Biomedical Engineering at MSU

Biomedical Engineering Concentrations can be completed by students who are enrolled in bachelor’s degree programs in the College of Engineering. These concentrations are designed for undergraduates who plan to pursue graduate work in biomedical areas or seek employment in selected medical-related areas. Upon completion, the concentrations will be noted on the final transcript.

How do you define biomedical engineering?


Biomedical engineers develop devices and procedures that solve medical and health-related problems by combining their knowledge of biology and medicine with engineering principles and practices. Many do research, along with life scientists, chemists, and medical scientists, to develop and evaluate systems and products such as artificial organs, prostheses (artificial devices that replace missing body parts), instrumentation, medical information systems, and health management and care delivery systems. Biomedical engineers may also design devices used in various medical procedures, imaging systems such as magnetic resonance imaging (MRI), and devices for automating insulin injections or controlling body functions. Most engineers in this specialty need a sound background in another engineering specialty…in addition to specialized biomedical training...

How do you decide which major to declare if interested in biomedical engineering?

At MSU, majors offering a biomedical engineering related concentration include Biosystems Engineering, Chemical Engineering, Electrical Engineering, Materials Science & Engineering, and Mechanical Engineering. Each one emphasizes areas most closely aligned with its own curriculum. Below is a brief sketch of ways in which these majors may contribute to biomedical engineering fields:

**Biosystems Engineering**

Biosystems engineers identify and solve problems at the interface of engineering and biology. In the biomedical area, biosystems engineering students have opportunities for undergraduate research in areas such as microbial modeling and biosensors for rapid detection of pathogens. In this application area, biosystems engineers find employment with pharmaceutical/healthcare companies, medical supply companies, and federal agencies, as well as continuing their studies in medical, veterinary, and graduate school.

**Chemical Engineering**

Historically, chemical engineers have designed devices, pharmaceutical processes, and artificial organs (such as the artificial kidney). Now chemical engineers are making significant contributions in computational and functional genomics, biosensors, cell and tissue engineering, biomolecular engineering, gene therapy, metabolic engineering, high-throughput drug screening, and drug formulation and delivery.
Electrical Engineering
Electrical Engineering students can take courses in the areas of bio-imaging and biomedical applications of signals and systems, and are given opportunities to conduct independent research with faculty in the areas of biomedical engineering. With the departments focus on developing physical systems and data analysis methods for biomedical applications, some of the current research includes: modeling of physiological systems, cardiovascular physiology, biomedical ultrasonics, medical imaging, neural engineering, development of implantable devices and biomedical signal processing.

Materials Science & Engineering
Biomedical materials engineers seek to create new materials and devices that are used to treat diseases and repair damaged tissues by combining their knowledge and skills in engineering materials design with biology and chemistry. They may conduct research in areas such as tissue engineering (creating new tissues like bone and muscle), and implant development (like total knee and hip replacements), as well as design devices used in various medical procedures (such as screws and plates used in orthopedics). Some will specialize in orthopedics and sports medicine, while others will work in areas such as implant design and manufacturing.

Mechanical Engineering
Mechanical engineers combining biomedical engineering are trained in biomechanical engineering and find employment designing, for example, prosthetics, artificial joints, automotive safety equipment, robotics for telemedicine, heart valves, left ventricle assist devices, and the whole range of medical devices. Research by biomechanical engineers includes studying the strength of bones and soft tissues, the motion of cells, the kinematics of human motion, and the flow of blood.