BIOPHYSICS PROGRAM

Emeritus: Harden M. McConnell (Chemistry)
Director: William I. Weis (on leave)
Acting Director: Axel Brunger
Professors: Richard W. Aldrich (Molecular and Cellular Physiology), Steve Block (Applied Physics), Steven Boxer (Chemistry), Axel Brunger (Molecular and Cellular Physiology), Douglas Brutlag (Biochemistry), Steven Chu (Applied Physics), Mark Davis (Microbiology, Immunology), Sebastian Doniach (Applied Physics), Philip C. Hanawalt (Biological Sciences), Keith O. Hodgson (Chemistry), Wray H. Huestis (Chemistry), Chaitan Khosla (Chemical Engineering), Eric Kool (Chemistry), Ron Kopito (Biological Sciences), Roger D. Kornberg (Structural Biology), Michael Levitt (Structural Biology), David B. McKay (Structural Biology), W. E. Moerner (Chemistry), Norbert Pelc (Radiology), Howard Schulman (Neurobiology), Ed Solomon (Chemistry), James A. Spudich (Biochemistry, Developmental Biology), James Swartz (Chemical Engineering), Helmut Wiedemann (Synchrotron, Applied Physics)
Associate Professors: Russ Altman (Medical Informatics, General Medicine), Gilbert Chu (Oncology), James Ferrell (Molecular Pharmacology), David Heeger (Psychology), Daniel Herschlag (Biochemistry), Tobias Meyer (Molecular Pharmacology) Jody Puglisi (Structural Biology), William Weis (Structural Biology, on leave)
Assistant Professors: Judith Frydman (Biological Sciences), K. Christopher Garcia (Microbiology and Immunology), Miriam Goodman (Molecular and Cellular Biology), Pehr Harbury (Biochemistry), Peter Jackson (Pathology), Peter Kuhn (SLAC), Merritt Maduke (Molecular and Cellular Biology), Vijay Pande (Chemistry), Julie Theriot (Biochemistry)

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Courses given in Biophysics have the subject code BIOPHYS. For a complete list of subject codes, see Appendix B.

The Biophysics Program offers instruction and research opportunities leading to the Ph.D. in Biophysics. Students admitted to the program may perform their graduate research in any appropriate department.

GRADUATE PROGRAM

For information on the University's basic requirements for the Ph.D. degree, see the "Graduate Degrees" section of this bulletin.

A small number of highly qualified applicants are admitted to the program each year. Applicants should present strong undergraduate backgrounds in the physical sciences and mathematics. The graduate course program, beyond the stated requirements, is worked out for each student individually with the help of appropriate advisers from the Committee on Biophysics. The requirements and recommendations for the Ph.D. degree include:

1. Training in physics or chemistry equivalent to that of an undergraduate physics or chemistry major at Stanford.
2. Completion of the following courses (or their equivalents):
   a) BIOPHYS 250
   b) BIOC 200, 201
   c) CHEM 131, 171, 173, and 175
   d) SBIO 241 and 242
   e) MED 255
   f) Additional courses as required for the individually tailored program
3. Proficiency in one or more foreign languages and/or a computer language may be required at the discretion of the major professor.
4. Opportunities for teaching are available during the first nine quarters, at the discretion of the advising committee.
5. The student must prepare a dissertation proposal defining the research to be undertaken, including methods of procedure. This proposal should be submitted by Winter Quarter of the third year, and it must be approved by a committee of at least three members including the principal research adviser and at least one member from the Committee on Biophysics. The candidate must defend the dissertation proposal in an oral examination. The Dissertation Reading Committee normally evolves from the Dissertation Proposal Review Committee.
6. The student must present a Ph.D. dissertation as the result of independent investigation and expressing a contribution to knowledge in the field of biophysics.
7. The student must pass the University oral examination, taken only after the student has substantially completed the research. The examination is preceded by a public seminar in which the research is presented by the candidate.

