BIOMEDICAL ENGINEERING
Industry Guide

Introduction

The Biomedical Engineering (BME) program at the University of British Columbia (UBC) is an interdisciplinary hub of innovation, combining principles from engineering, biology, and medicine to address complex healthcare challenges. With world-class faculty and cutting-edge research facilities, UBC BME prepares students to push the boundaries of healthcare technology and biomedical research.

Biomedical Engineers work at the intersection of technology and healthcare, advancing fields such as medical imaging, prosthetics, biotechnology, and health informatics. Their contributions revolutionize patient care, from developing life-saving medical devices to pioneering tissue engineering and regenerative medicine.

This guide highlights industries and companies where Biomedical Engineers can build impactful careers. While not exhaustive, it showcases the diverse and rapidly growing opportunities available within this dynamic and evolving field.

Key Areas of Study
- Medical Devices, Biotechnology, Imaging & Diagnostics, Health Informatics, Rehabilitation Engineering, Biomaterials, Biomedical Signal Processing, Neural Engineering, Bioinformatics, Tissue Engineering, Biomechanics.

Industries

Biomedical Engineering (BME) stands at the intersection of engineering and healthcare, driving innovation across diverse industries to improve lives and advance medical science. In the medical devices industry, BME professionals design and develop life-saving technologies, such as prosthetics, pacemakers, and surgical robots. The biotechnology sector leverages BME expertise for breakthroughs in tissue engineering, drug delivery systems, and synthetic biology.

In imaging and diagnostics, BME contributes to the development of cutting-edge imaging technologies and diagnostic devices that enhance accuracy and efficiency in medical care. The health informatics industry benefits from BME advancements in wearable devices, data analytics, and digital health solutions that improve patient monitoring and treatment.

BME also plays a pivotal role in rehabilitation engineering, creating assistive technologies and prosthetic systems that enhance mobility and independence. In biomaterials, BME professionals innovate materials for applications like implants and regenerative medicine. Collectively, these industries demonstrate the transformative impact of Biomedical Engineering in shaping the future of healthcare.

Industries

MEDICAL DEVICES

As a professional in the medical device industry, you will work on designing, developing, and testing devices that improve patient outcomes and save lives. This industry covers a wide range of products, including diagnostic tools, implantable devices, surgical instruments, and wearable health monitors. Medical device engineers collaborate with healthcare professionals to ensure that devices are both effective and compliant with stringent regulations. Pathways into this field often include internships or co-op programs, certifications in medical device design, and an understanding of regulatory standards like ISO 13485.

ESSENTIAL SKILLS:
- CAD Software (e.g., SolidWorks, AutoCAD)
- Knowledge of Regulatory Standards (e.g., FDA, ISO 13485)
- Prototyping and Testing Methods
- Biomedical Engineering Principles
- Materials Science
- Problem-Solving Abilities
- Communication Skills (including technical writing)

POSITIONS:
- Entry Level: Junior Biomedical Engineer, Medical Device Design Intern
- Mid-level: Biomedical Device Engineer, Medical Device Development Specialist
- Senior: Senior Biomedical Engineer, Medical Device R&D Lead, Regulatory Affairs Manager

AUTOMOTIVE

In the biotechnology industry, you will contribute to advancements in healthcare, agriculture, and environmental sustainability by applying biological processes to develop new products and technologies. Biomedical engineers in this sector work on projects related to genetic engineering, drug delivery systems, synthetic biology, and bio-manufacturing. With the rise of precision medicine and personalized therapies, this industry offers a dynamic and rapidly evolving career path. Entry into this field often involves lab-based research experience, internships, and a strong foundation in molecular biology and genetics.

ESSENTIAL SKILLS:
- Genetic Engineering Techniques
- Cell and Molecular Biology
- Bioprocessing
- Biotechnology Lab Techniques
- Data Analysis and Bioinformatics
- Problem-Solving Abilities
- Communication Skills (including technical writing)

POSITIONS:
- Entry Level: Research Assistant, Biotechnology Engineer Intern
- Mid-level: Biotech Engineer, Bioinformatics Specialist
- Senior: Senior Biotechnology Engineer, Principal Scientist, Biotechnology R&D Lead

IMAGING AND DIAGNOSTICS

Professionals in the imaging and diagnostics field develop and refine technologies that enable early detection and treatment of diseases. You will work with cutting-edge medical imaging equipment such as MRI, CT scanners, and ultrasound systems, ensuring they are effective and reliable for healthcare providers. Engineers in this field may also contribute to diagnostic software that aids in analyzing medical images. This industry often requires expertise in signal processing, image analysis, and working with both hardware and software. Pathways into this field include internships, lab experience, and familiarity with imaging technologies.

