# Career/Industry Forecast

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**Job Title:** Biomedical Engineering

**Job Description:**

A biomedical engineer implements engineering designs into medical practices. They combine math and science to create and maintain medical devices and products that assist humans in various ways such as prosthetics, organ implants, diagnostic equipment and computer software. Biomedical engineers usually work in laboratories or clinical settings in teams with other scientists, engineers, and healthcare professionals. The environment may change depending on the stage of your product as ones on final stages might require biomed engineers to work in hospitals installing and testing them.

**Training, Education, and Certification:**

- **Education:** Obtain a bachelor's degree in biomedical engineering, life sciences, biotechnology, or a related engineering field. Doing a master's program or any other advanced degrees can enhance your knowledge in the field and help you specialize in a certain aspect of it as well.
- **Certification:** Engineers seek an Engineering in Training (EIT) or Professional Engineer (PE) certification. For a more focused certificate for the biomedical field you need to obtain Biomedical Engineering Certification (CBET).
- **Licensing:** Requirements vary by region; for Texas specifically you need to retrieve a license from the Texas Board of Professional Engineers.
- **Security Clearance:** Might be required for projects involved with sensitive information or government related projects.

**College or Post High School Programs and Recommended High School Courses:**

During High School it is recommended to have at least one semester of trigonometry (included in Pre-Calculus or Statistics in our school), one year of elementary algebra (or Algebra 1), intermediate/advanced algebra (Algebra 2), geometry, chemistry, and physics. These classes will help students establish the base for the higher learning that will take place during their undergraduate career.

There are three major categories that biomedical engineering can be broken down into

- **Biomechanics**: the study of structure and function of biological systems applied onto mechanics.

- **Bioinstrumentation:** focuses on creating and using tools to measure, record, and analyze biological information.
- **Tissue engineering:** create solutions and build products that would restore, maintain, or improve damaged tissues or whole organs

If you plan on focusing on biomechanics then a mechanical engineering bachelor's degree would be the best suited, bioinstrumentation overlaps with electrical engineering and tissue engineering would be more related with a biomedical engineering degree. Getting a job right after just the bachelor's degree of biomedical engineering is proven to be very hard so it is often recommended to focus on another engineering major with a minor in biomedical engineering and getting outside internships and experiences for it to obtain a job right after graduating. Going for a mechanical engineering degree instead of biomedical engineering also gives you the upper hand with companies who believe that people with mechanical degrees hold more experience in engineering than their biomedical counterparts. This disconnect between academia and the industry makes it harder for biomedical engineering students to get a job since companies would rather fill the gap of the lack of knowledge on anatomy and physiology in engineers than fill the gap of the lack of engineering knowledge in biomedical engineers. All this taken into consideration it is safe to say that a mechanical or electrical engineering bachelor's degree would be a better option than a biomedical engineering degree.

If you did decide to take a biomedical engineering undergraduate then you most likely would have to opt for a masters degree as well in order to specialize in a certain aspect of the field (biomechanics, bioinstrumentation, tissue engineering, etc). This is not necessary though a bachelor's degree also makes you capable enough for a job in biomedical engineering.

**National and Local Professional Organizations:**

**National:**

- American Institute for Medical and Biological Engineering
- American Society of Biomechanics
- American Society for Engineering Education, Biomedical Engineering Division (ASEE BME)
- American Society of Mechanical Engineers, Bioengineering Division
- Association for the Advancement of Medical Instrumentation

**Local:**

- Biomedical Engineering Society Texas A&M University
- Djo
- Integer Holdings Corporation
- Velentium

**Related Areas:**

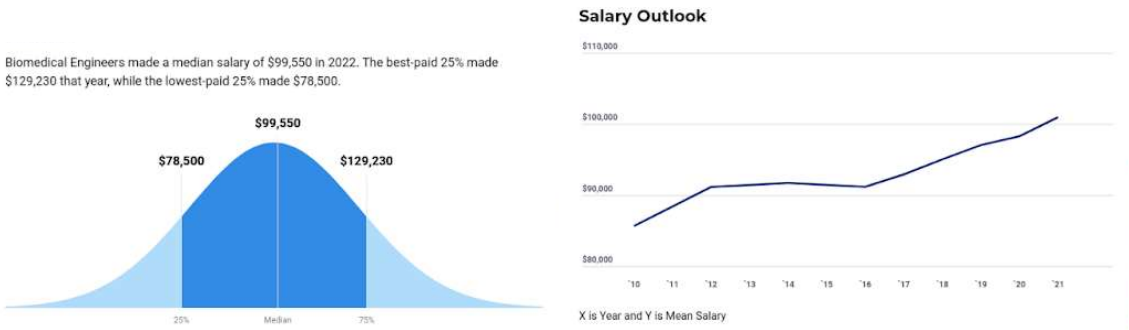
If a biomedical engineer aims for a biomedical engineering degree then related areas are:

