SCHOOL OF BIOMEDICAL ENGINEERING

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The School of Biomedical Engineering (SBME) stands on a foundation of strong faculty and research programs from four CSU colleges: the Walter Scott, Jr. College of Engineering, and the Colleges of Health and Human Sciences, Natural Sciences, and Veterinary Medicine & Biomedical Sciences. The unique structure of the School involves over 70 faculty members representing 14 departments to provide an interdisciplinary focus on improving health, fighting disease, and aiding persons with disabilities. Academic excellence across diverse fields converges into three primary areas of research: (1) regenerative and rehabilitative medicine, (2) imaging and diagnostics, and (3) medical devices and therapeutics.

At the graduate level, SBME offers a Master of Science and a Doctor of Philosophy in Bioengineering, and a Master of Engineering (online and on campus) with a specialization in Biomedical Engineering. See the Graduate and Professional Bulletin for graduate program listings. The Walter Scott, Jr. College of Engineering offers a Bachelor of Science in Biomedical Engineering with a unique five-year program where graduates receive two B.S. degrees: one in Biomedical Engineering and the other in one of three traditional engineering areas - Chemical & Biological Engineering, Electrical Engineering, or Mechanical Engineering. An undergraduate Biomedical Engineering Interdisciplinary Minor is also offered.

Biomedical engineering lies at the interface of engineering, biology, and medicine. With over 40 state-of-the-art biomedical and engineering research labs, including the world-renowned Veterinary Teaching Hospital and Animal Cancer Center, we offer hands-on experience for undergraduate and graduate students to work alongside leading researchers. CSU provides a rich environment for interdisciplinary research and day-to-day collaborations and is positioned to offer unique bioengineering degree programs due to our faculty expertise, the interdisciplinary nature of the SBME, and the highly-ranked veterinary program. Our Biomedical Engineering programs integrate biological, chemical, physical, and mathematical sciences with engineering principles and clinical studies, and our graduates are well prepared for careers in research, education, veterinary or human medicine, and industry.

Biomedical engineers are involved in a wide variety of activities on a daily basis. Practical applications of biomedical engineering include development, design, production, research, and/or teaching in areas such as:

• Designing biomedical materials and/or medical devices and equipment (e.g., pacemakers, assistive devices, exercise equipment for astronauts, creating/improving materials to help joint replacements last longer)
• Developing or improving therapies for fighting cancer, tuberculosis, or other illnesses and diseases (e.g., nanoscaffolding for localized chemotherapy delivery, telemetric sensors to determine healing rates in bone fractures or to detect key chemicals in live tissue with high temporal and spatial resolution)
• Finding better ways to image and/or diagnose illnesses (e.g., using laser-based imaging to detect viruses, developing ways to increase electrical signals to detect threats to food safety and security, designing biosensors to diagnose cancer cells, developing software to determine toxic pesticide levels in people)

Potential Occupations

Biomedical engineering applies engineering principles to medicine and improving quality of life for humans and animals. Biomedical engineers work in a variety of settings. Some biomedical engineers spend their days in the lab, researching new devices and systems that solve medical and health care-related problems. Others might work in clinical settings, run biomedical-focused enterprises, design/manufacture new therapies or diagnostics, assist medical facilities with engineering systems, or engage in regulatory affairs or patent law. Our graduates are well prepared for careers in research, education, or industry.

Undergraduate

Undergraduate Bachelor of Science Programs in Biomedical Engineering

The Bachelor of Science program in Biomedical Engineering has four pathways, each of which provide depth in a traditional area of engineering and breadth in biomedical engineering knowledge and applications. The coursework in these four pathways is designed not only to support biomedical engineering, but also to satisfy the curricular requirements of one of four traditional engineering degrees as administered by partner engineering departments.

The four curricular pathways for the BME B.S. degree are:

• B.S. degree in Biomedical Engineering combined with a B.S. degree in Chemical and Biological Engineering
• B.S. degree in Biomedical Engineering combined with a B.S. degree in Electrical Engineering, Electrical Engineering Concentration
• B.S. degree in Biomedical Engineering combined with a B.S. degree in Electrical Engineering, Laser and Optical Concentration
• B.S. degree in Biomedical Engineering combined with a B.S. degree in Mechanical Engineering

The BME program requires 157-158 credit hours of coursework, depending on the selected pathway, nominally distributed over five years.

In the first two years, students take introductory biomedical engineering courses as well as foundational math, science, and engineering courses. The third year and fourth years solidify expertise in the traditional
engineering major while building strength in biomedical engineering, life and physical sciences courses. The following years allow students to build a more thorough understanding of biomedical engineering, and their studies culminate in a Senior Design project in the fifth year that provides hands-on experience with an interdisciplinary team of peers. This combination of practical application and traditional academic rigor support the breadth and depth of this fairly unique program, and provides excellent preparation and market value for graduates’ next steps in industry, academia, or research.

The Bachelor of Science in Biomedical Engineering at Colorado State University is accredited by the Accreditation Board for Engineering and Technology (ABET). It was first accredited in 2016, and this accreditation is retroactive for all prior graduates of the B.S. in biomedical engineering program. The partner majors include electrical engineering (EE), chemical and biological engineering (CBE), and mechanical engineering (MECH) and these three degree programs are accredited by the Engineering Accreditation Commission of ABET.

The educational objectives of the biomedical engineering program are to prepare our students to:

• demonstrate high professional, social, and ethical standards while examining and addressing the global impact of technology to improve quality of life in society and environment
• apply broad and deep knowledge, practical experiences, and creativity to solving problems at the interface of engineering and the life sciences as individuals and team members
• use their multidisciplinary background to foster communication and collaboration across professional and disciplinary boundaries
• recognize and expand the scope of their knowledge, continue self-directed learning, and identify and create professional opportunities for themselves and others

Graduates in Biomedical Engineering will have:

• an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
• an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
• an ability to communicate effectively with a range of audiences
• an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
• an ability to function effectively on a multidisciplinary team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
• an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
• an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
• an ability to apply principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations), and statistics;

For more information on accreditation requirements, see https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2019-2020.

BME Bachelor of Science Programs

• Biomedical Engineering, B.S. combined with Chemical and Biological Engineering, B.S.
• Biomedical Engineering, B.S. combined with Electrical Engineering, B.S., Electrical Engineering Concentration
• Biomedical Engineering, B.S. combined with Electrical Engineering, B.S., Lasers and Optical Engineering Concentration
• Biomedical Engineering, B.S. combined with Mechanical Engineering, B.S.

Graduate Program in Biomedical Engineering

Students interested in graduate work should refer to the Graduate and Professional Bulletin (http://catalog.colostate.edu/general-catalog/graduate-bulletin) or the School of Biomedical Engineering.

Master's Programs

• Master of Engineering, Plan C, Biomedical Engineering Specialization
• Master of Science in Bioengineering

Ph.D.

• Ph.D. in Bioengineering

Courses

Biomedical Engineering (BIOM)