

Biomedical Engineer

At a Glance

Biomedical engineers (BMEs) develop instruments, techniques, and devices used by doctors to diagnose and treat people who are sick or hurt.

BC Focus Areas

Science & Applied Science

Earnings

Earnings Range: 45K - 140K

Level of Education

- University

Core Tasks

- Meet with medical personnel to discuss the item that is needed
- Design new equipment using software
- Test and repair equipment
- Clinical BMEs work in hospitals where they oversee the purchase and use of technology
- Bioinstrumentation engineers design computer systems for instruments such as CAT scanners

Attributes & Abilities

- Enjoy math and science
- Communication skills
- Problem-solving skills
- Curious and creative
- Detail-oriented

Workplace

- Employed by medical manufacturing companies, government agencies, hospitals, and medical research facilities
- Spend a lot of time in offices or labs, interacting with other engineers, scientists, techs, and administrative personnel
- Some work on factory floors, monitoring production and ensuring quality
- Clinical BMEs may spend time monitoring equipment during medical procedures

Job Description

Biomedical engineers (BMEs) combine biology and medicine with engineering to improve health care. The earliest achievements in medical engineering were things like crutches and wooden teeth. Today we have pacemakers, CAT scans, artificial organs, and hundreds of other instruments, techniques, and devices to diagnose and treat people who are sick or hurt.

Biomedical engineering is a broad and rapidly expanding field with many areas of specialization. For example, bioinstrumentation engineers design microcomputers for instruments such as CAT scanners, monitors used in surgery, and sensors that measure blood chemistry.

Biomechanics involves the study of motion and the flow of substances in the body. Researchers in this field have

developed artificial “spare parts” for the human body, such as hearts, heart valves, kidneys, hips, and joints.

Biomaterials researchers develop the materials used for artificial parts. The materials have to be non-toxic, stable, and strong. They work with living tissue as well as metals, ceramics, and other materials.

Rehabilitation engineers develop technology to expand the capabilities of people with physical impairments. They might design special wheelchairs, communication devices, or customized modifications to the home or job site of a person with disabilities. Rehabilitation engineers often work directly with their clients.

A biomedical engineer can focus either on research or on practical work in a hospital. Those who work in hospitals are called “clinical BMEs.” They oversee the purchase and use of biomedical technology.

Working closely with doctors, nurses, and other staff, clinical BMEs decide what technology is best suited to the hospital’s needs (and its budget). They then teach the other health professionals how to use the technology, and make sure it is properly maintained and working smoothly.

Working Conditions

Biomedical engineers (BMEs) are employed by medical manufacturing companies, government regulatory agencies, as well as by hospitals, universities, and medical research facilities.

BMEs working for medical manufacturing companies may concentrate on designing and testing new products, or they might move into management positions. Those in government positions test biomedical technology for effectiveness and safety. They also establish general safety standards.

Clinical BMEs rarely work directly with patients, but they do work in teams with other health professionals, including doctors, nurses, technologists, and other hospital staff.

Specific working conditions for BMEs, such as typical hours and levels of stress, vary according to where they are employed. Those who work in hospitals may have to be on their feet much of the day, but the job is not otherwise physically demanding.

Biomedical engineering is a rapidly evolving field, and BMEs in all sectors have to work hard to keep up with research and developments relevant to their work. The job requires a commitment to continual learning.

Earnings

Salaries for biomedical engineers vary with their level of responsibility and their level of education. Typically, engineers who complete a graduate degree (either a master’s degree or a PhD) earn more than those who enter the profession with a bachelor’s degree. Similarly, the type of employer also affects salary levels. For example, those who work for medical equipment manufacturers tend to earn more than engineers who work in hospitals.

Starting salaries in the private sector and in hospitals range from about \$45,000 to \$70,000 a year. Once they have acquired some experience, biomedical engineers often earn between \$60,000 and \$85,000 a year. Those who move into senior positions may earn between \$85,000 and \$140,000 a year.

In addition to a salary, biomedical engineers working on a full-time basis in hospitals, universities, and established private sector companies generally receive health and dental benefits, paid vacation and sick days, and contributions to retirement plans.

Education

To become a biomedical engineer, you must first complete a bachelor’s degree either in engineering or in science, and then do a special master’s program in biomedical engineering (BME).

Some universities offer interdisciplinary bachelor’s degree programs in BME, or concentrations on biomedical technology within other engineering programs. These options offer good preparation for BME master’s programs. It may be possible to find some entry-level jobs with only a bachelor’s degree, but most employers favour

applicants with a master's degree and most positions require one.

Master's degree programs generally accept students with bachelor's degrees in biomedical, chemical, electrical, or mechanical engineering. They also take students with degrees in the physical or life sciences (such as physics, chemistry, biology, or physiology).

