



Biomedical Engineering, Pharmaceutical, & Medical Manufacturing Industry Resource Guide

Background: The pharmaceutical and medicine manufacturing industry is focused on creating a variety of medicines and other health products that will improve the lives of people. The pharmaceutical industry is mainly known for its prominence in research and development (R&D) of new drugs, yet the actual manufacturing of these drugs is the last stage in a much longer process. This process starts with the R&D departments testing thousands of chemical compounds in the effort of finding a new drug. A large part of this is applied research, where scientific knowledge is used to develop a drug targeted to a specific use. After a drug is developed, it is tested through a screening process and after this, clinical investigations are conducted where the drug is tested on human patients. After the drug passes animal and clinical tests, the U.S. Food and Drug Administration's Center for Drug Evaluation and Research must review the drug's performance and approve it for commercial use. Once this approval is given, the drug is manufactured and marketed to the public.

The field of biomedical engineering encompasses the process of testing the millions of combinations to create new drugs, where engineering (genetic engineering, tissue engineering, fluids engineering) is required. "By definition, biomedical engineering integrates physical, chemical, mathematical, and computational sciences and engineering principles to the studies of biology, medicine, behavior, and health. Among the many applications are advances in materials, processes, implants, devices and informatics geared toward patient rehabilitation and improved quality of life.

Biomedical engineers aim to improve "human health through cross-disciplinary activities that integrate the engineering sciences with the biomedical sciences and clinical practice." Biomedical engineers have been responsible for various scientific advances, among them artificial joints, magnetic resonance imaging (MRI), the heart pacemaker, arthroscopy, angioplasty, bioengineered skin, kidney dialysis, and the heart-lung machine.

Career Pathways and Lifestyle: Companies hire professionals in this field because of their technical expertise, problem-solving ability, and adaptability. Most people in this field work for large science and technology companies, manufacturers, laboratories, pharmaceutical companies, colleges and universities, or medical entities. The work is generally problem-based and requires adherence to protocols and standard research and laboratory methodologies.

Most entry-level positions are a part of larger team typically managed by a senior scientist or team leader. New employees undergo intense training program and are required to adhere to standard protocols and follow applicable guidelines and laws governing research and design. An advanced degree is typically required to move into more senior roles in the field and to lead individual projects and teams.

Points of Entry: Many of the top firms offer internships (typically between the junior and senior years for undergraduates and between the first and second years for graduate students). Many people enter the profession through an internship that may convert to a job offer upon completion. Due to the growing nature of the industry, organizations recruit heavily on campus and seek to secure top-talent from schools like Hopkins. Positions can be found through Handshake or on individual company websites under either entry-level or experienced job postings.

Relevant Sample Areas of Specialization within the Industry:

- Scientist, Engineer, Technician
- Bioinstrumentation
- Systems Physiology
- Research and Development
- Science Technician
- Biomechanics
- Clinical Engineering
- Medical Instrumentation
- Sales and Related Jobs
- Biomaterials
- Rehabilitation Engineering
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What Employers Want: Individuals entering the field are often very-well educated. The entry-level degree is a bachelor of science, often in CHEMBE, Biomedical Engineering, chemistry, biology, mathematics, or a related field with many positions requiring graduate work in order to advance within employer organizations. Most applicants share in common several important skills and qualifications that both large and small companies find desirable including:

- Excellent Written and Oral Communication Skills
- Strong Research, Statistical, and Quantitative Skills
- Operation and Upkeep of Lab Equipment
- Materials Design and Development
- High-level Problem Solving Ability
- An Orientation Towards Working in Teams
- Ability to Analyze and Distill Lots of Information
- Proven Leadership Ability
- Ability to Build and Maintain Relationships
- Well-rounded Life Experience (global travel, cultural exposure, language training, etc.)

In addition, some positions may require more specialized knowledge including, but not limited to:

- Specific Computer and/or IT Skills
- Foreign Language Proficiency
- Private Sector Experience
- Finance and Budgeting Experience
- A Security Clearance (or ability to get one)
- Experience Living and Working Abroad
- Previous Experience in Leadership Positions
- Specific Academic or Technical Knowledge

Considering Consulting? A career in the Biomedical Engineering, Pharmaceutical, or Medical Manufacturing Fields can be very rewarding as you're typically working on innovative projects to help improve health and well-being. You will work hard and continue to develop skills during your time on the job. If you're considering a career in this field, consider attending events sponsored by the Career Center, conducting an informational interview with a JHU alumnus who is already working in the field, or visiting any of the professional association websites listed below.

Leading Firms

Johnson & Johnson www.jnj.com

Pfizer
www.pfizer.com

Novartis
www.us.novartis.com

Merck & Co.
www.merk.com

Bristol-Myers Squibb www.bms.com

Amgen
www.amgen.com

MedImmune
www.medimmune.com

Oriris Therapeutics, Inc.
www.oriris.com

Boston Scientific
www.bostonscientific.com

3M
www.3m.com

Professional Associations: Each industry field has at least one (but many times several) professional associations that serve professionals (including students) in that field. Many provide research on trends, access to job boards, and options to learn new skills through webinars, annual conferences, and industry publications (journals, newsletters, etc.).

A Sampling of Professional Associations in the Consulting Industry:

American Association of Pharmaceutical Scientists	Biotechnology Industry Organization
American Health Information Management Association	Pharmaceutical Research and Manufacturers of America
American Society of Mechanical Engineers: Bioengineering	Biomedical Engineering Society
American Pharmaceutical Association	European Society for Engineering in
Association The Food and Drug Administration	Medicine Institute for Biomedical Science