Biomedical Engineering Department

Chair
Yi-Xian Qin, Dept. of Biomedical Engineering, Bioengineering Bldg., Room 215, (631) 632-1481

Graduate Program Director
Eric Brouzes

Graduate Program Administrator
John Matheus

Degrees Awarded
M.S. in Biomedical Engineering; Ph.D. in Biomedical Engineering; Advanced Certificate in Life Sciences and Innovatin Entrepreneurship

Web Site
https://www.stonybrook.edu/bme/

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

Biomedical Engineering

Biomedical engineering is at the forefront of medicine's technologic revolution; its many successes have raised expectations for the prevention, diagnosis, and treatment of disease. Faculty at Stony Brook University have been active contributors to the cutting edge of this technology, and our University is building on internationally acclaimed strengths in Bioelectromagnetics, Biomechanics, Biomaterials, Biotechnology, Tissue Engineering, Instrumentation, and Medical Imaging. These disciplines thrive through active interdisciplinary collaborations among the faculty in the College of Engineering and Applied Sciences, the School of Medicine, and the College of Arts and Sciences, all of which are in close proximity. This ongoing biomedical research, combined with unique facilities at the University, Brookhaven National Laboratory, and Cold Spring Harbor Laboratory have helped distinguish Stony Brook as a superb resource for education in both the engineering and health sciences. With these intellectual and physical resources, the program in Biomedical Engineering is positioned to provide a rigorous, cross-disciplinary graduate training and research environment for our students.

This is a very exciting time for Biomedical Engineering. New areas are opening each day, ranging from the engineering of tissues to making outer space habitable for mankind. It is an excellent time to begin your studies in Biomedical Engineering and we believe you will find Stony Brook a superb place to train. Our faculty is diverse, our commitment is high, and our facilities are unique. If there are any questions which we might address, please do not hesitate to contact us directly.

The Graduate Program in Biomedical Engineering at Stony Brook University trains individuals with baccalaureate degrees in engineering, applied mathematics, and the sciences to provide them with the synthesis, design, and analysis skills necessary to contribute effectively to the advancement of technology in health and medical care. The M.S. and Ph.D. degree programs are specifically designed to provide graduate students and engineering professionals with the knowledge and skills necessary to transfer recent developments in the basic sciences into commercially viable products and processes. Training of the student is accomplished by exposing the individual to the biology, engineering, and business concepts critical to succeeding in the biomedical research and development environment.

Training in Biomedical Engineering is directed by faculty from the College of Engineering and Applied Sciences, the School of Medicine, the College of Arts and Sciences, the Health Sciences Center, as well as from the Brookhaven National Laboratory and Cold Spring Harbor Laboratory. These diverse faculty provide a spectrum of research opportunities. Breadth and depth of exposure is a hallmark of the program, and one which we believe emphasizes the importance of multidisciplinary, collaborative approaches to real-world engineering problems in biology and medicine. Graduate training includes course instruction, participation in seminar courses, and extensive involvement in selected projects emphasizing synthesis and design skills. The graduate program is based in the Bioengineering Building, on West Campus, and in close proximity to the University Hospital, the Basic Sciences, Engineering, and Business Schools.

Advanced Graduate Certificate in Life Sciences Innovation and Entrepreneurship

The Advanced Graduate Certificate (AGC) in Life Sciences Innovation and Entrepreneurship (LiSIE), is a collaboration between Stony Brook University's Department of Biomedical Engineering, College of Business, and Center for Biotechnology. The AGC is granted after completing a six course program that prepares students to translate science into therapeutics, diagnostics and/or medical devices. Students learn fundamentals of business, finance, regulatory affairs, market need, and due-diligence necessary for leveraging technology into bioscience oriented start-up companies, business ventures, or products in established companies. After completion of the LiSIE certificate, students can apply business strategies to innovations emerging from their own work, laboratories, incubators, and/or university community and prepare themselves for a broader range of career opportunities (e.g., intellectual property law, investment and financial analysis, business development, and regulatory as well as entrepreneurial activities).