BME master's programs are offered by many universities, and may be either 1 or 2 years in length. In order to research and teach biomedical engineering at a university, you need to complete a PhD in the field. After the master's degree, it usually takes 4 years to complete a PhD program.

Related College & University Programs

- Biomedical Engineering
- Biomedical Engineering Technology
- Biomedical Sciences

Other Suggested Qualifications

In addition to talent and passion for engineering and science, biomedical engineers should have good communication skills. Because their work involves knowledge of many areas of science and engineering, they are often required to explain technical information to more specialized scientists and engineers, as well as to non-specialists. In Canada, engineers who wish to offer their services directly to the public need to register as Professional Engineers (P.Engs) with their provincial or territorial association to legally offer their services as engineers. To be eligible for the P.Eng designation you must complete an engineering program, acquire several years of supervised work experience, and pass an exam.

Suggested High School Subjects

Grade 9

English
Mathematics
Science
Social Studies
Creative Arts
Computers
Health & Physical Education
French

Grade 10

English
Mathematics
Science
Social Studies
Personal & Career Development
Computers

Grade 11

English
Mathematics
Probability & Statistics
Biology
Chemistry
Physics
Social Studies
Computers

Grade 12

English
Mathematics
Algebra & Geometry
Biology
Chemistry
Physics
Social Studies
Computer Science

Important

- Check with your advisor to make sure that your course selections satisfy your graduation requirements.
- Courses available may vary from school to school.

Sample Career Path

People take different pathways through their careers, but no one starts at the top. This is an example of how the

earnings, education and experience requirements, and responsibilities might progress for someone in this occupation.

Level 1

Sample Title	Entry-Level Clinical Engineer
Earnings	\$45,000 to \$65,000 a year
Requirements	• Master's degree in biomedical or clinical engineering
Responsibilities	Hardware and software development; some project management.

Level 2

Sample Title	Clinical Engineer
Earnings	\$65,000 to \$90,000 a year
Requirements	• Master's degree in biomedical or clinical engineering • At least 5 years experience
Responsibilities	Clinical consulting and advising; technology management; project management.

Level 3

Sample Title	Head of Biomedical Engineering Department
Earnings	\$100,000 to \$140,000 a year or more
Requirements	• Master's degree in biomedical or clinical engineering • At least 10 years experience • PhD usually required for higher salaries
Responsibilities	Department management; strategic planning; clinical consulting and advising.

Related Careers

Here are some other occupations that you might be interested in. Click on an occupation name to learn more.

- Biologist
- Biotechnologist
- Chemical Engineer
- Doctor
- Electrical Engineer
- Industrial Designer
- Kinesiologist
- Materials / Metallurgical Engineer
- Mechanical Engineer

- Medical Imaging Tech
- Medical Lab Tech
- Nuclear Engineer
- Pedorthist
- Prosthetist / Orthotist
- Scientist
- Surgeon

Focus Areas

Focus Areas are groups or families of occupations that share common characteristics such as knowledge requirements, skill sets, and/or goals.

Science & Applied Science

National Occupational Classification

NOC Code: 2148

Other Resources

Canadian Medical and Biological Engineering Society (CMBES)

<http://www.cmbes.ca>

This organization promotes the theory and practice of medical device technology and serves those in the field. Be sure to have a look in their Schools section to find out about different learning opportunities around Canada.

BioMedical Engineering OnLine

<http://www.biomedical-engineering-online.com>

All the articles in this online journal are free. You can browse through the latest and most viewed articles on the home page or run a search.

National Engineering Month

<http://www.nem-mng.ca>

This is an annual celebration of engineering excellence. Click on Becoming An Engineer for more information on education and training.

Engineering Schools – Top 10 Qualities of a Great Engineer

<http://www.engineeringschools.com/resources/top-10-qualities-of-a-great-engineer>

Find out what qualities are needed to be a successful engineer!

Engineers Canada – Accredited engineering programs by institution

http://www.engineerscanada.ca/files/w_Accredited_Engineering_programs.pdf

Engineers Canada represents engineers of all disciplines across Canada and provide a listing of accredited engineering programs.

Engineers Canada – Why Engineering?

<http://www.whyengineering.ca>

This website is targeted to parents of future engineers. Read more about the career here!

P.Eng – The License to Engineer

<http://www.peng.ca>

Learn all about the P.Eng (Professional Engineer) licence at this informative website developed by Engineers Canada.

Biomedical Engineering Society (US)

<http://www.bmes.org>

This society promotes the use and knowledge of biomedical engineering. Scroll over About BMES and click on Examples And Explanations Of BME to find out more about the career and biomedical engineering areas of focus.

TryEngineering.Org (US)

<http://www.tryengineering.org>

Find helpful career and educational resources here. Be sure to click on Explore Engineering to learn about engineering and engineering technology careers.