- **Clinical Engineering:** Managing medical equipment in healthcare ensuring that they are properly maintained and working.
- **System Biology:** studies biological systems and uses computational models to understand them closer.
- **Pharmaceutical Engineering:** designs and develops drug delivery systems ensuring that drugs reach the right part of the body.
- **Rehabilitation Engineering:** designs and improves technology used in rehabilitation for people with disabilities.

If a biomedical engineer aims for a mechanical engineering degree then related areas are:

- **Aerospace engineering:** designs, develops, and tests aircrafts or spacecrafts.
- **Robotics and automation:** focuses on robots that can be used in various fields from manufacturing to healthcare.
- **Mechatronics:** combines mechanical engineering with software aspects to create smart products.
- **Structural Engineering:** focuses on structures that hold heavy loads such as buildings, bridges, or other infrastructures.

**Salary:**




The salary of a biomedical engineer is considerably high and can be higher as you gain more experience and leadership in the field. The chart on the left side displays the average entry, middle, and high level salaries of biomedical engineers while the one on the right gives an outlook on how salaries have become higher as the years go by.

**Career Outlook:**

According to articles, biomedical engineering is predicted to grow 7% every year from 2023-2033, this is faster than all occupations currently. Around 1400 openings are available per

year, this is due to the labor force leaving the workplace- either by leaving the job, switching workforce or even retiring - allowing for the field to have a growing need for workers.

**Terminology:**

- **Pharma:** Companies/Organizations that create treatments with synthetic chemistry; often referring to larger companies such as Pfizer and Vertex.
    - **Biopharma:** Is a subset of pharma; molecular drugs that are similar to pharma but produced through biological means.
- **Biotech:** Creates treatment with compounds from bodily organisms like antibodies.
- **Therapeutics:** Describes companies that are affiliated with treating diseases or reducing pain for patients.
- **Synbio:** Uses synthetics for biological systems and genes, is data-driven.
- **Diagnostics:** Finding and identifying diseases.
- **Medtech:** Industries that deal with medical device design and deployment.
    - **NeuroTech:** A branch of medtech that focuses on the neurological (brain) part of your body.
- **Digital Health:** Uses digital technologies such as apps, IoT, ios, or machine learning with healthcare for increased efficiency.
- **Biomaterials:** develops natural, bioengineered, or artificial materials to replace tissues.
- **Biofabrication:** Bioengineering or using biological organisms to make new material for consumers or medical purposes.
- **Nanotech:** focuses on design and manufacturing of extremely small devices.
- **Microfluidics:** uses small (micro) tubes to redirect liquids and is usually used for diagnostics.
- **Imaging:** Industry that gets, compiles, and analyzes medical images as well as data.
- **Biomechanics**: the study of structure and function of biological systems applied onto mechanics.
- **Bioinstrumentation:** focuses on creating and using tools to measure, record, and analyze biological information.
- **Tissue engineering:** create solutions and build products that would restore, maintain, or improve damaged tissues or whole organs

**Analysis:**

I learned that my initial interest in engineering, which began with computer science classes during my freshman year, has evolved significantly. Initially, I saw engineering as a stereotypical and bland occupation, but over time, as I experimented with coding and applied it to various projects, I discovered a deeper passion for the field. My experience at the UT Austin summer camp, where I built an autonomous car, solidified my interest in robotics. I realized that my passion lies not just in coding but in understanding the technical aspects of how robots

function. This project itself definitely sealed the deal to an already finalized decision for opting biomedical engineering as a career.

To me the realization that marks my shift in motivation to pursue a career is important. I used to want a job that would allow me to make a lot of money, buy a mansion, a lot of cars, and vacation several times in a year but while researching biomedical engineering I put all of those concerns behind me. I didn't pay a whole lot of attention to the materialistic aspects of the occupation rather the fact that I had genuine will to continue on this path. Even though I had multiple moments where I didn't grasp a concept as quickly as my peers I had the willpower to keep grinding on the problem and understand how it is working the way it is working.