Admission Requirements of Biomedical Engineering Department

Students may matriculate directly into either the M.S. or Ph.D. programs. For admission to the Program in Biomedical Engineering, the following are normally required:

A. A four-year undergraduate degree in engineering or related field such as the physical sciences, or mathematics.

B. An official transcript of undergraduate record and of any work completed at the graduate level.

C. Letters of recommendation from three previous or current instructors/employers.

D. Submission of a personal statement outlining your background, interests, and career goals in the field of biomedical engineering.

E. Acceptance by both the Program and the Graduate School.

Stipends and tuition scholarships are available for selected students. Distribution of these awards will be based on undergraduate performance, professional experience, and research/career objectives as outlined in a personal statement.

Certificate Requirements

To receive the Stony Brook certificate in Life Sciences Innovations and Entrepreneurship, a student must complete six courses as specified below, with at least a B grade in each course.

Biological Sciences Entrepreneurship (2 courses)

- BME 511: Fundamentals of the Bioscience Industry
- BME 512: Fundamentals of Bio-Entrepreneurship

Biological Sciences Business and Science Communication (2 courses)

- BUS 510: Bio-Startups and Innovation
- JRN 501: Foundations of Science Communication 1

Technical Electives (choice of 2 courses for 6 credits under advisement from the certificate director)

- BME 501: Engineering Principles in Cell Biology
- BME 502: Advanced Numerical Analysis Applied to Biological Systems
- CHE 541: Biomolecular Structure and Analysis
- CHE 542: Chemical Biology
- BGE 510: Graduate Genetics
- MCB/HBM 503: Molecular Genetics
- HBH 631: Graduate Pharmacology I
- HBH 632: Graduate Pharmacology II
- HBM 640: Molecular Mechanisms of Microbial Pathogenesis
- HBP 533: Immunology
- BNB 561: Introduction to Neuroscience 1
- BNB 562: Introduction to Neuroscience 2

Requirements for the M.S. Degree in Biomedical Engineering

A minimum of 33 graduate credits is required to earn the Master of Science in BME (project option) or 39 credits for the Master of Science in BME (thesis option). The program study can be chosen from any of the following approved concentrations: Biomedical Principles, Biomedical Design or Biomedical Entrepreneurship; each with their own specific requirements as outlined below. The program of study can be tailored in consultation with your faculty advisor/mentor to accommodate almost any BME area of interest through the use of a technical elective system. The following courses must be taken by all BME graduate students: BME 501 and BME 502. Additionally, all students (except those pursuing the Medical Physics Accredited Certificate Program) must also fulfill a business/management course requirement, which can be met by taking BME 509 or the following MBA class (MBA 502, MBA 503, MBA 504, MBA 505, MBA 506, MBA 507, MBA 511, or MBA 589) from the School of Business. All students are required to register for BME 590 (at least zero credits per semester), during every semester of full-time enrollment. The following courses are only required for students in the Biomedical Principles concentration: BME 505, BME 520, BME 521 and BME 698. The following courses are only required for students in the Biomedical Design concentration: BME 505, BME 581 and BME 520 or BME 521. The following courses are only required for students in the Biomedical Entrepreneurship concentration: EMP 521 and JRN 565 (or 3 of the following JRN 501, JRN 502, JRN 503, JRN 504, JRN 508, JRN 509, JRN 511 or JRN 512). Each concentration requires that the student completes 6 technical electives that can be tailored to the specific plan of study. Students in the Biomedical Principles and Biomedical Design concentration are required to take a minimum of six technical elective courses (4 of which have to be BME). Students in the Biomedical Entrepreneurship concentration are required to take a minimum of six technical elective courses (3 of which have to be BME and 3 of which are focused on entrepreneurship). Please consult with the graduate program director for an approved list of technical electives for all concentrations.

A grade point average of B or better must be attained for the core BME courses taken and an overall grade point average of 3.0 out of 4.0 must be maintained overall.

