Biochemistry and Structural Biology

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Degree Awarded
Ph.D. in Biochemistry and Structural Biology; MS in Biomedical Science

Web Site
http://www.stonybrook.edu/biochem/bsb/

Application
https://graduateschool.stonybrook.edu/apply/

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, X-ray diffraction, and electron cryo-microscopy 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, Applied Mathematics and Statistics, 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 Graduate Program

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 chemistry; general physics; and one year of biology.

B. Letters from three previous instructors.

C. 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 houses several high-field NMR instruments, and facilities for X-ray crystallography and electron cryo-microscopy. 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 (BSB 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/BSB 604) in the third, fourth and fifth years.

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

B. Qualifying and Thesis Proposal Examination
During their fourth semester, all students take a qualifying examination that is based primarily on their thesis proposal research.

Each student is required to prepare and defend a research proposal based on their own research. The student prepares a detailed write up of the background and logic of the proposal, and how the research will be carried out, which then forms the basis for an oral proposal examination. Questions during the exam can cover material from the core courses and test the student's ability to integrate basic concepts and information. The qualifying examination and the thesis proposal examination together constitute the preliminary examination specified in the regulations of the Graduate School.

C. 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.

D. 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 proposal 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.

E. 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.

F. 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.

G. 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.

Requirements for the MS in Biomedical Science
Completion of this track will require 30 credits from the approved PhD curriculum in Biochemistry and Structural Biology and a thesis.

Faculty of Biochemistry and Structural Biology Graduate Program
Distinguished Professors
Dill, Ken, Ph.D., 1978, UCSD, Computer modeling of protein molecules and theory and principles of the machine mechanisms and evolution of cells
London, Erwin¹, Ph.D., 1979, Cornell University: Membrane protein structure/translocation/folding, Structure and function of sphingolipid/cholesterol rafts in membranes.
Sampson, Nicole⁴, 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
Professors
Bahou, Wadie, F., MD, Genetic disorders of bleeding and thrombosis

Stony Brook University Graduate Bulletin: www.stonybrook.edu/gradbulletin
Boon, Elizabeth M., Ph.D., 2003, California Institute of Technology: Nitric oxide signaling in bacteria

Gergen, J. Peter, Ph.D., 1982, Brandeis University: Transcriptional regulation in development; structure and function of Runt domain proteins

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

Hollingsworth, Nancy, Ph.D., Meiotic synopsis, recombination, and segregation in yeast

Hannun, Yusuf, MD, Bioactive lipids in cancer pathogenesis and therapeutics

Karzai, Wali, Ph.D., Johns Hopkins University, 1995. Structure-Function studies of RNA-protein interactions

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

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

Obeid, Lina, Ph.D., Bioactive lipids in inflammation, aging and cancer

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

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

Siemerling, Carlos L., 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

Simon, Sanford R., Ph.D., 1967, Rockefeller University: Proteinases and their inhibitors in invasiveness, inflammation and tumor metastasis; Inhibition of bacterial metalloproteinases.

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

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

Tonge, Peter J., Ph.D., 1986, University of Birmingham, England: Tuberculosis pathogenesis and drug discovery; enzyme mechanisms and rational inhibitor design; fluorescent proteins

Wang Jin, Ph.D., 1991 University of Illinois: Fundamental mechanism of biomolecular folding and recognition

Wollmuth, Lonnie, Ph.D. Structure-function, physiology, and pathophysiology of ligand-gated ion channels

Associate Professors

Bowen, Mark E., Ph.D., 1998, University of Illinois, Chicago: Single molecule spectroscopy; signaling by the MAGUK family of scaffolds

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

Garcia-Diaz, Miguel, Ph.D., 2003, UAM University (Madrid, Spain): Structural enzymology of eukaryotic DNA/RNA transactions

Glynn, Steven, Ph.D. 2005, University of Sheffield, UK., Mechanisms of mitochondrial proteostasis

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

Luk, Edward, Ph.D., Chromosome biology and genome regulation

Martin, Benjamin L., Ph.D., 2005, University of California, Berkeley: Stem cell maintenance and differentiation, developmental mechanisms of cancer pathogenesis

Pisconti, Dada. PhD 2003, University of Bari (Italy). Muscle stem cells and regeneration, muscular dystrophy.

Seeliger, Jessica, Ph.D., Stanford University, Mechanisms of bacterial cell envelope assembly in infectious disease; development and application of novel biochemical methods to mycobacteria

Seeliger, Markus, Ph.D., Cambridge University, 2003, Mechanism of protein kinases and ubiquitin ligases in cancer and aging

Assistant Professors

Airola, Michael, Ph.D., 2010, Cornell University: Structure, function, and inhibition of lipid modifying enzymes
Chowdhury, Saikat\textsuperscript{1}, Ph.D. Cytoskeletal dynamics and regulation, cryo-electron microscopy and cell biology

French, Jarrod\textsuperscript{1}, Ph.D., Cornell University, Structure, function and mechanism of proteins and protein complexes involved in human nucleotide metabolism

Kaczocha, Martin, Ph.D., Role of fatty acid binding proteins and endocannabinoids in pain, inflammation, and related pathophysiologies

Leftin, Avigdor, Ph.D., Biomolecular magnetic resonance spectroscopy and imaging

Matus, David Q., Ph.D., 2006, University of Hawaii, Cell cycle regulation of morphogenesis and cell invasive behavior in development and cancer

Rosebrock, Adam, Ph.D. Regulation of central carbon metabolism during cell growth and division using mass spectrometry and metabolomics

Tan, Dongyan\textsuperscript{2}, Ph.D. Structure and function of macromolecules involved in epigenetic regulation of gene expression

Scientists

Liu, Chang-Jun\textsuperscript{5}, Ph. D. 1999, Shanghai Institute of Plant Physiology, the Chinese Academy of Sciences.

Miller, Lisa M.\textsuperscript{5}, Ph.D., 1995, Albert Einstein College of Medicine: synchrotron imaging of cell and tissue composition; role of metal ions and protein misfolding in disease


Schwender, Jörg \textsuperscript{5}, Ph. D., 1999, University of Karlsruhe, Germany: Experimental and theoretical analysis of plant metabolic networks.

Shanklin, John\textsuperscript{5}, Ph.D., 1988, University of Wisconsin-Madison: Structure-function relationships of lipid modification enzymes.

Number of teaching, graduate, and research assistantships, Fall 2018: 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) Department of Medicine
8) Department of Radiology

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