

# STRUCTURAL BIOLOGY

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Courses given in Structural Biology have the subject code SBIO. For a complete list of subject codes, see Appendix B.

The department offers opportunities for course work and research in cell biology. Courses fall into two categories: (1) a series of one quarter courses that treat special topics of current interest in cell biology at an advanced level; and (2) Structure of Cells and Tissues (211), a one quarter course tailored to the needs of medical students that includes both lectures on structure-function relationships of mammalian cells and tissues and a lab on medical histology.

The emphasis of research in the department is on understanding fundamental cellular processes in terms of the structure and function of organelles and molecular assemblies. Techniques used include standard methods of biochemistry, cell culture, fluorescence microscopy, genetic engineering, and image processing and three-dimensional reconstruction from electron micrographs, x-ray and electron diffraction, and computational methods.

## GRADUATE PROGRAMS

### DOCTOR OF PHILOSOPHY

University requirements for the Ph.D. are described in the "Graduate Degrees" section of this bulletin.

The graduate program in Structural Biology leads to the Ph.D. degree. The department also participates in the Medical Scientists Training Program in which individuals are candidates for both the Ph.D. and M.D. degrees.

The graduate program is intended to prepare students for careers as independent investigators in cell and molecular biology. The principal requirement of a Ph.D. degree is the completion of research constituting an original and significant contribution to the advancement of knowledge. The requirements and recommendations for the Ph.D. degree include:

1. Completion of the following courses or their equivalents:
  - a) BIOC 200, 201
  - b) CHEM 131, 171, 173, and 175
  - c) SBIO 241 and 242
  - d) MED 255
  - e) additional courses as required for the individually tailored program
2. Opportunities for teaching are available during the first nine quarters at the discretion of the advising committee.
3. 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 Department of Structural Biology. The candidate must defend the dissertation proposal in an oral examination. The dissertation reading committee normally evolves from the dissertation proposal review committee.

4. The student must present a Ph.D. dissertation as the result of independent investigation and expressing a contribution to knowledge in the field of structural biology.
5. 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.

Applicants to the program should have a bachelor's degree and should have completed at least a year of course work in biology, mathematics, organic chemistry, physical chemistry, and physics. Application forms must be received by the department before December 15 for notification by April 15. Application to the National Science Foundation for fellowship support is also encouraged. Remission of fees and a personal stipend are available to graduate students in the department. Prospective applicants should contact the Department of Structural Biology for further information.

Current topics of research in the department lie in the areas of gene expression; theoretical, crystallographic, and genetic analysis of protein structure; and cell-cell interaction. See <http://www.med.stanford.edu/school/structuralbio/> for further information.

## COURSES

Course and lab instruction in the Department of Structural Biology conforms to the "Policy on the Use of Vertebrate Animals in Teaching Activities," the text of which is available at <http://www.stanford.edu/dept/DoR/rph/8-2.html>.

### SBIO 199. Undergraduate Research

*1-18 units, Aut, Win, Spr, Sum (Staff)*

### SBIO 201. Advanced Immunology I—(Enroll in MI 211, IMMUNOL 201.)

*3 units, Win (Chien, Staff)*

**SBIO 204. Cells to Tissues**—The structural organization of cells and tissues in relation to their function. Topics include light and electron microscopy of epithelia, muscle, connective tissue, bone and cartilage, blood, lymphoid tissue, nerve tissue, and integument. Lab.

*2-3 units, Aut (Cross)*

**SBIO 228. Computational Structural Biology**—(Same as BIOPHYS 228.) Interatomic forces and interactions such as electrostatics and hydrophobicity, and protein structure in terms of amino acid properties, local chain conformation, secondary structure, domains, and families of folds. How protein motion can be simulated. Bioinformatics introduced in terms of methods that compare protein via their amino acid sequences and their three-dimensional structures. Structure prediction via simple comparative modeling. How remote homologues can be detected and modeled. Predicting the structure of a protein from knowledge of its amino acid sequence.

*3 units, Win (Levitt)*

**SBIO 229. The Eukaryote Chromosome**—The principles of chromosome structure and function including: the structure, dynamics, and topological forms of DNA; units and hierarchies of DNA coiling in chromosomes; centromeres, telomeres, and basis of chromosome maintenance and sorting in mitosis; mechanism of gene activation with particular regard to enhancer, promoter, and terminator sequences; basis of sequence-specific protein-DNA interaction; and organization and assembly of the cell nucleus. Prerequisite: basic biochemistry and cell biology.

*3 units, Spr (Kornberg)*

**SBIO 241. Biological Macromolecules**—Introduction to the physical and chemical basis of macromolecular function. The 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. Prerequisite: introductory biochemistry

3-5 units, Aut (Puglisi, Block, Herschlag, Kirkegaard, McKay)

**SBIO 242. Methods in Molecular Biophysics**—(Same as BIOC 242.)

The potential utility of physical approaches to research, and how to evaluate literature that incorporates these methods. Experimental methods in molecular biophysics from theoretical and practical standpoints. Emphasis is on x-ray diffraction and nuclear magnetic resonance spectroscopy. Additional topics include fluorescence spectroscopy, circular dichroism, calorimetry, and separation methods.

3 units (McKay, Puglisi) alternate years, given 2004-05

**SBIO 299. Directed Reading**—Prerequisite: consent of instructor. See faculty list for section numbers.

1-18 units, Aut, Win, Spr, Sum, by arrangement

**SBIO 399. Individual Research**—Investigations sponsored by individual faculty members. Prerequisite: consent of instructor. See faculty list for section numbers.

1-18 units, Aut, Win, Spr, Sum, by arrangement

**SBIO 450. Introduction to Biotechnology**—(Enroll in CHEMENG 450, BIOC 450.)

3 units, Spr (Kao)

**SBIO 459. Frontiers in Interdisciplinary Biosciences**—(Crosslisted in multiple departments in the schools of Humanities and Sciences, Engineering, and Medicine. Students should enroll through their affiliated department; otherwise enroll in CHEMENG 459.) See CHEMENG 459 or [http://biox.stanford.edu/chemeng\\_index.html](http://biox.stanford.edu/chemeng_index.html) for description.

1 unit, Aut, Win, Spr (Robertson)

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