Medical Device Manufacturing

A medical device is an instrument, apparatus, implant, in vitro reagent, or similar or related article that is used to diagnose, prevent, or treat disease or other conditions, and does not achieve its purposes through chemical action within or on the body (which would make it a drug). Whereas medicinal products (also called pharmaceuticals) achieve their principal action by pharmacological, metabolic or immunological means, medical devices act by other means like physical, mechanical, or thermal means. Medical devices vary greatly in complexity and application. Examples range from simple devices such as tongue depressors, medical thermometers, and disposable gloves to advanced devices such as computers which assist in the conduct of medical testing, implants, and prostheses. The design of medical devices constitutes a major segment of the field of biomedical engineering. — WIKIPEDIA

Massachusetts Job Growth Forecast of Typical Jobs Found in Medical Device Manufacturing

JOB TITLE	EMPLOYMENT 2012	EMPLOYMENT 2022	AVERAGE ANNUAL JOB OPENINGS	AVERAGE ANNUAL WAGE
Engineers	48,476	51,816	1,593	$95,363
Life, Physical, and Social Science Technicians	12,316	14,144	582	$47,714
Life Scientists	18,085	20,642	694	$92,280
Physical Scientists	8,941	10,061	351	$82,208
Medical and Clinical Laboratory Technicians	5,302	6,575	266	$42,450
Software Developers, Applications	27,353	32,937	909	$103,250
Software Developers, Systems Software	30,032	36,293	1,011	$113,250

Source: Massachusetts Executive Office of Labor and Workforce Development

Necessary Skills

Workers in Medical Devices need skills such as math, science, computers, engineering, technical reading and writing, and communication along with teamwork, creative thinking, and problem solving.

Participating North Shore Medical Device Companies

- **Analogic Corporation** – Peabody, MA
- **Microline Surgical** – Beverly, MA

Company Profile: Analogic

Analogic creates innovative technology that improves the practice of medicine and saves lives. For over 40 years Analogic has created markets by anticipating and solving some of the world's most complex medical and engineering challenges. Today, specific areas of expertise include developing enabling technologies used in computed tomography (CT), ultrasound, digital mammography (DM), and magnetic resonance imaging (MRI). The company also develops state-of-the-art threat detection

systems for airport checked-baggage screening and checkpoint screening as well as motion controls. Analogic employs approximately 800 people in several locations, with its global headquarters in Peabody, MA. Jobs including mechanical and electromechanical engineering, physicists and other scientists, computer software experts, regulatory experts, and manufacturing technicians.

Company Profile: Microline Surgical

Microline Surgical develops and manufactures high precision open and laparoscopic surgical instruments. Microline's laparoscopic reposable instruments provide a cost effective eco-friendly solution for today's operating room. The MiFusion product line offers a broad spectrum of open and laparoscopic instruments used to seal and divide tissue utilizing proprietary Thermal Fusion technology. The company strives to be innovative and customer-centric so as to develop products that provide unique value, both clinically and economically. Currently the company employs 185 people in a variety of positions including industrial and electromechanical engineers, regulatory experts, assembly, and machining.

Critical Technical and Core Competencies

Medical device companies require a high level of math skills, as well as the ability to collaborate and work in teams. In addition, companies look for individuals who show initiative and have a strong ability to follow through with this initiative. Employees should have a passion for the work, be enthusiastic, reliable and focused. Engineers are highly valued, but the preferred engineer is one that can move beyond theory and into product design with a strong level of manual dexterity.

High School graduates with vocational training and the interest and capability to continue learning are also highly valued. Individuals who have work on robotics projects and have the ability to use manufacturing hardware such as screw drivers and wrenches are a plus. The ability to take a design to the manufacturing level, i.e., transfer skills from theoretical to product, is highly valued.

Employees also must be strong in communication skills, Microsoft products, and SolidWorks. Companies often provide tuition reimbursement as well as in-house training. Many companies are interested in hiring women as part of diversifying their workforce.

Other North Shore Medical Device Companies

- **Medtronic** – Danvers, MA
- **NeuroLogica Corporation** – Danvers, MA
- **Helix Medical** – Gloucester, MA

Advanced Manufacturing

Advanced Manufacturing is a relatively new concept not fully defined in a uniform manner by researchers and those in the field. The term "advanced manufacturing" encompasses many of the developments in the manufacturing field during the late 20th and early 21st centuries, including high tech products and processes and lean, green, and flexible manufacturing, among others. No one definition captures everything said about advanced manufacturing, although the majority of definitions found on the web include the use of innovative technology to improve products and/or processes, and many also include the use of new business/management methodologies. — WIKIPEDIA

Massachusetts Job Growth Forecast of Typical Jobs Found in Advanced Manufacturing Companies

