken after completion of core biochemistry curriculum. Prerequisites: BMB:3120 with a minimum grade of B- and BMB:3130 with a minimum grade of B- and BMB:3140 with a minimum grade of B- and BMB:3150 with a minimum grade of B-. Requirements: BMB:3993 or URES:3994 or HONR:3994 or prior research experience or lab practicum.
- BMB:5215 Directed Readings for Graduate Students** arr.
Directed readings with course content arranged with professor.
- BMB:5240 Biophysics and Advanced Biochemistry** 3 s.h.
Principles and experimental approaches used to study macromolecular structure, stability, and function; ligand binding and macromolecular interactions; enzyme kinetics and mechanisms; X-ray crystallography and NMR spectroscopy; single molecule and other biophysical approaches. Requirements: one year of biochemistry. Recommendations: physical chemistry course and one semester of calculus.
- BMB:5241 Biophysical Chemistry I** 3 s.h.
Principles and experimental approaches used to study structure and function of biological macromolecules; protein structure, stability, and dynamics; macromolecular interactions; common biophysical methods. Requirements: one year of biochemistry. Recommendations: physical chemistry course and one semester of calculus.
- BMB:5242 Biophysical Chemistry II** 3 s.h.
Principles and experimental approaches used to study structure and function of biological macromolecules; ligand binding and enzyme catalysis; X-ray crystallography; NMR spectroscopy. Requirements: one year of biochemistry. Recommendations: physical chemistry course and one semester of calculus.
- BMB:5243 Biophysical Chemistry I, Module I** 1 s.h.
Overview of principles of protein structure, stability, folding, and dynamics; brief treatment of structural biology approaches to help students become critical users of models derived from X-ray crystallography and NMR; taken alone or as part of BMB:5241. Requirements: introductory course in biochemistry.
- BMB:5244 Molecular Recognition** 1 s.h.
Focus on determinants in protein small molecule binding, particularly involving pharmaceutically relevant enzymes and receptors; how modern structure-based drug discovery is greatly aided by ability to employ protein structures in discovery and design of certain classes of drugs; structural approaches for predicting and improving drug affinity and selectivity, which have made a lasting impact across a number of diseases; important contemporary topics include in-depth lectures on fragment based drug discovery (FBDD), use and pitfalls of in silico docking and other screening methods, and emergence of covalent drugs. Requirements: introductory course in biochemistry. Same as PHAR:5542.
- BMB:5245 Biophysical Chemistry I, Module II** 1 s.h.
In-depth examination of statistical thermodynamics and molecular forces in biological systems as related to protein structure, stability, and folding; nucleic acid structure and stability; taken alone or as part of BMB:5241. Requirements: introductory course in biochemistry.
- BMB:5246 Biophysical Chemistry II, Module II** 1 s.h.
Utilization of X-ray crystallography and NMR spectroscopy in determining atomic resolution biomolecular structures; crystal geometry, X-ray diffraction, the phase problem, data collection, structure solving and refinement; basic principles of NMR spectroscopy including magnetic properties of nuclei, chemical shift, resonance assignments, determination of NOEs, scalar couplings, RDCs, and simulated annealing approaches to structure determination; for students interested in structural biology; taken alone or as part of BMB:5242. Requirements: introductory course in biochemistry.
- BMB:5247 Biophysical Chemistry I, Module III** 1 s.h.
In-depth examination of protein-protein interactions and protein-nucleic acid interactions; implications in biological motility, transcription, and replication; taken alone or as part of BMB:5241. Requirements: introductory course in biochemistry.
- BMB:5248 Biophysical Chemistry II, Module III** 1 s.h.
Methods for studying biomolecular dynamics, structure of large biomolecules and biomolecular complexes; measurement and analysis of NMR parameters for characterization of dynamics including T1, T2, hetNOE, CPMG-RD, and RDCs; introduction to computational approaches (e.g., molecular dynamics); NMR methods for studying large biomolecular systems and survey of other approaches including cryoEM and SAX; for students interested in structural biology; taken alone or as part of BMB:5242. Requirements: one year of biochemistry. Recommendations: basic knowledge of spectroscopy and some previous exposure to NMR from basic chemistry courses.
- BMB:5261 Research Techniques** 1-6 s.h.
Laboratory rotation for first-year graduate students in biochemistry.
- BMB:5282 Seminar** 0-2 s.h.
How to evaluate reports of scientific investigations critically; techniques for presenting scientific information.
- BMB:5875 Perspectives in Biocatalysis** 1-3 s.h.
Applied enzymology, protein design, structure-activity relationships, biosensor technology, microbial transformations, biodegradation of environmental pollutants. Requirements: graduate standing in a participating department supported by the Predoctoral Training Program in Biotechnology. Same as CBE:5875, CEE:5875, CHEM:5875, MICR:5875, PHAR:5875.

BMB:7251 Introduction to Protein Structures 1 s.h.

Basics of protein structures and amino acids; module covers chapters 1-5 of Lehninger's *Principles of Biochemistry*. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7252 Enzymes, Carbohydrates, Nucleic Acids, and Bioenergetics 1 s.h.

Basics of enzyme kinetics and enzyme mechanisms, carbohydrates, nucleic acids, and bioenergetics; module covers chapters 6, 7, 8, and 13 of Lehninger's *Principles of Biochemistry*. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7253 Metabolism I 1 s.h.

Basics of carbohydrate metabolism (glycolysis, gluconeogenesis, the pentose phosphate pathway), hormonal regulation of carbohydrate metabolism, the citric acid cycle, amino acid catabolism, oxidative phosphorylation; assignment of an advanced topic related to material, typically a recent research paper, extending inquiry beyond that presented in class and presented orally at end of five-week module. Requirements: undergraduate biochemistry course or background in enzyme function.

BMB:7254 Cellular Biochemistry 1 s.h.

Carbohydrate biosynthesis in plants and bacteria, lipid structure/function, biological membranes and transport, signaling, and protein turnover; can be taken alone or as part of BMB:3130; for graduate students who wish to refresh or advance their knowledge of cellular biochemistry. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7255 Metabolism II 1 s.h.

Fatty acid metabolism, lipid biosynthesis, synthesis of nitrogen containing compounds (amino acids, nucleotides) and principles of hormonal regulation of metabolic pathways; can be taken alone or as part of BMB:3130; for graduate students who wish to refresh or advance their knowledge of metabolism. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7256 Molecular Biology 1 s.h.

Chromosomal organization, DNA replication, gene expression, RNA processing, and translation; can be taken alone or as part of BMB:3130; for graduate students who wish to refresh or advance their knowledge of the central dogma of molecular biology. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7292 Research Biochemistry arr.

Thesis research.

BMB:8101 Biochemistry for Dental Students 3 s.h.

Biochemical concepts and application to clinical problems. Requirements: CHEM:2210 and D.D.S. enrollment. Recommendations: CHEM:2220.