Biochemistry and Molecular Biology

Chair

Kris A. DeMali

Undergraduate major: biochemistry and molecular biology (BA, BS)

Graduate degrees: MS in biochemistry and molecular biology; PhD in biochemistry and molecular biology

Website: https://bmb.medicine.uiowa.edu

Courses

Biochemistry and Molecular Biology Courses

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. Prerequisites: CHEM:2210 with a minimum grade of C- or CHEM:2230 with a minimum grade of C-. Recommendations: college-level biology course.

BMB:3120 Biochemistry and Molecular Biology I **3 s.h.**
First of the two-semester sequence of biochemistry courses, followed by BMB:3130. Physical and chemical foundations of biochemistry, structure of biological molecules, catalysis, transport, biosignaling, glycolysis, and gluconeogenesis. Prerequisites: CHEM:2210 with a minimum grade of C- or CHEM:2230 with a minimum grade of C-. Recommendations: college-level biology course.

BMB:3130 Biochemistry and Molecular Biology II **3 s.h.**
Second of the two-semester comprehensive biochemistry sequence. Glycogen metabolism, citric acid cycle and the molecular principles of photosynthesis and oxidative phosphorylation; metabolism of lipids, amino acids, and nucleic acids; DNA replication, transcription, and protein translation; team-taught, didactic lecture style. Prerequisites: BMB:3120 with a minimum grade of C-.

BMB:3140 Experimental Biochemistry **3 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 and molecular biology faculty member; experience in an active biochemistry and molecular biology 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 and molecular biology 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: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.
Advanced directed research with a biochemistry and molecular biology 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 and molecular biology faculty member and taken after completion of core biochemistry and molecular biology 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- and (BMB:3993 or URES:3994 or HONR:3994).

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: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 Biotechnology 1 s.h.
Topics related to careers in biotechnology with an emphasis on preparing graduate students for careers outside of academia; discussions led by a series of guest speakers from leading biotech industries; understanding the societal impact of basic research; participation in round-table discussions; and presentation of student research findings. Requirements: graduate standing and good academic 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 selected chapters of Lehninger's *Principles of Biochemistry*. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7252 Enzymes, Carbohydrates, Nucleic Acids, Lipids, and Membranes 1 s.h.
Basics of enzyme kinetics and enzyme mechanisms, carbohydrates, nucleic acids, and lipids; module covers selected chapters of Lehninger's *Principles of Biochemistry*. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7253 Introduction to Metabolism 1 s.h.
Introduction to metabolism including bioenergetics of metabolic reactions, biochemical signaling, and the basics of carbohydrate metabolism (glycolysis, gluconeogenesis, the pentose phosphate pathway). Module covers selected chapters of Lehninger's *Principles of Biochemistry*. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7254 Metabolism I 1 s.h.
Glycogen metabolism, the citric acid cycle, and amino acid and fatty acid catabolism. Module covers selected chapters of Lehninger's *Principles of Biochemistry*. Recommendations: first-year graduate standing in biosciences or physical sciences.

BMB:7255 Metabolism II 1 s.h.
Oxidative phosphorylation, photosynthesis, the synthesis of nitrogen-containing compounds (amino acids, nucleotides), and principles of hormonal regulation of metabolic pathways. Module covers selected chapters of *Principles of Biochemistry* by Lehninger. 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; module covers selected chapters of Lehninger's *Principles of Biochemistry*; 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 DDS enrollment. Recommendations: CHEM:2220.