STRUCTURAL BIOLOGY

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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, microinjection of cells and nuclei, nanosecond fluorescence spectroscopy, and x-ray and electron diffraction. The department owns and operates a computing center equipped with advanced time-sharing and color graphics systems for data analysis and molecular modeling.

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. In addition, students are required to enroll in the series of special topics courses taught by the faculty of the department. Finally, students gain teaching experience by assisting in the one-quarter courses offered by all faculty in the department.

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 January 1 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 write to 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 work and lab instruction in the Department of Structural Biology conform to the Policy on the Use of Vertebrate Animals in Teaching Activities as stated in the front of this catalog.

211. Structure of Cells and Tissues—The structural organization of tissues in relation to their function. Topics: light and electron microscopy, epithelia, muscle, connective tissue, bone and cartilage, blood, cardiovascular system, lymphoid tissue, nervous tissue, skin, endocrine, exocrine, gastrointestinal, respiratory, urinary, female and male genital systems, and the ear and eye. Three lectures, two labs, and one review session per week.

7 units, Aut (Cross, Staff)

228. Protein and Nucleic Acid Structure, Dynamics, and Engineering—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, Win (Levitt)

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

3 units, Spr (Kornberg)

450. Introduction to Biotechnology—(Same as Biochemistry 450, Chemical Engineering 450, Civil and Environmental Engineering 450, Developmental Biology 450.) Faculty from the departments of Biochemistry, Biological Sciences, Chemical Engineering, Civil and Environmental Engineering, Developmental Biology, Structural Biology, and invited industrial speakers review the interrelated elements of modern biotechnology. Topics: protein structure and dynamics, protein engineering, biocatalysis, gene expression, cellular metabolism and metabolic engineering, fermentation technology, and purification of biomolecules. Prerequisite: graduate student or upper-division undergraduate in the sciences or engineering.

3 units, Spr (Robertson, Swartz)

241. Biological Macromolecules—The molecular principles of protein and nucleic acid structures. The forces that stabilize biopolymers is presented with the goal of understanding three-dimensional structures and their functional implications. Topics: protein folding, domain structures, enzyme active sites, DNA and RNA structure, and protein-nucleic acid complexes.

3 units, Aut (Aldrich, Ferrell, Herschlag, Lewis, Puglisi, Weis)

242. Methods in Molecular Biophysics—(Same as Biochemistry 242.) Introduces students from diverse backgrounds to the potential utility of physical approaches to research and helps prepare them to evaluate literature that incorporates these methods. Experimental methods in molecular biophysics are from a theoretical and practical standpoint. Emphasis is on x-ray diffraction and nuclear and nuclear magnetic resonance spectroscopy. Fluorescence spectroscopy, circular diochroism, calorimetry, separation methods.

3 units, Win (Harbury, McKay, Puglisi, Weis)

260. Supervised Study—Research or advanced tutorial for undergraduates.

1-18 units, any quarter (Staff)

299. Directed Reading
1-18 units, any quarter (Staff)

399. Individual Research
1-18 units, any quarter (Staff)

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, if at all possible.) Introduction to cutting-edge research involving interdisciplinary approaches to bioscience and biotechnology; for specialists and non-specialists. Associated with Stanford's Clark Center for Interdisciplinary Bioscience, and held in conjunction with a seminar series meeting twice monthly during 2000-01. Leading investigators from Stanford and throughout the world speak on their research; students also meet separately to present and discuss the ever-changing subject matter, related literature, and future directions. Prerequisite: keen interest in all of science, with particular interest in life itself. Recommended: basic knowledge of biology, chemistry, and physics.
2 units, Aut, Win, Spr (S. Block)