Physiology and Biophysics Department

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Degrees Awarded
Ph.D. in Physiology and Biophysics; M.S. in Basic Health Sciences

Physiology and Biophysics Department

The Department of Physiology and Biophysics offers graduate studies leading to the Ph.D. degree. The department’s faculty has a broad spectrum of research interests, with a major emphasis on understanding the mechanisms of regulation of cellular and organ function in mammalian systems.

The overall goals of the new Master of Science degree program in Physiology and Biophysics are to prepare students for a research staff scientist career in industry (without a focus on R&D), a teaching career at the undergraduate college level, or further graduate study leading to the Ph.D degree in the Biomedical Sciences. For students interested in attending medical school, the M.S. degree program can complement and enhance your background in the physiological sciences, including biomedical research. To accomplish these goals, the program of study provides training in cellular and systems-level physiology, membrane biophysics, experimental design, data analysis, and commonly used laboratory techniques in integrative physiology. Elective courses in Physiology and Biophysics, Biomedical Engineering, Neuroscience, Molecular and Cellular Biology, and Pharmacological Sciences are then selected to complement and expand on the above core training, and meet the individual needs of each student. For more information, please contact Dr. Solomon at irene.solomon@stonybrook.edu.

There are five main research areas in the department: 1) Regulation of cell function and metabolism, 2) Intercellular and intracellular signaling mechanisms, 3) Biophysical studies of membranes, 4) Cellular and systems electrophysiology and neurobiology, and 5) Cardiac pre-conditioning and arrhythmia prevention.

The department strives to offer a broad spectrum of experimental approaches and a wide range of research interests, including membrane biophysics, systems biology, cardiac physiology, membrane transport, and the molecular physiology of cell signaling systems. The department also offers expertise in a wide range of experimental methods including patch clamping, protein chemistry, optical spectroscopy, recombinant DNA and siRNA technology and state of the art cell imaging.

Some department faculty members are associated with the Health Sciences Center Diabetes and Metabolism Center and others participate in University-wide program in Molecular and Cellular Biology, Structural Biology, Biophysics and Biosystems. Most faculty have collaborative arrangements with other basic science and clinical departments. Through joint faculty appointments, students have access to the unique facilities of Brookhaven National Laboratory and Cold Spring Harbor Laboratory, which are located near Stony Brook.

Housed within the Department of Physiology and Biophysics is the Institute of Molecular Cardiology. Since heart disease is still the number one cause of death in the United States, the Institute of Molecular Cardiology was established to bring a multidisciplinary group of basic scientists and clinical investigators together to focus on clinically relevant problems. Biophysicists, molecular biologists, cell biologists, engineers, and cardiovascular surgeons compose the group which currently works together investigating ischemic preconditioning, atrial and ventricular arrhythmias, cardiac contractility, and the development of stem-cell-based therapies.

The Graduate Program in Physiology and Biophysics

Goals
The diverse nature of the department’s research provides a unique environment for graduate study. The overall goal of our program is to prepare students to investigate complex physiological and biophysical problems that often bridge traditional academic boundaries. This requires sound training in a broad range of biological disciplines, plus experience in using the latest techniques in physiology, biochemistry, molecular biology, physics, applied mathematics, and computing.

To accomplish this goal, we recruit a relatively small number of students with diverse undergraduate training in the physical and biological sciences. Individual courses of study are then designed that reflect the background and goals of each student.

Overview of Curriculum
During the first year, all students take courses in cellular and organ systems physiology, biochemistry, and experimental design and data analysis methods. During the second-year, students select from a variety of advanced courses that suit their scientific interests, goals, and background. Most students complete their coursework at the end of the fall semester of their second year. Students rotate through at least three faculty laboratories to gain research experience in their first year. Students also participate, under faculty supervision, in the teaching of physiology or biophysics. Upon completion of the qualifying examination and the selection of a faculty advisor for their research, the students then devote essentially all of their time to dissertation research.

