Biochemistry and Molecular Biology Courses (BIOC)

This is a list of all biochemistry courses. For more information, see Biochemistry and Molecular Biology.

BIOC: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.

BIOC: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 course of two-semester sequence that concludes with BIOC:3130. Requirements: two semesters of general chemistry and one of organic chemistry. Recommendations: BIOL:1411, BIOL:1412, and an additional organic chemistry course.

BIOC: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: BIOC:3120 with a minimum grade of C-.

BIOC:3140 Experimental Biochemistry 2 s.h.
Use of modern instruments and techniques to fractionate, identify, and characterize constituents of biochemical systems. Prerequisites: BIOC:3120 with a minimum grade of C. Requirements: two semesters of general chemistry and one semester of organic chemistry.

BIOC:3150 Development of Senior Research Project 2 s.h.
Preparation for biochemistry majors pursuing a senior research project in BIOC: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: BIOC:3120 or BIOC:3140 or BIOC:3130. Requirements: biochemistry major, and junior or senior standing.

BIOC: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: BIOC:3110, or BIOC:3120 and BIOC:3130, or other upper-level life sciences courses. Same as CBIO:3310, MMED:3310.

BIOC: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.

BIOC:3993 Undergraduate Biochemistry Research arr.
Preparation for BIOC: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.

BIOC: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: BIOC:3120 with a minimum grade of C- and BIOC:3130 with a minimum grade of C-. Requirements: one year of biochemistry. Recommendations: physical chemistry course and one semester of calculus.

BIOC: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: BIOC:3120 with a minimum grade of C- and BIOC:3130 with a minimum grade of C-. Requirements: one year of biochemistry. Recommendations: physical chemistry course and one semester of calculus.

BIOC: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: BIOC:3110 or BIOC:3120. Same as BME:4310.

BIOC:4999 Advanced Undergraduate Biochemistry Research arr.
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: BIOC:3120 with a minimum grade of B- and BIOC:3130 with a minimum grade of B- and BIOC:3140 with a minimum grade of B- and BIOC:3150 with a minimum grade of B-. Requirements: BIOC:3993 or URES:3994 or HONR:3994 or prior research experience or lab practicum.

BIOC:5215 Directed Readings for Graduate Students arr.
Directed readings with course content arranged with professor.

BIOC: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.

BIOC: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.

BIOC: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 BIOC:5241. Requirements: introductory course in biochemistry.

BIOC:5244 Biophysical Chemistry II, Module I 1 s.h.
Enzymes as unparalleled catalysts that represent a unique class of drug targets; focus on organic chemistry of enzyme catalyzed reactions and enzyme inhibition by small molecules from a medicinal chemistry perspective; chemical and enzyme kinetics, sources of catalytic power, chemical mechanisms used in enzyme catalysis, role of coenzymes; strategies in enzyme inhibition, drug resistance, drug synergism, reversible enzyme inhibitors, transition state analogs, slow tight binding inhibitors, irreversible inhibition; taken alone or as part of BIOC:5242. Requirements: introductory course in biochemistry. Same as PHAR:5542.

BIOC: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 BIOC:5241. Requirements: introductory course in biochemistry.

BIOC: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 BIOC:5242. Requirements: introductory course in biochemistry.

BIOC: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 BIOC:5241. Requirements: introductory course in biochemistry.

BIOC: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 BIOC:5242. Requirements: one year of biochemistry. Recommendations: basic knowledge of spectroscopy and some previous exposure to NMR from basic chemistry courses.

BIOC:5261 Research Techniques 1-6 s.h.
Laboratory rotation for first-year graduate students in biochemistry.

BIOC:5282 Seminar 0-2 s.h.
How to evaluate reports of scientific investigations critically; techniques for presenting scientific information.

BIOC: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.

BIOC: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.

BIOC: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.

BIOC: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.

BIOC: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 BIOC: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.

BIOC: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 BIOC:3130; for graduate students who wish to refresh or advance their knowledge of metabolism. Recommendations: first-year graduate standing in biosciences or physical sciences.

BIOC:7256 Molecular Biology 1 s.h.
Chromosomal organization, DNA replication, gene expression, RNA processing, and translation; can be taken alone or as part of BIOC: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.

BIOC:7292 Research Biochemistry arr.
Thesis research.

BIOC: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.