COURSES

BIOPHYS 205. DNA Repair and Mutagenesis—(Enroll in BIOSCI 205.)
3 units, Spr (Hanawalt)

BIOPHYS 210. Advanced Topics in Membrane Biochemistry—(Enroll in BIOC 210.)
4 units (Pfeffer) not given 2002-03

BIOPHYS 210A. Principles of Cell Physiology—(Enroll in MCP 210.)
4 units, Spr (Aldrich, Lewis)

BIOPHYS 211. Biophysics of Sensory Transduction—(Enroll in BIOSCI 211.)
4 units, Spr (S. Block)

BIOPHYS 228. Protein and Nucleic Acid Structure, Dynamics, and Engineering—(Same as SBIO 228.) The availability of three-dimensional atomic structures of proteins and nucleic acids allows interpretation of biological processes based on the physical and chemical properties of these molecules. Crystallographic studies include structural themes exemplified by local chain conformation, secondary structure, domains, families of folds, protein folding, and thermodynamic stability. How these structures move is considered by combining the results of experiments with theoretical molecular dynamics simulations: enzyme catalysis. Novel molecules are engineered from the experimental and predictive aspects, using interactive computer graphics programs to illustrate problems. Systems include protein-nucleic acid complexes and antibody-antigen interactions. Prerequisites: knowledge of basic biochemistry and cell biology.
3 units (Staff) not given 2002-03

BIOPHYS 241. Biological Macromolecules—(Enroll in SBIO 241)
3-5 units, Aut (Puglisi, Block, Herschlag, Kirkegaard, McKay)

BIOPHYS 250. Seminar in Biophysics—All graduate students in Biophysics must participate. Presentation of current research projects and results by all faculty in the Biophysics Program.
1 unit, Aut, Win (Staff)

BIOPHYS 255. The Responsible Conduct of Research—(Enroll in MED 255) A forum for scientists to familiarize themselves with institutional policies/practices and professional standards that define scientific integrity. Overview of ethics in research, authorship, patents, and human interest at the academic-commercial interface, and small group sessions for more extended discourse between students and faculty. Completion fulfills NIH/ADAMHA requirement for instruction in the ethical conduct of research. Required course for incoming students.

1 unit, Win (Staff)

BIOPHYS 297. Bio-Inorganic Chemistry—(Same as CHEM 297.) Overview of metal sites in biology. Metalloproteins as elaborated inorganic complexes, their basic coordination chemistry and bonding, unique features of the protein ligand, and the physical methods used to study active sites. Active site structures are correlated with function. Prerequisites: 153 and 173, or equivalents.

3 units, Win (Solomon) alternate years, not given 2003-04

BIOPHYS 300. Research

1-18 units (Staff)

BIOPHYS 450. Introduction to Biotechnology—Stanford faculty from the schools of Medicine, Humanities and Sciences, Engineering and invited industrial speakers review the interrelated elements of modern biotechnology. Topics: development of recombinant protein pharmaceuticals, bacterial fermentation and scale-up, mammalian cell culture and scale-up, transgenic animals, transgenic protein production in plants, isolation and purification of protein pharmaceuticals, formulation and delivery of pharmaceutical proteins, environmental biotechnology, metabolic engineering, industrial enzymes, diagnostic devices, transciptomics and proteomics, drug delivery systems. Prerequisite: graduate student or upper-division undergraduate in the sciences or engineering.

3 units, Spr (Robertson, Swartz)

BIOPHYS 459. Frontiers in Interdisciplinary Biosciences—(Cross-listed in multiple departments in the schools of Humanities and Sciences, Engineering, and Medicine; students should enroll directly through their affiliated department, otherwise enroll in CHEMENG 459.) An introduction to cutting-edge research involving interdisciplinary approaches to bioscience and biotechnology; for specialists and non-specialists. Organized and sponsored by the Stanford BioX Program. Three seminars each quarter address a broad set of scientific and technical themes related to interdisciplinary approaches to important issues in bioengineering, medicine, and the chemical, physical, and biological sciences. Leading investigators from Stanford and throughout the world present the latest breakthroughs and endeavors that cut broadly across many core disciplines. Pre-seminars introduce basic concepts and provide background for non-experts. Registered students attend all pre-seminars in advance of the primary seminars, others welcome. Prerequisite: keen interest in all of science, engineering, and medicine with particular interest in life itself. Recommended: basic knowledge of mathematics, biology, chemistry, and physics.

1 unit, Aut, Win, Spr (Robertson)