There are three research concentrations available to graduate students: Cellular and Molecular Physiology, Biophysics, and Systems Physiology.
Cellular and Molecular Physiology
The goal of the Cellular and Molecular Physiology concentration is to train students to investigate significant problems in human physiology using modern techniques of molecular and cellular biology. Students who choose this option generally have undergraduate degrees in biochemistry or biology, and will take advanced graduate classes in cellular and molecular biology and molecular genetics during their second year. To increase the training and research opportunities available to our students, this program is affiliated with an interdepartmental program in Molecular and Cellular Biology (MCB). The MCB Program consists of approximately 100 faculty from 11 departments, as well as investigators at Cold Spring Harbor and Brookhaven National Laboratories. It offers several core courses taken by all graduate students in the biological sciences.

Biophysics
The goal of the Biophysics Studies concentration is to train students with strong backgrounds in physics and/or chemistry in modern biophysics. The program is an interdepartmental effort, consisting of faculty from Cold Spring Harbor and Brookhaven National Laboratories. Students who choose this option generally take advanced courses in biophysical chemistry, computational biophysics, electrophysiology, or advanced biochemistry. Biophysics students carry out rotations and dissertation research in the lab of any faculty member affiliated with the Biophysics Program.

Systems Physiology
The primary goal of the systems physiology concentration is to provide an educational framework that focuses on preparing students to attack complex integrative problems using interdisciplinary approaches, and to work effectively as part of a multi-disciplinary team. Areas of specialization in the department include systems neurophysiology, cardiovascular and microvascular physiology, and vision research. The systems physiology concentration is a central element in the BioSystems Group, which is an interdepartmental consortium of faculty members drawn from 6 departments, including Physiology & Biophysics, Biomedical Engineering, Neurobiology & Behavior, Pharmacological Sciences, Medicine, and Applied Mathematics & Statistics, as well as members from Brookhaven National Laboratories and Cold Spring Harbor Laboratories.

The campus-wide nature of the BioSystems Group provides educational and research opportunities of exceptional depth and diversity, and the ability to accommodate students with a broad spectrum of interests and backgrounds. This diversity is reflected in the areas of specialization within the graduate programs. These include the general areas of systems physiology, cellular/molecular physiology, biophysics, biomedical engineering, neuroscience, pharmacology, computational biology, and signal processing.

Requirements and Procedures Advisory Committee
After admission and until the student qualifies for candidacy, the student’s education is directed by the Departmental Graduate Committee. The Committee will assess the student’s background and preparation and will develop with each student an individual program of courses, laboratory experiences, and independent study. The Committee is also responsible for monitoring student performance and assessing progress after the end of the first year.

Laboratory Experience
During the first year, students rotate through at least three laboratories affiliated with the department. The duration of these rotations may vary, but should not exceed six months. At the end of each rotation, students will submit a written report of the aims and results, as well as the difficulties with the project.

Teaching Experience
Students are required to serve as teaching assistants for one semester in a course offered by the Department. This will fulfill the Teaching Practicum required for doctoral degrees awarded by the State University of New York.

Seminars and Journal Club
The Department hosts an extensive series of seminars on topics of direct and indirect relevance to research interests of the faculty. Seminars are given by faculty and visiting scientists. Students are required to attend all departmental seminars. Students are also required to participate in the student journal club, in which a student critically presents a journal article to members of the department.

Course of Study
Graduate students are required to take the following courses:

Cellular Physiology and Biophysics HBY 530, Human Physiology HBY 501 or

Medical Physiology HBY 531, Biomembranes MCB 517, Graduate Biochemistry MCB 520, Statistical Analysis of Physiological Data HBY 561, Model-based Analysis of Physiological Data HBY 562, Teaching Practicum HBY 695, Research in Physiology and Biophysics HBY 591, Journal Club HBY 570, Seminar in Physiology and Biophysics HBY 690, and Thesis Research in Physiology and Biophysics HBY 699 or HBY 700, GRD 500 Scientific Integrity.

Students must also take at least four elective courses equaling 12 credits.


Students are also required to demonstrate competency in statistics and computer programming, either by formal undergraduate or graduate courses, or by passing an exam after self study.

Qualifying for Candidacy

Stony Brook University Graduate Bulletin: www.stonybrook.edu/gradbulletin
The major purpose of the Qualifying Examination is to establish how well the student is able to formulate scientific questions independently. To accomplish this, the student will be required to write, within a prescribed period of time, a formal research proposal with format and scope similar to a NIH Postdoctoral Fellowship Application under the guidance of a faculty committee.

