Those applying for graduate study should have at least a baccalaureate degree and should have completed work in cell and developmental biology, basic biochemistry and molecular biology, and genetics. Also required are: at least one year of university physics; differential and integral calculus; and analytical, organic, inorganic, and physical chemistry. The department is especially interested in those applicants who have research experience in biology or chemistry. Students must submit an application, including transcripts and letters of recommendation, by December 2.

Applications should be submitted at http://gradadmissions.stanford.edu. Applicants are notified by March 27 of decisions on their applications. Stanford University requires scores from the Graduate Record Examination (GRE) (verbal, quantitative, and analytical), and applicants are encouraged to submit scores from the GRE Subject Test in either biochemistry, biology, or chemistry. Applicants should take the October GRE exam.

All applicants are urged to compete for non-Stanford fellowships or scholarships, and U.S. citizens should complete an application for a National Science Foundation Predoctoral Traineeship. Students are provided with financial support to cover normal living expenses; Stanford tuition costs are paid. Applicants for admission to the department are considered without regard to race, color, creed, religion, sex, age, national origin, or marital status.

Postdoctoral research training is available to graduates who hold a Ph.D. or an M.D. degree. Qualified individuals may write to individual faculty members for further information.

At present, the primary research interests of the department are the structure and function of proteins and nucleic acids, the biochemistry and control of development processes, molecular motors and the cytoskeleton, the trafficking of proteins between membrane-bound organelles, the control and regulation of gene expression, bioinformatics/protein structure design, and the application of microarrays to problems in human health and disease.
GRADUATE COURSES IN BIOCHEMISTRY

Primarily for graduate students; undergraduates may enroll with consent of instructor.

BIOC 201. Advanced Molecular Biology
Literature-based lectures and discussion on rapidly developing frontiers in chromosome structure and function and modern insights into the control of gene expression. Emphasis is on experimental approaches and insights. Topics include chromosome organization, novel modes of transcriptional control, RNA-based mechanisms for controlling gene expression and emerging translational regulatory mechanisms. Prerequisite: undergraduate molecular biology.

5 units, not given this year

BIOC 210. Advanced Topics in Membrane Trafficking
The structure, function, and biosynthesis of cellular membranes and organelles. Current literature. Prerequisite: consent of instructor.

3 units, not given this year

BIOC 215. Frontiers in Biological Research
(Same as DBIO 215, GENE 215.) Literature discussion in conjunction with the Frontiers in Biological Research seminar series hosted by Biochemistry, Developmental Biology, and Genetics in which distinguished investigators present current work. Students and faculty meet beforehand to discuss papers from the speaker’s primary research literature. Students meet with the speaker after the seminar to discuss their research and future direction, commonly used techniques to study problems in biology, and comparison between the genetic and biochemical approaches in biological research.

1 unit, Aut (Harbury, P; Tan, M; Villeneuve, A), Win (Harbury, P; Tan, M; Villeneuve, A)

BIOC 218. Computational Molecular Biology
(Same as BIOMEDIN 231.) Via Internet. For molecular biologists and computer scientists. Representation and analysis of genomes, sequences, and proteins. Strengths and limitations of existing methods. Course work performed on web or using downloadable applications. See http://biochem218.stanford.edu/. Prerequisites: introductory molecular biology course at level of BIO 41 or consent of instructor.

3 units, Aut (Brutlag, D), Win (Brutlag, D), Spr (Brutlag, D)

BIOC 220. Chemistry of Biological Processes
(Same as CSB 220.) The principles of organic and physical chemistry as applied to biomolecules. Goal is a working knowledge of chemical principles that underlie biological processes, and chemical tools used to study and manipulate biological systems. Prerequisites: organic chemistry and biochemistry, or consent of instructor.

4 units, Spr (Wandless, T; Herschlag, D; Chen, J), alternate years, not given next year

BIOC 221. The Teaching of Biochemistry
Required for teaching assistants in Biochemistry. Practical experience in teaching on a one-to-one basis, and problem set design and analysis. Familiarization with current lecture and text materials; evaluations of class papers and examinations. Prerequisite: enrollment in the Biochemistry Ph.D. program or consent of instructor.

3 units, Aut (Staff), Win (Staff), Spr (Staff), Sum (Staff)

BIOC 224. Advanced Cell Biology
(Same as BIO 214.) For Ph.D. students. Current research on cell structure, function, and dynamics. Topics include complex cell phenomena such as cell division, apoptosis, compartmentalization, transport and trafficking, motility and adhesion, differentiation, and multicellularity. Current papers from the primary literature. Prerequisite for advanced undergraduates: BIO 129A,B, and consent of instructor.

2-5 units, Win (Kopito, R; Pfeffer, S; Nelson, W; Theriot, J; Straight, A)

BIOC 225. Interdisciplinary Approaches to Cell Biology: the Role of the Cytoskeleton
The molecular basis of energy transduction leading to movements generated by microfilament-based and microtubule-based motors. Forms of myosin, dynein, and kinesin and their roles in the cell as a model for understanding the structural, biochemical, and functional properties of biological machines. Topics: structure of the molecular motors and their accessory proteins; regulation of the function of motile assemblies; functions of molecular motors in cells; spatial and temporal controls on the formation of motile assemblies in cells. Experimental approaches: genetic analysis, RNA cloning and expression, reconstitution of functional assemblies from purified proteins, x-ray diffraction, three-dimensional reconstruction of electron microscope images, spectroscopic methods, high-resolution light microscopy, and computational approaches. Prerequisites: basic biochemistry and cell biology.

