Biomedical Engineering

Master of Science in Engineering
Doctor of Philosophy

For More Information

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Objectives

Graduate degrees in biomedical engineering have been offered by the University since 1974. The undergraduate degree program and the Department of Biomedical Engineering were established in 2001. The department fosters a unique environment in which scholars and scientists may excel in both fundamental research and its translation to clinical applications.

The mission of the UT Austin graduate program in biomedical engineering is to educate students in the fundamentals of engineering and science as they affect biology and medicine and to perform multidisciplinary, disease-oriented research at the molecular, cellular, organ, and systemic levels. The program aims fully to integrate biology and engineering research and education at the graduate level.

The graduate program has approximately 130 students, with backgrounds in biology, chemistry, physics, and various engineering disciplines. Students come from all over the United States and the world to gain unique knowledge and experience. Apart from coursework and research in some of the world's premier laboratories, there are many opportunities for personal and professional development through interaction with industry professionals, conference attendance, and seminars with leaders in the field.

Doctoral students receive full financial support, either through teaching assistant or graduate research assistant positions or through one of many fellowships. More than half the students in the program have fellowships from a source like the National Science Foundation, National Institutes of Health, the Graduate School, or the Cockrell School of Engineering.

Facilities for Graduate Work

The Department of Biomedical Engineering has offices and laboratories in the Biomedical Engineering Building, completed in 2008, and laboratories in the Engineering and Education Resource Center, completed in 2017. Research is also conducted in the Dell Medical School, at partner institutions in Houston such as the University of Texas MD Anderson Cancer Center, and at the University of Texas Health Science Center at San Antonio. Students have access to facilities for research in biochemical and protein engineering, cell and tissue engineering, gene therapy, cell-electronic interfaces and nanostructure engineering, cell biomechanics, whole-body biomechanics and gait analysis, thermal engineering, optical spectroscopy and imaging, ultrasound imaging, laser-tissue interactions, image processing, biosignal analysis and computer graphics, protein bioinformatics, functional genomics, biomimetics, protein modeling, and computational disease diagnosis.

In addition to individual research laboratories, a number of core facilities are available for research at the medical school campuses. The following are located on The University of Texas at Austin campus:

Institute for Biomaterials, Drug Delivery, and Regenerative Medicine. The institute provides a focal point for impactful activities in research, education, and service in biomaterials, Drug Delivery, and regenerative medicine—key areas to transforming health care. Areas of focus are cancer, cardiovascular diseases, neurological diseases, diabetes, and infections and autoimmune diseases. More information provided online.

Center for Emerging Imaging Technologies. The CEIT brings together basic and clinical scientists, engineers, and physicians from medical centers within Texas, building on strengths in optical imaging, biomedical optics, ultrasound, and image processing to create novel imaging approaches for understanding basic biological processes as well as clinical applications in the diagnosis and treatment of diseases. The center fosters collaborative research at the interface of chemical, physical, mathematics, engineering, and life sciences. Areas of focus are imaging contrast agents, image processing, modeling and informatics, and clinical translation of imaging techniques and therapeutics. More information provided online.

Willerson Center for Cardiovascular Modeling and Simulation. The overarching goal of the WCCMS is developing computational biomechanical models for understanding the heart valve and heart disease progression for developing clinical interventions, including prosthetic devices. The Center develops or utilizes a range of unique in-vivo and in-vitro data for elucidating mechanisms that underlie the observed pathologies. The Center ultimately seeks to provide cardiovascular scientists and clinicians with advanced simulations for the rational development of treatments for structural heart and valve diseases. More information provided online.

Center for Computational Oncology. As our knowledge of cancer grows, there is a desperate need to make real connections between those designing clinical trials and those studying mathematical models of tumor growth and treatment response so that the field of theoretical oncology can provide systematic, testable predictions of the response of individual patients to individual therapeutic regimens. The long-term goal of the CCO is to build a testable, mathematical theory of cancer. Cancer biologists could use such a theory to discover new biology, while oncologists could select the most promising treatment for an individual patient in a systematic fashion. More information provided online.