The qualifying exam will be administered to all second-year students in the Spring semester. At that time, the student will choose a topic which may complement but not be directly in the area of the student’s own major research interest. The student will then meet with the Preliminary Examination Committee, twice over the course of 6-8 weeks. The student will then distribute copies of the proposal to the faculty and present a seminar to the entire department describing the proposal. Following the seminar, the student will meet with the faculty to defend the proposal. The Preliminary Examination Committee will then vote on whether the student passes, fails or must amend portions of his/her exam.

Doctoral Program Committee
After completing three rotations, the student will select a faculty committee to provide guidance throughout the dissertation research. The thesis advisor will join (but will not chair) this committee. The committee will meet at least once a year to assess the progress of the work toward a dissertation. The committee will advise the student when it is appropriate to assemble the committee for the dissertation defense.

Thesis Research Proposal
In consultation with the student’s advisor and Doctoral Program Committee, the student is required to submit a written thesis proposal to the Doctoral Program Committee as soon as the direction and scope of the dissertation research project is established. The student is also required to present a seminar describing his proposal to the entire department and to defend the proposal in a closed meeting with the Doctoral Program Committee. The approved thesis proposal should be submitted 1 – 2 years after advancement to candidacy.

Dissertation Defense
A Dissertation Defense Committee is appointed by the dean of the Graduate School, and is to include at least four faculty members, of whom at least one must be from outside the Program. The thesis advisor may be in attendance, but is without vote.

Doctoral Thesis
The thesis will be written in the form of one or more scientific publications in accordance with the guidelines of the Graduate School. The student then presents his/her thesis work to departmental members in an open seminar, after which, the student meets privately with the Dissertation Defense Committee for an oral examination. The Dissertation Defense Committee evaluates both the oral exam and the completed thesis.

Time Limits
All requirements must be completed within seven years.

Admission requirements of Physiology and Biophysics Department
For admission to the Ph.D. program in Physiology and Biophysics or the M.S. program, the following, in addition to the minimum Graduate School requirements, are normally required:

A. A four-year undergraduate degree including the following courses: one year of calculus, one year of general biology with laboratory, one year of physics using calculus, and one year of chemistry. Training in the following areas is strongly recommended: organic chemistry, biochemistry, and physical chemistry. Courses in genetics, cell biology, and biostatistics will also be useful. In exceptional circumstances, permission may be granted to correct deficiencies in undergraduate training during the first year of graduate study.

B. Three letters of reference are required.

C. The Graduate Record Examination (GRE) General Test is required. Instructions on reporting scores to this campus is on the Graduate School Web site. So that the scores will be available for a timely admission decision, the test should be taken no later than January. The deadline for receipt of the online applications for admission in the Fall is March 1. The TOEFL examination is also necessary for non-native speakers of English. Acceptance by both the Department of Physiology and Biophysics and the Graduate School is required.

D. A GPA of 3.0 or higher is required.

Facilities of Physiology and Biophysics Department
In addition to the wide range of instrumentation and technical centers available on campus, the Department of Physiology and Biophysics is well equipped with major research instrumentation for physiological, metabolic, and biochemical studies. The department houses a Molecular Biology Core which has scintillation counters, ultracentrifuges, amino acid analyzers, protein sequencers, and a wide variety of chromatographic, electrophoretic, and spectrophotometric equipment. Also available are a peptide synthesizer, and a laboratory for chemical synthesis of low-molecular-weight compounds. NMR instrumentation is available through collaboration with other departments. Tissue culture services, including monoclonal antibody production, are also available. Specialized equipment used in studies of membrane physiology and biophysics (e.g., membrane electrophysiology and patch-clamp studies on ion channels) are in routine use in several faculty laboratories. The department also houses an imaging center containing two confocal microscopes with image acquisition and processing systems.

Molecular Biology Core
The molecular biology core was established to provide students and faculty ready access to DNA/RNA recombinant technology. Departmental facilities include a 37-degree environmental room, a DNA synthesizer, and an automatic DNA sequencer, large orbital shakers, an array of incubators, DNA sequencing gel set ups (IBI), electrophoretic apparatus and power supplies, an IBI gel reader and a software package which permits the reading of DNA sequencing gels, a selection of restriction enzymes, and a number of cDNA expression libraries.
Molecular Modeling
Computational molecular modeling and visualization are valuable tools for the study of signal transduction systems and protein structure/function. Some current applications of faculty affiliated with our Biophysics Program include examining the physical factors involved in protein/membrane, protein/protein, protein/DNA interactions, studying the specificity of ligand and substrate binding to enzymes, and building models of proteins using domain structures from homologous proteins. Several departmental members have access to the University’s Supercomputing Center.