3 units, not given this year

BIOC 228. Computational Genomic Biology
(Same as BIOMEDIN 228.) Application of computational genomics methods to biological problems. Topics include: assembly of genomic sequences, genome databases; comparative genomics; gene discovery; gene expression analyses including gene clustering by expression, transcription factor binding site discovery, metabolic pathway discovery, functional genomics, and gene and genome ontologies; and medical diagnostics using SNPs and gene expression. Recent papers from the literature and hands-on use of the methods. Prerequisites: introductory course in computational molecular biology or genomics such as BIOC 218, BIOMEDIN 214 or GENE 211.

3 units, Win (Brutlag, D)

BIOC 230. Molecular Interventions in Human Disease
For M.D. students who intend to declare a concentration in molecular biology of medicine, MSTP students, and Ph.D. students. Advanced medical biochemistry focusing on cases where molecular-level research has led to new medical treatments or changes in the understanding of important diseases. Different topics each week explore the underlying molecular basis of a variety of diseases and the reasons for success and failure in molecular approaches to treatment. Student-led discussions dissect papers from the primary medical and scientific research literature.

2-3 units, Aut (Theriot, J; Harbury, P)

BIOC 236. Biology by the Numbers
(Same as APPPHYS 136.) Skillbuilding in biological quantitative reasoning. Topics include: biological size scales from proteins to ecosystems; biological time scales from enzymatic catalysis and DNA replication to evolution; biological energy, motion, and force from molecular to organismic scales; mechanisms of environmental sensing from bacterial chemotaxis to vision. Prerequisite: Physics 21, 41, or consent of instructor.

3 units, Win (Theriot, J; Fisher, D)

BIOC 238. Computational Proteomic Biology
(Same as BIOMEDIN 238.) Application of computational protein analysis to biological problems. Topics include: protein sequence analysis and comparison including protein sequence databases, amino acid composition, protein alignment, protein motifs, protein families, and probabilistic models of families; protein structure including structure comparison and superposition methods, structural motifs, and structure and domain databases; protein structure prediction including secondary structure, homology modeling, threading, and ab inito structure prediction; protein-protein interaction databases and protein-protein interaction prediction; and protein-DNA interaction motifs and protein-ligand docking. Prerequisite: An introductory course in computational biology such as BIOC 218, BIOMEDIN 214, or SBIO/BIOPHYS 228. Via Internet in Spring.

3 units, not given this year

BIOC 241. Biological Macromolecules
(Same as BIOPHYS 241, SBIO 241.) The physical and chemical basis of macromolecular function. Forces that stabilize biopolymers with three-dimensional structures and their functional implications. Thermodynamics, molecular forces, and kinetics of enzymatic and diffusional processes, and relationship to their practical application in experimental design and interpretation. Biological function and the level of individual molecular interactions and at the level of complex processes. Case studies. Prerequisites: introductory biochemistry and physical chemistry or consent of instructor.

3-5 units, Aut (Herschlag, D; Puglisi, J; Garcia, K; Ferrell, J; Block, S; Weis, W)
BIOC 257. Currents in Biochemistry
Seminars by Biochemistry faculty on their ongoing research. Background, current advances and retreats, general significance, and tactical and strategic research directions.
  1 unit, Aut (Spudich, J)

BIOC 278. Systems Biology
(See BIOC 217.) Complex biological behaviors through the integration of computational modeling and molecular biology. Topics: reconstructing biological networks from high-throughput data and knowledge bases. Network properties. Computational modeling of network behaviors at the small and large scale. Using model predictions to guide an experimental program. Robustness, noise, and cellular variation. Prerequisites: background in biology and mathematical analysis.
  3 units, Aut (Covert, M; Dill, D; Brutlag, D; Ferrell, J)

BIOC 298. Biochemistry Consulting Service
Students are presented with requests for advice from faculty and students in the biological sciences and Medical School encountering experimental and analytical problems in their research. Students work with the instructor and other biochemistry faculty to propose solutions. May be repeated for credit.
  3 units, Aut (Brown, P), Win (Brown, P), Spr (Brown, P), Sum (Brown, P)

BIOC 299. Directed Reading in Biochemistry
Prerequisite: consent of instructor.
  1-18 units, Aut (Staff), Win (Staff), Spr (Staff), Sum (Staff)

BIOC 399. Graduate Research and Special Advanced Work
Allows for qualified students to undertake investigations sponsored by individual faculty members.
  1-18 units, Aut (Staff), Win (Staff), Spr (Staff), Sum (Staff)

BIOC 459. Frontiers in Interdisciplinary Biosciences
(See BIOC 459, CHEM 459, CHEMEN 459, CHEM 459, PSYCH 459.) Students register through their affiliated department; otherwise register for CHEMEN 459. For specialists and non-specialists. Sponsored by the Stanford BioX Program. Three seminars per quarter address scientific and technical themes related to interdisciplinary approaches in bioengineering, medicine, and the chemical, physical, and biological sciences. Leading investigators from Stanford and the world present breakthroughs and endeavors that cut across core disciplines. Pre-seminars introduce basic concepts and background for non-experts. Registered students attend all pre-seminars; others welcome. See http://biox.stanford.edu/courses/459.html. Recommended: basic mathematics, biology, chemistry, and physics.
  1 unit, Aut, Win, Spr (Robertson, C)