Center for Biomedical Research Support core facilities. The Center for Biomedical Research Support (CBRS) provides access to cutting-edge technology and expert advice to enhance research. Core facilities include the Biological Mass Spectrometry Facility, the Biomedical Imaging Center, the Computational Biology and Bioinformatics core facility, Cryo-Electron Microscopy, the Genomic Sequencing and Analysis Facility, Microscopy and Flow Cytometry, and Mouse Genetic Engineering Facility. More information is given online.

Texas Materials Institute and Center for Nano and Molecular Science and Technology core facilities. The Texas Materials Institute (TMI) maintains core facilities in electron microscopy, surface analysis, polymer characterization, and X-ray scattering. The Center for Nano and Molecular Science and Technology (CNM) is a multidisciplinary, collaborative research center focused on several emerging areas of research. A multidepartmental effort of the College of Natural Sciences and the Cockrell School of Engineering, CNM houses extensive shared user facilities, including a picosecond fluorescence lifetime spectrometer/microscope; an FTIR spectrometer; a near-field scanning optical microscope; organic thin film fabrication equipment; beam lithography systems; a molecular force probe microscope; a transmission electron microscope; and a time-correlated single photon counting facility.

Animal Resources Center facilities. The Animal Resources Center (ARC) is a 14,000-square-foot state-of-the-art facility in which animal surgical procedures are performed. A separate building houses transgenic and knock-out animals. The facility is fully staffed and equipped in compliance with NIH and AAALAC guidelines for accreditation. Available are animal operating rooms, support staff, equipment for preparing tissue specimens, and veterinary consultation for both animal husbandry and surgery.

Computer and computational facilities. All research groups maintain computers for use by their graduate students, and each academic unit has one or more core computer facilities. The University also has core computer user facilities across campus. Extensive computing facilities are available to faculty members and students, including the Texas Advanced Computing Center (TACC). TACC's comprehensive advanced computing resources include high performance computing (HPC) systems of a variety of architectures to enable larger simulations analyses and faster computation times than are possible using computers available to individual researchers, academic departments, and research centers and institutes; advanced scientific visualization (SciVis) resources including computing systems with high performance graphics hardware, large displays, and immersive environments, and high-end post-production facilities to enable large data analysis and promote knowledge discovery; and massive data storage/archival systems to house the vast quantities of data that result from performing simulations on HPC systems and developing visualizations of large data sets.

Library facilities. The University has outstanding library facilities, including a general collection of 2.5 million volumes in the Perry-Castañeda Library and topical collections in specialized libraries like the Mallet Chemistry Library, the McKinney Engineering Library, and the Life Sciences Library.

Areas of Study

The biomedical engineering program is interdisciplinary, with a faculty that includes members of the Dell Medical School, College of Natural Sciences, the Departments of Kinesiology and Health Education, Chemistry and Biochemistry, Psychology, Biomedical Engineering, and several other departments in the Cockrell School of Engineering. In addition, several faculty members from the University of Texas Health Science Center at San Antonio, the University of Texas Health Science Center at Houston, and the University of Texas MD Anderson Cancer Center serve on the Graduate Studies Committee and supervise biomedical engineering students.

The current research of this faculty is focused in the following areas: biomedical imaging and instrumentation; cellular and biomolecular engineering; computational biomedical engineering; and molecular, cellular, and tissue biomechanics. Research activities embrace such topics as bioinstrumentation, modeling and control of biological systems, nerve fiber regeneration, biomedical computer and information technology, biomechanics, cell and tissue mechanics, thermal processes, musculoskeletal modeling, acquisition and analysis of in vivo and ex vivo spatial human biomechanics data, acquisition of physiological data by noninvasive means, cell and tissue engineering, design and testing of novel fluid and drug delivery systems, effects of laser radiation on biological material, laser applications in medicine, coherence imaging of biological materials, pulsed photothermal tomography, biorheology, visual system instrumentation, computer vision, production and purification of genetically engineered proteins, DNA and drug delivery, cell-electronic interfaces, acquisition and processing of neurological signals, neuroprostheses, applications of finite element modeling in medicine, acoustics and ultrasound, image processing, thermography, hyperthermia, genomic signal processing, biological and medical informatics, and nanotechnology.