My perspective of engineering as a bland career option was changed a few years ago but this assignment really helped me gain a new appreciation for biomedical engineering. Learning about the different components of the same subjects varies so vastly has helped me see the profession as a team effort rather than individual efforts. Being a part of this industry helps me be a crucial part of the development of processes that can help save numerous lives and advance our society.

I am definitely more encouraged to continue with this topic and am even more interested in deep diving on a specific aspect of it. I want to explore deeper and delve into the exact type of biomedical engineering I want to do such as biomechanics, tissue engineering, etc. Watching vlogs of biomedical engineers and reading articles about their initiative makes me want to learn more and possibly be a part of the community one day.

I will find a specification of biomedical engineering that I am interested in and find local professionals that are educated about the topic. I want to reach out to them and be exposed to as many aspects of not only biomedical but also engineering in general. Any experience gained, any knowledge acquired- no matter how big or small - progresses towards a wiser person; in the future I want to take the steps to becoming a wiser more intelligent person not only in biomedical engineering but also just life itself.

**Work Cited:**

"Research / Research Areas: Biomechanics." McCormick School of Engineering, Northwestern University, www.mccormick.northwestern.edu/biomedical/research/areas/biomechanics.html#:~:text=Biomechanics%20is%20the%20study%20of,organs%2C%20cells%20and%20cell%20organelles. Accessed 29 Aug. 2024.

"About." UC Berkeley Department of Bioengineering, University of California, Berkeley, bioeng.berkeley.edu/research/bioinstrumentation#:~=Bioinstrumentation%20is%20the%20development%20of,diagnosis%20and%20treatment%20of%20disease. Accessed 29 Aug. 2024.

"Tissue Engineering and Regenerative Medicine." National Institute of Biomedical Imaging and Bioengineering, U.S. Department of Health and Human Services, www.nibib.nih.gov/science-education/science-topics/tissue-engineering-and-regenerative-medicine#:~:text=The%20goal%20of%20tissue%20engineering,limited%20use%20in%20human%20patients. Accessed 29 Aug. 2024.

Foley, [Author's First Name]. "How to Know If Biomedical Engineering Is a Good Major for You." Engineering Expectations, 5 Apr. 2021, engineeringexpectations.com/biomedical-engineering-good-major/#:~=If%20your%20goal%20is%20to,these%20majors%20than%20in%20biomedical.

"Texas Biomedical Engineering Schools - Educating Engineers." Educating Engineers - Find Engineering Schools and Degree Programs, 18 Oct. 2022, educatingengineers.com/states/texas/biomedical-engineering/#:~=Before%20you%20can%20officially%20begin,and%20a%20%24200%20licensing%20fee. Accessed 29 Aug. 2024.

"Erik Jonsson School of Engineering and Computer Science." Biomedical Engineering (BS) - UT Dallas 2022 Undergraduate Catalog, The University of Texas at Dallas, catalog.utdallas.edu/2022/undergraduate/programs/ecs/biomedical-engineering. Accessed 29 Aug. 2024.

"What You Need to Know about Becoming a Biomedical Engineering Major." U.S. News & World Report, www.usnews.com/education/best-colleges/biomedical-engineering-major-overview. Accessed 29 Aug. 2024.

"Top 22 Bio-Medical Engineering Innovators in Texas." Inven, inven.ai/company-lists/top-22-biomedical-engineering-companies-in-texas. Accessed 29 Aug. 2024.

University, Wayne State. “What Is Biomedical Engineering?” College of Engineering, engineering.wayne.edu/careers/explained/biomedical. Accessed 29 Aug. 2024.
"Home: Biomedical Engineering Texas A&M University." BMES TAMU, www.bmestamu.com/. Accessed 29 Aug. 2024.

"Library Guides: Biomedical Engineering: Professional Organizations." Professional Organizations - Biomedical Engineering - Library Guides at Penn State University, guides.libraries.psu.edu/c.php?g=318448&p=2258484. Accessed 29 Aug. 2024.

"Biomedical Engineer Salary." U.S. News & World Report, money.usnews.com/careers/best-jobs/biomedical-engineer/salary. Accessed 30 Aug. 2024.

"Biomedical Engineering Industry Terms." Office of Career Strategy - Yale University, 10 July 2023, ocs.yale.edu/resources/biomedical-engineering-industry-terms/.