Computing Facilities
Access to the campus-wide wireless network is available. All computers are connected via Ethernet to a local area network.

Requirements of Physiology and Biophysics
In addition to the minimum Graduate School requirements, the following are required:

A) Completion of HBY 531 or HBY 501, HBY 530, HBY 561 HBY 562, MCB 517, MCB 520, HBY 570, HBY 591, HBY 690, HBY 699, HBY 695, and 12 credits of elective courses.

B) Satisfactory completion of the preliminary examination at the end of the second year of study.

C) Submission of a thesis research proposal by the end of the third year.

D) Participation in the teaching practicum.

E) Submission of an approved dissertation and successful oral defense.

F) Completion of all requirements within seven years.

Faculty of Physiology and Biophysics Department

Professors
Brink, Peter R., Chairperson. Ph.D., 1976, University of Illinois: Physiology and biophysics of junctional and excitable membranes.
Cohen, Ira S., M.D., Leading Professor, Ph.D., 1974, New York University: Electrophysiology of the heart; synaptic physiology.
Dilger, James P., Ph.D., 1980, Stony Brook University: Neuromuscular junction; ion channels in nerve membranes.
Johnson, Roger A., Ph.D., 1968, University of Southern California: Mechanism of hormone action; inter- and intracellular regulation of membrane-bound hormone-sensitive enzymes.
Mathias, Richard T., Ph.D., 1975, University of California, Los Angeles: Electrophysiology of cardiac muscle; volume regulation in the lens.
McLaughlin, Stuart, Ph.D., 1968, University of British Columbia, Canada: Biophysics of membranes.
Mendell, Lorne, Ph.D., 1965, Massachusetts Institute of Technology: Physiology and modify ability of synapses in the spinal cord.
Miller, W. Todd, Ph.D., 1988, Rockefeller University: Protein structure and function; molecular mechanisms of signal transduction.
Moore, Leon C., Ph.D., 1976, University of Southern California: Renal physiology.
Qin, Yi-Xian, Ph.D., 1997, Stony Brook University: Mechanisms in the control of tissue growth, bone adaptation by mechanical environment.
Scarlata, Suzanne, Graduate Ph.D. Program Director Ph.D., 1984, University of Illinois: Biophysics of signaling proteins.
Smith, Steven O., Ph.D., 1985, University of California, Berkeley: Molecular mechanisms of signal transduction.
Solomon, Irene C., Graduate Program Director (M.S.), Ph.D., 1994, University of California, Davis: Neural control of respiratory motor output and fast oscillatory rhythms.
White, Thomas W., Ph.D., 1984, Harvard University: Biology of cell-to-cell communication and gap junction.

Associate Professors
Clausen, Chris, Ph.D., 1979, University of California, Los Angeles: Electrical properties of transporting epithelia.
Collins, William, Ph.D., 1980, Univ. of Pennsylvania: Relationship between intrinsic properties of individual neurons and nervous system function.
McKinnon, David, Ph.D., 1987, Australian National University: Control of ion channel expression.
Spector, Ilan, Ph.D., 1967, University of Paris, France: Electrophysiology of nerve and muscle cell lines; ion channels; neurotoxins.

Assistant Professors
Bowen, Mark, Ph.D., 1998, University of Illinois, Chicago; Molecular aspects of signal transduction.

Entcheva, Emilia, Ph.D., 1998, Memphis: Cardiac cell function.

Frame, Mary, Ph.D., 1990, University of Missouri: Microcirculation; tissue engineering; nanofabrication.

Research Faculty
Cameron, Roger H., Assistant Professor. Ph.D., 1990, Stony Brook University: Electron microscopy; pharmacology of plasma cells secretion.

El-Maghrabi, Raafat, Associate Professor. Ph.D., 1978, Wake Forest University: Enzyme regulation; hormonal control of metabolism.