Project or Thesis Options. The student has the option of earning the Master of Science Degree in BME on either a project or thesis option. If the project option is elected, the student undertakes elective graduate coursework to complete the 33 credits. The culmination of the degree is earned through an appropriate project that is submitted for approval to a faculty committee and/or the graduate program director. If the thesis option is elected, the student must additionally complete six credits of BME 599 and submit and defend a written thesis.

For the project option, most students can complete this program within three academic semesters, and most students can complete the thesis option in four academic semesters. The project option is recommended for students who wish to pursue a career in industry that does not involve Research & Development (R&D). Students pursing the project option cannot use BME 599 to fulfill any requirements (i.e., it is not a technical elective nor core course, but they can enroll in BME 595 to document completion of the project). The thesis option is recommended for students

who will be continuing on for their doctoral degree and for students who wish to pursue an industrial career with an R&D focus. Students in the thesis option cannot enroll in BME 595 and use it to satisfy degree requirements.

Requirements for the Ph.D. Degree in Biomedical Engineering

1. **Completion of the M.S. degree in Biomedical Engineering or equivalent graduate program**
2. **Satisfactory completion of the BME qualifying exam**
3. **Plan of Study**

Student matriculating in to the doctoral (Ph.D.) degree program must complete all the requirements for the M.S. degree in BME at Stony Brook or enter the program with a relevant M.S. degree. This latter option is termed admission with “Advanced Standing." After completion of the M.S. degree or admission with Advanced Standing, there are no course requirements per se, though certain courses may be required to fill any gaps in the student's knowledge. Following completion of a qualifying exam, an independent basic research program will be undertaken. Subsequently, the student will present and defend their dissertation proposal. Successful completion of this stage will enable the student to “Advanced to Candidacy." One semester of teaching practicum must be satisfactorily performed. Completion of the research program will culminate in the submission and oral defense of a doctoral dissertation. The University requires at least two consecutive semesters of full-time graduate study.

4. Teaching Requirements

The BME teaching requirement for the Ph.D. degree can be fulfilled in any of the following three manners:

1. Deliver 4 lectures in a BME undergraduate or graduate course, and present a seminar that covers the state-of-the-art in your field of research.
2. Teach a BME course, either as the instructor of record (if you have G5 student status) or as the principal instructor (for G4 student status).
3. Petition for something else that is equivalent to the above.

5. Thesis Proposal Examination

After successful completion of the qualifying examination, the student selects a thesis advisor and writes a proposal for thesis research. After approval by the thesis advisor, the proposal is orally defended before a thesis committee.

6. Advancement to Candidacy

After successful completion of all required and elective courses, the qualifying examination, and the thesis proposal examination, the student will be recommended to the Graduate School for advancement to candidacy.

7. Dissertation

The research for the Ph.D. dissertation is conducted under the supervision of the thesis committee. The dissertation must represent a significant contribution to the scientific and/or engineering literature. Upon approval of the completed dissertation by the thesis committee, a formal public oral defense of the dissertation is scheduled at which the student presents their findings and is questioned by members of the examining committee and by other members of the audience. On acceptance of the dissertation by the thesis committee, all requirements for the degree will have been satisfied.

8. Time Limit/Residency Requirements

All requirements for the Ph.D. degree must be completed within seven years after completing 24 credits of graduate study. The University requires at least two consecutive semesters of full-time graduate study.

Faculty of Biomedical Engineering Department

Distinguished Professors

Dill, Ken A., Ph.D., 1978, UC San Diego: Quantitative Biology.

Hsiao, Benjamin, Ph.D., 1987, Institute of Materials Science at University of Connecticut: Structural and morphological development of complex polymer systems during preparation and processing in real time.

Rafailovich, Miriam, Ph.D., 1980, Stony Brook University: Polymeric liquids; phase transitions; thin film wetting phenomena; biopolymers.

Rubin, Clinton, T., Chair, Ph.D., 1983, Bristol University: Tissue adaptation; biophysical treatment of musculoskeletal disorders.

Takeuchi, Esther, Ph.D., 1981, Ohio State University: Cutting-edge research in electrochemistry, batteries and their intersection with human health.

