Updated Spring 2025

Courses listed in the bulletin:

BIOC-B 502 Analysis of Biochemical Literature (1.5 cr.) P: Concurrent enrollment in B680 (Biochemical Regulation) or consent of instructor. Critical evaluation of the biochemical literature, using selected papers as examples; development of written and oral communication skills in the context of literature analysis. Updated Spring 2025

BIOC-B 511 Duplicating and Expressing the Genome (3 cr.) P: Graduate student status. Attain an advanced level of understanding of the molecular basis of DNA replication and its control; comprehend the molecular basis of gene expression and its control; understand the interplay between chromatin and nuclear structure and replication and transcription; evaluate primary literature in this field.

BIOC-B 512 Mechanisms of DNA repair (1.5 cr.) The explicit connection between failed repair pathways and cancer emerged in the late nineties and understanding the biochemical mechanisms of DNA repair has expanded dramatically. The student will consider mechanisms of DNA repair, including base excision repair, nucleotide excision repair, mismatch repair, and specialized repair pathways. Double-stranded break repair pathways, including homologous recombination, strand exchange mechanisms, non-homologous end joining and telomerase maintenance will be covered.

BIOC-B 513 Cellular responses to DNA damage (1.5 cr.) The student will connect genome instability (DNA damage and failed DNA metabolism) with human disease. Featured will be mechanisms of cell cycle control of double-strand break repair, cellular responses in the context of chromatin structure. Students who successfully navigate the B511/512/513 series will develop a mechanistically detailed view of DNA metabolism that is highly relevant to understanding human disease.

BIOC-B 522 Structural Biology of Supramolecular Complexes (1.5 cr.). Students will participate in a detailed look at selected supramolecular complexes from the perspective of structural biology. An emphasis will be placed on application of molecular graphics to understand function and intermolecular interactions. Specific topics include protein/DNA and protein/RNA interactions, covering repressor, nucleosome and reverse transcriptase structures. Mechanisms of binding cooperativity, large complex assembly, viral assembly, and membrane fusion proteins will be covered.

BIOC-B 524 Structural Biology of Signaling (1.5 cr.). Students will investigate macromolecular complexes and membrane proteins of diverse cellular functions, focusing on signal transduction, membrane fusion and cell adhesion. A specific emphasis on G-protein coupled receptor mechanisms will be presented as a model system for transmembrane signaling.

BIOC-B 525 Membranes and Membrane Proteins (1.5 cr.). Students will be grounded in a general understanding of the physical and chemical forces that hold membranes together and support the structure and function of biological membrane assemblies. Course work will focus on the molecular characteristics of lipids and membrane proteins, as well as how these molecules play a role in physiological events at the membrane interface. Specific topics include membrane protein structure, folding, biogenesis and quality control; organelle membranes, intracellular trafficking, and diseases that result from defective membrane proteins.

BIOC-B 530 Macromolecular Structure and Function (1.5 cr.) Undergraduate biochemistry (equivalent to C483 or C484), one semester of undergraduate organic chemistry (equivalent to C341), or consent of instructor. Undergraduate (bio)physical chemistry (equivalent to C481 or C361) is strongly recommended. Stabilizing forces in macromolecular structures; protein structure analysis; nucleic acid structure and probing; structure determination by nmr and X-ray crystallographic analysis.

BIOC-B 531 Biomolecular Analysis and Interaction (1.5 cr.) Undergraduate biochemistry (equivalent to C483 or C484), one semester of undergraduate organic chemistry (equivalent to C341), and B530 or consent of instructor. Undergraduate (bio)physical chemistry (equivalent to C481 or C361) is strongly recommended. Principles of inter- and intra-molecular interactions; thermodynamic and kinetic analysis of complex binding; experimental methods for analysis of macromolecular structure and binding.

BIOC-B 580 Introduction to Biochemical Research (3 cr.) P: Graduate standing. Objectives and techniques of biochemical research.

BIOC-B 600 Seminar in Biochemistry (1 cr.) P: B502 or consent of instructor. Advanced critical analysis of the current scientific literature and scientific presentations. Attendance and partici¬pation in the weekly biochemistry program seminar series is required.

BIOC-B 680 Special Topics in Biochemistry (1-3 cr.) P: Consent of instructor. Topics vary yearly and include the following: physico-chemical techniques in the study of macromolecules; experi¬mental methods in enzymology; organic chemistry of enzymatic reactions and enzyme models; conformational properties and macromolecules. Can be retaken for credit.

BIOC-B 680 Cellular Motors, Pumps and Switches (1.5 cr.). Hydrolysis of nucleotide triphosphates (NTPs), most notably ATP and GTP, can be harnessed in biological pathways to perform myriad functions. An examination of NTP hydrolysis and exchange in the context of cellular motors, pumps, and switches will provide detailed insights into how macromolecular machines, biological assemblies and signaling pathways use NTPs in essential cellular processes.

BIOC-B 680 Digital Imaging: Biological Electron Microscopy (1.5 cr). Electron Microscopy is a powerful tool for examining large complexes. Single particle reconstitution can now achieve near atomic resolution for complexes of more than 200 kDa. At lower resolutions, EM techniques can elucidate the 3D organization of complex assemblies diverse biomacromolecules.

This course supplies hands-on training to the 'tools of the trade' for researchers studying supramolecular complexes and may be appropriate for students pursuing either the minor or the technology to support their research.

BIOC-B 680 Digital Imaging: Light and Microscopy (1.5 cr.). An intensive, hands-on course that introduces students to the capabilities of Light Microscopy Imaging Center (LMIC) on campus. The Center features state-of-the-art microscopy facilities to characterize living or fixed samples using fluorescence, confocal, scanning confocal, spinning disk confocal, and TIRF (total internal reflection) microscopy.

BIOC-B 680 Structural Virology (1.5 cr.). The goals of this course are to provide a fundamental understanding of virus structure and function, and to strengthen critical thinking skills of students. The course will examine key concepts in structural virology, focusing on the molecular mechanisms underlying viral replication. We will follow the replication cycle of viruses, including virus structure, virus attachment and cell entry, protein expression and genome replication, and assembly and release of virus particles.

BIOC-B 680 Current Advances in Genome Biology (1 cr.). The study of nucleic acid metabolism is a foundational aspect of modern biology, representing both a mature field and one that is still vibrant. The biochemical analysis of the machinery underlying genome integrity is even more so. This course exposes students to new and classic work from the primary literature in a journal club format.

BIOC-B 680 Biological CryoEM (1.5 cr.). Students will develop an understanding of the principles of electron microscopy as applied to the study of biological macromolecules and tissues. Knowledge of these principles will form a foundation for gaining practical experience and training in biological electron microscopy.

BIOC-B 880 Research: Biochemistry (arr. cr.). This course is eligible for a deferred grade.