Biochemistry and Structural Biology

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Degree Awarded
Ph.D. in Biochemistry and Structural Biology

Biochemistry and Structural Biology

The Biochemistry and Structural Biology Graduate Program stresses biochemical, structural, and computational approaches to solving complex biological problems. Training is offered in a broad range of research areas leading to the Ph.D. degree. Research in biochemistry and structural biology includes structure-function studies of proteins and nucleic acids, the molecular basis of gene expression, the chemical basis of enzyme action, as well as membrane and carbohydrate biochemistry. The aim of structural biology is to obtain high-resolution structures of biological macromolecules and molecular complexes through experimental techniques such as nuclear magnetic resonance (NMR) spectroscopy and X-ray diffraction in order to provide a view of biology at the molecular and atomic levels. High-resolution structures combined with biochemical studies represent the blueprints for understanding enzyme catalysis, cell signaling and transport, gene expression and regulation, and numerous other cellular processes. Advances in instrumentation and computational analysis have laid the groundwork for structure determination of proteins discovered through genome sequencing efforts and have opened up structural studies on membrane proteins and large complexes of proteins and nucleic acids.

The program includes faculty from the Departments of Biochemistry and Cell Biology, Chemistry, Physiology and Biophysics, and the Pharmacological Sciences, as well as from Brookhaven National Laboratory.

For more information visit the BSB Web site at www.stonybrook.edu/biochem/bsb/.

Admission requirements of Biochemistry and Structural Biology Department

Graduate studies in Biochemistry and Structural Biology require the following in addition to the Graduate School admissions requirements:

A. A bachelor’s degree with the following minimal preparation: mathematics through one year of calculus; chemistry, including organic and physical chemistry; general physics; and one year of biology.

B. Letters from three previous instructors.

C. Graduate Record Examination (GRE) General Test scores.

D. Acceptance by the Graduate Program in Biochemistry and Structural Biology and by the Graduate School.

In special cases, students not meeting all of the requirements listed in item A above may be admitted, but deficiencies must be remedied.

Facilities of Biochemistry and Structural Biology Department

State-of-the-art facilities are available for biochemistry and structural biology. The Center for Structural Biology has several high-field NMR instruments and facilities for X-ray crystallography. With close ties to the Brookhaven National Laboratory, Stony Brook takes advantage of the high-energy beam lines for diffraction studies. Throughout the program there is state-of-the-art equipment for protein purification and analysis, including Raman, infrared, fluorescence, and CD spectrophotometers. The biological sciences complex also has tissue culture facilities, a transgenic mouse facility, and a centralized Drosophila facility. These facilities are supported by a wide range of instrumentation for cell and molecular biology including transmission and scanning electron microscopes, confocal microscopes, and phosphoimagers.

Requirements for the Ph.D. Degree in Biochemistry and Structural Biology

A. Course Requirements

Core courses:

1. Graduate Biochemistry I (MCB 520)

2 Biomembranes (MCB 517)

3. Computational Methods in Biochemistry and Structural Biology (BSB 515)

4. Structural Biology and Spectroscopy (MCB 512)

5. Cell Biology (MCB 656) or Molecular Genetics (MCB 503)

6. Experimental Projects in Biochemistry and Structural Biology (BSB 509/BSB 510), a two-semester course in which the students spend 2-3 months in each of three different faculty laboratories actively participating in the research work of the laboratory.
7. Enrollment every semester in Colloquium in Biochemistry and Structural Biology (BSB 601/BSB 602), a series of invited lectures by visiting scientists from other institutions.

8. Two electives from an approved list of biochemistry, chemistry, molecular, and cell biology courses.

9. Enrollment for one semester of Journal Club (BSB 532) in the first and second years.

10. Enrollment for one semester of Student Seminar (BSB 603/BSB604) in the third, fourth and fifth years.

11. Enrollment in the second year in Ethics (GRD500)

B. Qualifying Examination
At the beginning of the fourth semester, all students take a written qualifying examination covering the material from the core courses. This examination tests the student’s ability to integrate basic concepts and information from the core courses.

C. Research Proposal
After passing the qualifying examination, each student is required to prepare and defend a research proposal based on their own research. The student prepares a detailed writeup of the background and logic of the proposition, and how the research will be carried out, which then forms the basis for an oral proposition examination. The qualifying examination and the proposition examination together constitute the preliminary examination specified in the regulations of the Graduate School.

D. Advancement to Candidacy
When the above requirements have been satisfactorily completed, a recommendation for advancement to candidacy for the Ph.D. will be forwarded to the Graduate School.

E. Dissertation
During the second year, the student initiates a dissertation research project in the laboratory of a particular member of the program faculty. After the student has passed the proposition examination, a research committee is appointed to guide the dissertation research, and when the research nears completion, a dissertation examining committee is approved by the dean of the Graduate School.

F. Dissertation Defense
The dissertation defense, which completes the requirements for the Ph.D., consists of a public seminar presentation of the dissertation work followed by an oral examination before the dissertation examining committee.