Gao, Junyuan, Assistant Professor. Ph.D., 1994, Stony Brook University: Sodium potassium pump current in cardiac myocytes.

Kumari, Sindhu, Assistant Professor. Ph.D., 1988, Madurai Kamaraj University, India: Biochemical and molecular characterization of gap junction channels and sodium potassium pump.


Rebecchi, Mario J., Associate Professor. Ph.D., 1984, New York University School of Medicine: Signal transduction in mammalian cells.

Rosati, Barbara, Assistant Professor. Ph.D., 2000, Milan, Italy: Transcriptional regulation of ion channel genes in the heart.

Valiunas, Virginijus, Assistant Professor. Ph.D., 1992, Kaunas Medical University, Lithuania: Gap junction; intercellular communication and cardiac electrophysiology.


Wang, Hsien Yu, Associate Professor. Ph.D., 1989, Stony Brook University: Signal transduction and development.

Biophysics Program Affiliated Faculty
Grollman, Arthur P., Distinguished Professor, M.D., 1959, Johns Hopkins University: Department of Pharmacological Science. Chemical carcinogenesis and mutagenesis.

Jacobsen, Chris J., Professor, Ph.D., 1988, Stony Brook University; Department of Physics. Soft X-ray microscopy of cellular structure and materials structure.

Joshua-Tor, Leemor, Assistant Investigator, Ph.D., 1991, The Weizmann Institute of Science; Cold Spring Harbor Laboratory. Structural biology; X-ray crystallography; molecular recognition; transcription; proteases.

Kirz, Janos, Professor, Ph.D., 1963, University of California, Berkeley: Department of Physics. Microscopy and microanalysis of cellular architecture with soft X-rays.

Krainer, Adrian R., Professor, Ph.D., 1986, Harvard University; Cold Spring Harbor Lab. Mechanisms and regulation of messenger RNA splicing in human cells.

London, Erwin, Professor, Ph.D., 1979, Cornell University: Department of Biochemistry. Membrane lipid-protein interactions; protein toxin structure and function.

Malbon, C., Leading Professor, Ph.D., 1976, Case Western Reserve University: Department of Pharmacology. Elucidating the genetic basis of developmental and metabolic diseases.

Matthews, Gary, Leading Professor, Ph.D., 1975, University of Pennsylvania: Department of Neurobiology and Behavior. Cellular biophysics of electrical signals in the retina.

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

Rubin, Clinton, T., Professor, Ph.D., 1983, Bristol University: Department of Orthopaedics. Cellular mechanisms responsible for adaptation in bone.

Sampson, Nicole S., Professor, Ph.D., 1990, University of California, Berkeley: Department of Chemistry. Enzyme mechanisms and protein structure-function relationships.
Setlow, Richard, Professor, Ph.D., 1947, Yale University; Senior Scientist, Department of Biology, Brookhaven National Laboratory. DNA damage and repair.

Tonge, Peter J., Professor, Ph.D., 1986, University of Birmingham, England: Department of Chemistry. Enzyme mechanisms in antitubercular drugs and Alzheimer’s disease.

Wong, Stanislaus, Assistant Professor, Ph.D., 1999, Harvard University: Department of Chemistry. Fundamental structure correlations in unique nanostructures.

1) Joint appointment, Department of Neurobiology and Behavior
2) Joint appointment, Department of Medicine
3) Joint appointment, Department of Surgery
4) Joint appointment, Department of Pediatrics
5) Joint appointment, Department of Anesthesiology
6) Joint appointment, Cold Spring Harbor Laboratory
7) Joint appointment, Brookhaven National Laboratory
8) Joint appointment, Department of Applied Mathematics and Statistics
9) Joint appointment, Department of Orthopedics
10) Joint appointment, Veterans Administration Hospital
11) Joint appointment, North Shore University Hospital
12) Joint appointment, Department of Urology
13) Joint appointment, SUNY Old Westbury
14) Joint appointment, Department of Biochemistry and Cell Biology
15) Joint appointment, Department of Biology, University of Tulsa, Oklahoma
16) Joint appointment, Department of Pharmacology, College of Physicians and Surgeons, Columbia University
17) Joint appointment, Department of Molecular Genetics and Microbiology
18) Joint appointment, Department of Biomedical Engineering

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