JOB TITLE	EMPLOYMENT 2012	EMPLOYMENT 2022	AVERAGE ANNUAL JOB OPENINGS	AVERAGE ANNUAL WAGE
Engineers	48,476	51,816	1,593	$95,363
Drafters, Engineering Technicians, and Mapping Technicians	18,931	18,385	385	$57,559
Computer-Controlled Machine Tool Operators, Metal and Plastic	2,556	2,669	83	$41,930
Heavy and Tractor-Trailer Truck Drivers	22,429	24,796	596	$47,170
Industrial Machinery Mechanics	3,916	4,589	180	$53,570
Inspectors, Testers, Sorters, Samplers, and Weighers	8,524	8,614	196	$42,320
Machinists	9,145	9,124	210	$47,640
Welders, Cutters, Solderers, and Brazers	2,986	2,947	73	$46,380

Source: Massachusetts Executive Office of Labor and Workforce Development

Necessary Skills

Workers in Advanced Manufacturing need skills such as math, science, engineering, machining, computer skills, and various types of middle-skilled labor, along with teamwork, communication skills, and creative thinking.

Participating North Shore Advanced Manufacturing Companies

- **Applied Materials** – Gloucester, MA
- **Fleet Machine** – Gloucester, MA

Company Profile: Applied Materials

Applied Materials is a global leader in providing innovative equipment, services and software to enable the manufacture of advanced semiconductor, flat panel display, and solar photovoltaic products. The company operates in four segments: semiconductor, applied global services, display, and energy/environmental solutions. The company employs 13,700 worldwide and between 500 and 1,000 in its Gloucester facility. Primary STEM occupations include many different types of engineers, such as mechanical, electrical,

Note: This industry profile is based on information shared at the North Shore STEM Guidance/Teacher event held on May 7, 2014 at Analogic Corporation.

systems, and process. Also employed are technicians at various levels of expertise—military experience is very helpful. Finally, people with business development expertise are in demand as well.

Company Profile: Fleet Machines

Fleet Machine is an example of a small Advanced Manufacturing company, employing eight people and focusing on customized products for a variety of clients across the Manufacturing spectrum. In an increasingly competitive global manufacturing environment, Fleet Machines provides the technological edge that enables their clients to exceed quality and on-time delivery requirements and budget goals. Their unique software as a service (SaaS) shop management software enables their clients to track the progress of each order. Their quality department leverages statistical methods to monitor and control all manufacturing processes. Primary STEM occupations include Skilled Machinists and Business Development experts.

Critical Technical and Core Competencies
Identified by Employers at Applied Materials and Fleet Machines

Technical Skills

Primary technical skills now needed—and what will be needed in the future? Engineering skills (both theoretical and technical) are now and will continue to be in demand well into the future. This involves the ability to solve problems and develop new solutions and products to make customers satisfied with the services provided. The ability to not only design but to participate in the actual manufacture of products at some level is critical. Skills and high comfort level

in using various software package—both Microsoft as well as machining/CAD-CAM/other packages very important. Math (calculus) is very important as well as writing skills.

Core Competencies

Primary core competencies now needed—and what will be needed in the future? Critical competencies include the ability to work in teams, the ability to write, and the ability to present data in a way that informs and provides needed support to co-workers and customers. Applicants who have been on athletic teams, robotic teams, have previous work experience, or have, on their own, participated in projects that show teamwork, initiative, creativity, and problem solving are particularly attractive to this industry. A good, solid appearance, as well as general good work habits are also must. In the case of small business, students should show an entrepreneurial spirit that contributes to the growth of the company.

Other North Shore Advanced Manufacturing Companies

- **Bomco**
- **Axcelis**
- **General Electric**
- **Thermal Circuits**

Biotechnology

Biotechnology is the use of living systems and organisms to develop or make useful products, or "any technological application that uses biological systems, living organisms or derivatives thereof, to make or modify products or processes for specific use" (UN Convention on Biological Diversity, Art. 2). Depending on the tools and applications, it often overlaps with the (related) fields of bioengineering and biomedical engineering. For thousands of years, humankind has used biotechnology in agriculture, food production, and medicine. The term itself is largely believed to have been coined in 1919 by Hungarian engineer Károly Ereky. In the late 20th and early 21st century, biotechnology has expanded to include new and diverse sciences such as genomics, recombinant gene technologies, applied immunology, and development of pharmaceutical therapies and diagnostic tests. — WIKIPEDIA

Massachusetts Job Growth Forecast of Typical Jobs Found in Biotechnology

JOB TITLE	EMPLOYMENT 2012	EMPLOYMENT 2022	AVERAGE ANNUAL JOB OPENINGS	AVERAGE ANNUAL WAGE
Engineers	48,476	51,816	1,593	$95,363
Life, Physical, and Social Science Technicians	12,316	14,144	582	$47,714
Life Scientists	18,085	20,642	694	$92,280
Physical Scientists	8,941	10,061	351	$82,208
Medical and Clinical Laboratory Technicians	5,302	6,575	266	$42,450
Software Developers, Applications	27,353	32,937	909	$103,250
Software Developers, Systems Software	30,032	36,293	1,011	$113,250

Source: Massachusetts Executive Office of Labor and Workforce Development

Necessary Skills

Workers in Biotechnology need skills such as math, science, computer skills, problem solving, writing, and research.