Professors

Abi-Dargham, Anissa, M.D., 1984, St. Joseph’s University: Molecular imaging, pharmacology, schizophrenia and addiction.

Balazsi, Gabor, Ph.D., 2001, University of Missouri-Saint Louis: Synthetic gene circuits.

Bluestein, Daniel (Danny), Ph.D., 1992, Tel Aviv University, Israel: Dynamics of fluid flow and cellular transport through vessels.

Clark, Richard, M.D., 1971, University of Rochester: Tissue engineering in wound repair.

Dilmanian, F. Avraham, Ph.D., 1980, Massachusetts Institute of Technology: Experimental methods of radiation therapy utilizing the tissue-sparing effects.

Du, Congwu, Ph.D., 1996, University of Luebeck, Germany: Development of advanced biomedical optical imaging techniques for translational research.

Einav, Shmuel, Ph.D., 1972, Stony Brook University: Basic physiological flow phenomena, both experimentally and numerically.

Frame, Molly, Ph.D., 1990, University of Missouri: Microvascular flow control at the fluid dynamic and molecular levels.

Ghebrehiwet, Berhane, D.Sc., 1974, Université de Paris: Structure and function of C1q receptors (C1qRs) in health and disease.

Hannon, Gregory, Ph.D., 1992, Case Western Reserve University: Explores the mechanisms and regulation of RNA interference as well as its applications to cancer research.

Judex, Stefan, Ph.D., 1999, University of Calgary, Canada: Molecular bioengineering; mechanical, molecular, and genetic influences on the adaptation of bone and connective tissues to physiologic stimuli.

Kaufman, Arie E., Ph.D., 1977, Ben-Gurion University: Computer graphics; visualization; interactive systems; 3-D virtual colonoscopy; computer architecture.

Liang, Jerome, Ph.D., 1987, City University of New York: Development of medical imaging hardware for single photon detection.

Lin, Richard, M.D., 1988, University of California, San Francisco: Biology of Phosphoinositide 3-Kinases.

Lieber, Baruch, Ph.D., 1985, Georgia Institute of Technology: Cerebrovascular Research.

McCombie, Richard, Ph.D., 1982, University of Michigan: Structure and function in complex genomes.

Miller, Lisa, Ph.D., 1995, Albert Einstein College of Medicine: Research focuses on the study of the chemical makeup of tissue in disease using high-resolution infrared and x-ray imaging.

Mitra, Partha, Ph.D., 1993, Harvard University: Brain function.

Mueller, Klaus, Ph.D., 1998, Ohio State University: Computer graphics, data visualization, medical imaging.

Mujica-Parodi, Lilianne, Ph.D., 1998, Columbia University: Relationships between four simultaneously or near-simultaneously interacting systems: neural, cardiac, endocrine, and cognitive, to better understand the neurobiology of arousal, fear, and stress.

Pan, Yingtian, Ph.D., 1992, National Laser Technology Laboratories, China: Optical/NIR spectroscopy and imaging methods and applying these techniques to provide clinical diagnostic information.

Parsey, Ramin, M.D., Ph.D., 1994, University of Maryland Baltimore: State-of-the-art imaging modalities to investigate psychiatric and neurological disorders.

Peña, Louis A, Ph.D., UCLA, 1991, M.B.A, Stony Brook University, 2013: Biotechnology innovation and entrepreneurship, workforce development, tissue engineering, radiation biology, signal transduction of stress.

Qin, Yi-Xian, Ph.D., 1997, Stony Brook University: Physical mechanisms involved in the control of tissue growth, healing, and homeostasis, especially bone adaptation influenced by mechanical environment.

Rizzo, Robert, Ph.D., 2001, Yale University: Application of computational techniques to drug discovery.

Saltz, Joel, M.D., Ph.D., 1985, Duke University: Development of digital pathology tools, techniques and tools to enable deep integrative translational research and biomedical informatics methods.

Shroyer, Kenneth, M.D., Ph.D., 1987, 1983, University of Colorado: Basic and translational research related to prognostic and predictive biomarkers and molecular mechanisms that drive tumor aggression.