Graduate Studies Committee

The following faculty members served on the Graduate Studies Committee (GSC) in the spring 2023 semester.

Lawrence D Abraham	Sapun Harshad Parekh
Deji Akinwande	John A Pearce
Chandrajit L Bajaj	Nicholas A Peppas
Aaron Blair Baker	Tyrone Porter
Adela Ben-Yakar	Chad Chad Quarles
Alan C Bovik	Manuel Karl Rausch
Amy Brock	Gregory Paul Reece
Adam Bush	Pengyu Ren
Edward Castillo	Christopher G Rylander
Ray T Chen	Henry G Rylander III
Elizabeth Cosgriff-Hernandez	Marissa N Rylander
Zhengrong Cui	Michael S Sacks
Kevin N Dalby	Samantha Rose Santacruz
Kenneth R Diller	Stephanie K Seidlits
Ming-Chieh Ding	Jason B Shear
Andrew K Dunn	Li Shi
Andrew Ellington	Hugh D Smyth
Lief Fenno	Max Snodderly
Nicholas P Fey	Konstantin V Sokolov
Ilya J Finkelstein	Jeanne Casstevens Stachowiak
Wilson S Geisler III	Laura J Suggs
George Georgiou	James W Tunnell
Debadyuti Ghosh	Jonathan W Valvano
Joydeep Ghosh	Sriram Vishwanath
Vernita Gordon	Huiliang Wang
Hyun Jung Kim	Thomas Yankeelov
Nanshu Lu	Hsin-Chih Yeh
Yi Lu	Stephen Yi
Edward M Marcotte	Bo Zhao
Mia K Markey	Yuebing Zheng
Alexander Marras	Janeta Zoldan
Jose del R Millan	

Admission Requirements

The graduate advisor and the Admissions Committee make all admission decisions. Standards for entrance into the program exceed the minimum standards established by the University. Students must have a bachelor's degree with the following coursework or equivalent knowledge: freshman biology, freshman inorganic chemistry, physiology, differential equations, probability and statistics, and calculus-based physics. An applicant with a degree in an area other than engineering must take specified preliminary coursework before applying to the graduate program in biomedical engineering. The coursework does not need to be completed at UT Austin. Information about the admission process is given online.

Admission decisions are based on a careful review of all aspects of each applicant's file, including scores on the Test of English as a Foreign Language, if needed, grade point average, letters of recommendation, résumé, personal statement, transcripts, previous research or work experience, and contributions to the broader impacts of the field.
Only the most qualified applicants are accepted. Graduate Record Examination (GRE) scores are not considered as part of the application file and applicants are not advantaged in the admissions process by

submitting GRE scores. All applications received by the applicable deadline are reviewed holistically. The number of students admitted each semester depends on the availability of supervising faculty members to provide research facilities and possible financial support. Students are admitted for doctoral study. Students interested in a terminal master's degree are required to obtain faculty nomination before applying. Admission is offered for fall entry only.

Admission into the Doctor of Medicine/Master of Science in Engineering dual degree program is only open to current Dell Medical Students. Admission into the integrated Bachelor of Science in Biomedical Engineering/Master of Science in Engineering degree is only open to current biomedical engineering undergraduate students at The University of Texas at Austin.

All applicants whose native language is not English must submit a score on the Test of English as a Foreign Language (TOEFL), unless exempt. More information is given online.