ESSENTIAL SKILLS:
- Medical Imaging Technologies (e.g., MRI, CT, Ultrasound)
- Signal Processing
- Image Reconstruction Techniques
- Data Analysis and Machine Learning for Imaging
- Knowledge of Regulatory Standards (e.g., FDA)
- Problem-Solving Abilities

POSITIONS:
- Entry Level: Junior Imaging Engineer, Medical Imaging Intern
- Mid-level: Imaging Systems Engineer, Diagnostic Imaging Specialist
- Senior: Senior Medical Imaging Engineer, Imaging R&D Lead, Imaging Software Developer

Industries

HEALTH INFORMATICS

Health informatics professionals work to improve healthcare delivery through data and technology. You will focus on the integration of healthcare systems, electronic health records (EHR), and telemedicine platforms to optimize patient care and administrative processes. Engineers in this industry work closely with software developers, healthcare providers, and data scientists to design and implement solutions that make health data more accessible and actionable. Skills in data management, software development, and understanding healthcare workflows are essential. Entry into health informatics often involves internships in healthcare IT, certifications, and familiarity with medical data standards.

ESSENTIAL SKILLS:
- Data Management and Analysis
- Healthcare IT Systems (e.g., EHR, EMR)
- Knowledge of Medical Data Standards (e.g., HL7, DICOM)
- Software Development for Health Applications
- Telemedicine Platforms
- Problem-Solving Abilities

POSITIONS:
- Entry Level: Health Informatics Intern, Healthcare Data Analyst
- Mid-level: Health Informatics Engineer, Healthcare IT Specialist
- Senior: Senior Health Informatics Engineer, Health Systems Architect, Director of Health IT

REHABILITATION ENGINEERING

In rehabilitation engineering, you will design and develop assistive technologies and devices that help individuals with physical impairments regain mobility, independence, and quality of life. This can include developing prosthetics, orthotics, exoskeletons, and other assistive devices. Working in this field requires knowledge of biomechanics, material science, and human physiology to ensure that devices are both functional and comfortable for patients. Rehabilitation engineering positions often require hands-on experience with device design and a passion for improving patient outcomes.

- ESSENTIAL SKILLS:
- Biomechanics
- Materials Science for Prosthetics
- Human-Computer Interaction
- Prototyping and Testing
- Device Fabrication Techniques
- Problem-Solving Abilities

POSITIONS:
- Entry Level: Rehabilitation Engineering Intern, Prosthetics Design Assistant
- Mid-level: Rehabilitation Engineer, Assistive Technology Specialist
- Senior: Senior Rehabilitation Engineer, Prosthetics R&D Lead, Director of Rehabilitation Engineering

BIOMATERIALS

Biomaterials engineers develop and refine materials used in medical devices, implants, and prosthetics that interact with biological systems. This field focuses on creating materials that are biocompatible, durable, and functional, with applications ranging from joint replacements to drug-delivery systems. You will work at the interface of materials science, biology, and medicine, testing and ensuring that biomaterials are safe and effective for medical applications. Entry into this field typically requires a strong foundation in materials science, biology, and lab-based research.

ESSENTIAL SKILLS:
- Materials Science
- Biocompatibility Testing
- Polymer Chemistry
- Tissue Engineering
- Regulatory Knowledge (e.g., FDA approval)
- Problem-Solving Abilities

POSITIONS:
- Entry Level: Biomaterials Research Assistant, Materials Engineer Intern
- Mid-level: Biomaterials Engineer, Medical Materials Development Specialist
- Senior: Senior Biomaterials Engineer, Principal Biomaterials Scientist, R&D Lead

Industries

TISSUE ENGINEERING AND REGENERATIVE MEDICINE

In tissue engineering and regenerative medicine, you will work on developing artificial tissues and organs to replace or repair damaged biological systems. This field combines elements of biology, engineering, and medicine to create solutions for conditions that currently have no cure. The goal is to regenerate tissues and organs to restore normal function, with applications ranging from skin grafts to organ transplants. This field requires a deep understanding of cell biology, materials science, and bioengineering. Entry to this industry typically involves internships in research labs, knowledge of stem cell biology, and expertise in bioreactor design.