G. Teaching Experience
All students in molecular biology and biochemistry, whether or not they are supported by teaching assistantships, are required to gain experience in teaching by assisting in laboratory sections, leading discussion sections, or helping to formulate and grade examination papers. The teaching experience may be in either undergraduate or graduate courses, and generally extends over a period of two semesters.

H. Residence Requirement
The University requires at least two consecutive semesters of full-time graduate study. The demands of the course of study necessitate a longer period of residence.

Faculty of Biochemistry and Structural Biology Department

Distinguished Professors
Sternglanz, Rolf1, Ph.D., 1967, Harvard University: Chromatin structure and function in yeast; histone modifying enzymes.

Professors
Brown, Deborah1, Ph.D., 1987, Stanford University: Structure and function of caveolae and cholesterol/sphingolipid-rich membrane domains.
Citovsky, Vitaly1, Ph.D., 1987, Hebrew University, Jerusalem: Nuclear targeting and intercellular communication in plants.
Dean, Neta1, Ph.D., 1988, UCLA: Protein glycosylation, fungal cell wall biosynthesis; fungal pathogenesis
Deutsch, Dale1, Ph.D., 1972, Purdue University: Metabolism and uptake of the endocannabinoids (anandamide and 2-AG).
Gergen, J. Peter1, Ph.D., 1982, Brandeis University: Transcriptional regulation in development; structure and function of Runt domain proteins.
Haltiwanger, Robert1, Ph.D., 1986, Duke University: Glycobiology: Role of protein glycosylation in signal transduction and development.
Li, Huilin1, Ph.D., 1994, University of Sciences and Technology, Beijing China: Structural biology of macromolecular assemblies and membrane proteins by cryo-electron microscopy.
McLaughlin, Stuart, Ph.D., 1968, British Columbia: Calcium/phospholipid second messenger system.

Miller, W. Todd, Ph.D., 1989, Rockefeller University: Tyrosine phosphorylation and signal transduction.

Raleigh, Daniel P., Ph.D., 1988, Massachusetts Institute of Technology: Experimental studies of protein folding and amyloid formation.

Sampson, Nicole, Ph.D., 1990, University of California, Berkeley: Structure and function of enzymes in mycobacterial sterol metabolic pathways and their role in pathogenesis; Chemical biology of mammalian fertilization; new polymer synthesis.


Smith, Steven O., Ph.D., 1985, University of California, Berkeley: Structure and function of membrane proteins.

Tong, Peter J., Ph.D., 1986, University of Birmingham, England: Tuberculosis pathogenesis and drug discovery; Enzyme mechanisms and rational inhibitor design; Fluorescent proteins.

Associate Professors

Holdener, Bernadette, Ph.D., 1990, University of Illinois: The role of protein folding in WNT signal transduction and development.


Neiman, Aaron, Ph.D., 1994, University of California, San Francisco: Vesicle trafficking and intracellular signaling in yeast.

Schärer, Orlando D., Ph.D., 1996, Harvard University: Chemistry and Biology of DNA damage and repair.

Simmerling, Carlos, Ph.D., 1991, University of Illinois: Development of tools for efficient simulation of chemical systems and using them to study the structure and dynamics of molecules involved in biological processes.

Thomsen, Gerald H., Ph.D., 1988, Rockefeller University: Regulation of early vertebrate development by growth factor signals, ubiquitin modification, and T box family transcription factors.

Assistant Professors


Bowen, Mark E., Ph.D., 1998, University of Illinois, Chicago.

Carrico, Isaac, Ph.D, 2003, California Institute of Technology: Site-specific protein labeling; glycoproteins.

Czapinski, Kevin, Ph.D., 1999, UMDNJ-Robert Wood Johnson Medical School: Post transcriptional control of gene expression in the nervous system.

de los Santos, Carlos, Ph.D., 1987, Buenos Aires, Argentina: Solution structures of damaged DNA; structural basis of chemical mutagenesis, lesion recognition, and DNA repair.


Green, David, Ph.D., 2002, MIT: Protein design; computational glycobiology; specificity of protein interaction networks.

Rizzo, Robert, Ph.D 2001, Yale University: Computational biology; drug design.


Scientists

Allaire, Marc, 1992, University of Sherbrooke: Synchrotron-based techniques and structural biology.

Fu, Dax, 1996, Mayo Graduate School of Medicine: X-ray crystallography of membrane protein transporters and channels.

Liu, Chang-Jun, Ph. D. 1999, Shanghai Institute of Plant Physiology, the Chinese Academy of Sciences.


Number of teaching, graduate, and research assistantships, fall 2010: 27

1) Department of Biochemistry and Cell Biology
2) Department of Pharmacological Sciences
3) Department of Physiology and Biophysics
4) Department of Chemistry
5) Brookhaven National Laboratory
6) Department of Applied Mathematics and Statistics
7) Cold Spring Harbor Laboratory

*NOTE: The course descriptions for this program can be found in the corresponding program PDF or at COURSE SEARCH.*