Simmerling, Carlos, Ph.D., 1994, University of Illinois, Chicago: Simulate known properties of molecules, assist in the refinement and interpretation of experimental data.

Simon, Sanford, Ph.D., 1967, Rockefeller University: Acute and chronic inflammatory responses.

Skiena, Steven, Ph.D., 1988, University of Illinois: Computational geometry; biologic algorithms.

Tracey, Kevin, M.D., 1983, Boston University: Research focuses on the roles of individual mediators of systemic inflammation, and their regulation by interactions between the brain and the innate immune system.

Vaska, Paul, Ph.D., 1997, State University of New York at Stony Brook: Instrumentation for positron emission tomography (PET).

Zhao, Wei, Ph.D., 1997, University of Toronto, Canada: Development of novel detector concept and new clinical applications for early detection of cancer.

Zhu, Donghui (Don), Ph.D., 2006, University of Missouri: Biodegradable metallic materials for tissue engineering and regeneration.

Associate Professors

Brouzes, Eric, Ph.D., 2004, University Paris 7 - Institute Curie, Paris: Microfluidic technologies for single-cell genomics.

Button, Terry, Ph.D., 1989, University at Buffalo: High-resolution computer-aided tomography.

DeLorenzo, Christine, Ph.D., 2007, Yale University: Brain Imaging and mental disease.

Powers, Scott, Ph.D., 1983, Columbia University: Cancer gene discovery; cancer diagnostics and therapeutics; cancer biology.

Rubenstein, David, Ph.D., 2007, Stony Brook University: Fabrication of complex three dimensional biomimetic scaffolds and to test the compatibility of the fabricated scaffolds with the vascular system.

Schlyer, David, Ph.D., 1976, San Diego State University: Development of multi-modality imaging.

Sitharaman, Balaji, Ph.D., 2005, Rice University: Research related to related to the diagnosis/ treatment of disease and tissue regeneration.

Sordella, Raffaella, Ph.D., 1998, University of Turin: Why cancer cells are responsive to the inhibition of one particular gene or gene product.

Strey, Helmut, Ph.D., 1993, Technical University, Munich: Nanostructured Materials for Applications in Bioseparation, Drug Delivery and Biosensors.

Wang, Jun, Ph.D., 2010, Purdue University: Sensing platforms for the multiplexed detection of protein biomarkers and DNA.

Yin, Wei, Ph.D., 2004, Stony Brook University: Role of disturbed shear stress on platelets, vascular endothelial cells and their interactions.

Assistant Professors

Arbab, Hassan, Ph.D., 2012, University of Washington: Terahertz spectroscopy, Ultrafast photonics and femtosecond optics, Wavelet methods, Biomedical optics.

Bialkowska, Agnieszka, Ph.D. 2003, Institute of Biochemistry and Biophysics: Inflammation within the gastrointestinal tract.

Chan, Mei Lin, Ph.D., 2009, Columbia University: Bone adaptation, mechanotransduction and osteoimmunology in normal and pathological conditions.

Goldan, Amirhossein, Ph.D., 2012, University of Waterloo: Biomedical imaging and instrumentation: development of ultra-high resolution brain PET scanner.

Huang, Chuan, Ph.D., 2012, University of Arizona: Medical Imaging Analysis.

Li, Yu Yulee, Ph.D., 2002, University of Illinois at Urbana-Champaign: Cardiac magnetic resonance imaging research program with a focus on high-speed imaging.

Sheltzer, Jason, Ph.D., 2015, Massachusetts Institute of Technology: Understand the genetic differences between normal, malignant, and metastatic cells.

Van Snellenberg, Jared, Ph.D., 2012, Columbia University: Development of novel signal processing and statistical methods for pre- and post-processing of brain functional MRI data in populations with psychotic disorders.

Research Assistant Professor

Jawaad Sheriff, Ph.D., 2010, Stony Brook University: Role of the patient age in clot formation risk under flow conditions.

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