ESSENTIAL SKILLS:
- Cell Culture and Stem Cell Biology
- Tissue Scaffold Design
- Bioreactor Design and Optimization
- Regenerative Medicine Techniques
- Biomaterials for Tissue Engineering
- Problem-Solving Abilities

POSITIONS:
- Entry Level: Tissue Engineering Research Assistant, Regenerative Medicine Intern
- Mid-level: Tissue Engineer, Regenerative Medicine Specialist
- Senior: Senior Tissue Engineer, Director of Regenerative Medicine, Principal Research Scientist

Technical Skills

CORE SKILLS

BIOMEDICAL SIGNAL PROCESSING

Proficiency in analyzing and processing biological signals such as ECG, EEG, EMG, and blood pressure signals. This includes understanding noise filtering, feature extraction, and signal analysis techniques for medical applications.

MEDICAL DEVICE DESIGN

Experience in designing medical devices that meet regulatory standards. This involves knowledge of materials, biocompatibility, testing protocols, and ensuring the devices are safe and effective for patient use.

BIOMATERIALS

Understanding the properties and applications of biomaterials in medical devices, implants, and prosthetics.

TISSUE ENGINEERING

Knowledge of tissue engineering principles, including the development of artificial tissues and organs

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BIOMECHANICS

Understanding of mechanical principles as applied to biological systems. This includes knowledge of human motion, joint mechanics, and the development of assistive devices like prosthetics and orthotics.

MEDICAL IMAGING

Familiarity with medical imaging techniques such as MRI, CT, ultrasound, and X-ray. This includes understanding image processing, segmentation, and the integration of imaging technologies for diagnosis and treatment.

HEALTH INFORMATICS

Knowledge of health information systems, including electronic health records (EHR), telemedicine platforms, and data analytics.

CONTROL SYSTEMS IN BIOMEDICAL APPLICATIONS

Understanding of control systems as applied to biomedical devices, such as regulating insulin pumps, pacemakers, and other life-sustaining systems. This includes feedback loops, stability analysis, and control algorithms for medical devices.

SOFTWARES AND TOOLS

MEDICAL DEVICE DESIGN TOOLS

- SolidWorks: A 3D CAD software used for designing medical devices and implants, providing detailed models for manufacturing and prototyping.
- AutoCAD: Software for 2D and 3D design and drafting, often used for designing medical components and equipment.

BIOMEDICAL SIGNAL PROCESSING TOOLS

- MATLAB: Used for analyzing and processing biological signals, implementing algorithms for signal filtering, noise removal, and feature extraction.
- LabVIEW: A graphical programming environment used for biomedical data acquisition, measurement, and signal processing.

MEDICAL IMAGING SOFTWARE

- OsiriX: A leading medical imaging software platform for viewing and processing DICOM images used in clinical practice.

STATISTICS & DATA ANALYSIS TOOLS

- R
- SPSS: Statistical software for analyzing medical research data, including hypothesis testing, regression, and data visualization.

SIMULATION & MODELING SOFTWARE

- COMSOL Multiphysics: Used for simulating the physical behavior of biological systems, including heat transfer, fluid flow, and electromagnetics.
- ANSYS: Used for simulation of biomedical devices.

CLINICAL TRIAL MANAGEMENT SOFTWARE

- Medrio: A cloud-based platform for managing clinical trials and collecting data from medical research and patient studies.
- REDCap: A secure, web-based application for data collection and management used in clinical research.

How to get Involved

- Engineering Design Teams
- BME Undergraduate Student Association
- EUS
- UBC Clubs
- Personal Projects
- UBC Work Learn Program

Other Resources

- American Institute for Medical and Biological Engineering (AIMBE)
- About your degree - Biomedical