Participating North Shore Biotechnology Companies

- **North Shore Innoventures** – Beverly, MA
- **New England Biolabs** – Ipswich, MA

Company Profile: North Shore Innoventures

North Shore Innoventures (NSIV) is an organization that helps emerging, early stage biotechnology companies and scientist/engineer inventors to evaluate and test their ideas to determine whether these concepts can become viable business opportunities. The companies that are accepted into NSIV become part of the innovation community and benefit from shared physical resources (lab space, equipment),

and receive access to experienced entrepreneurs, investment advisors and other types of business support. This incubation business model and the nurturing environment offered by NSIV can improve the likelihood that the early stage company becomes successful with raising funds and adding jobs in the future. Start up companies remain at the incubator for up to three years before graduating into their own corporate space. NSIV currently supports about 10 biotech companies and is expanding in size. The companies employ scientists (biologists, chemists) and engineers of varying levels, and also routinely hire research interns. Start up companies are a great environment for learning new skills and taking on different and varied tasks. Hiring managers will be look for flexibility and adaptability in the candidates they interview.

Company Profile: New England Biolabs

Founded in the mid-1970s as a collective of scientists committed to developing innovative products for the life sciences industry, New England Biolabs is now a recognized world leader in the discovery, development and commercialization of recombinant and native enzymes for genomic research. Created "by scientists for scientists," NEB is renowned for consistently providing exceptional product quality and unsurpassed technical support. For nearly four decades, NEB has been shaping the landscape of bioscience research by discovering, developing and supporting superior research reagents. In addition to NEB's commitment to scientific innovation and customer relations, NEB notably ensures the environmental sustainability of the company's business practices. NEB employs 400 people, about 150 of which are PhD's. Occupations include chemists, genetic scientists, biologists, and engineers. Each summer 50 college interns join the company.

Critical Technical and Core Competencies
Identified by New England Biolabs and North Shore Innoventures

Biotechnology companies require a high level of math and science skills as well as the ability to be part of a team and work in a fast pace environment. Employees who have applied their knowledge in some way through activities like science clubs and science fairs, or internships and jobs close to the industry, are as important, if not more so, than straight As. Individuals who can demonstrate unique experience, are problem solvers and leaders, can share life experiences, speak up and have confidence to speak as part of a group are critical. Individuals must be able to show passion about their work. Applicants must also be very careful with social media as companies do searches as part of the application process. Many companies are particularly interested in hiring women as part of diversifying the workforce.

Other North Shore Biotechnology Companies

- **Cell Signaling Technology** – Danvers, MA
- **Thermo Fisher Scientific Inc.** – Beverly, MA

Information Technology

Information technology (IT) is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise. The term is commonly used as a synonym for computers and computer networks, but it also encompasses other information distribution technologies such as television and telephones. Several industries are associated with information technology, including computer hardware, software, electronics, semiconductors, internet, telecom equipment, e-commerce and computer services. — WIKIPEDIA

Massachusetts Job Growth Forecast of Typical Jobs Found in Information Technology

JOB TITLE	EMPLOYMENT 2012	EMPLOYMENT 2022	AVERAGE ANNUAL JOB OPENINGS	AVERAGE ANNUAL WAGE
Computer Programmers	8,511	9,095	280	$82,750
Computer Systems Analysts	16,820	20,837	666	$87,030
Database Administrators	4,498	5,413	177	$82,560
Information Security Analysts	2,635	3,664	144	$93,070
Network and Computer Systems Administrators	10,019	11,279	283	$80,770
Software Developers, Applications	27,353	32,937	909	$103,250
Software Developers, Systems Software	30,032	36,293	1,011	$113,250

Source: Massachusetts Executive Office of Labor and Workforce Development

Necessary Skills

Workers in IT need skills such as math, computer technology, analytical skills, and writing.

Participating North Shore IT Companies

- **EBSCO Information Services** – Ipswich, MA

Company Profile: EBSCO

EBSCO is a 30 year old international company with 3,000 employees, including 1,100 in Topsfield and Ipswich. The company provides a complete and optimized research solution comprised of research databases, e-books and e-journals—all combined with the most powerful discovery service and management resources to support the information and collection development needs of libraries and other institutions and to maximize the search experience for researchers and other end users.

EBSCO serves the content needs of all researchers whether they access EBSCO resources via academic institutions, schools, public libraries, hospitals and medical institutions, corporations, associations, or government institutions.

EBSCO hires about 140 technical jobs each year and 15-20 co-op students for 6-9 month periods of time. They look for individuals who are pro-active and entrepreneurial—who have developed websites for

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themselves of friends and can demonstrate an interest in learning engineering or IT on their own. Software programs include HTML, Javascript, php, linux, or apache.

They have three large 24/7 data centers with 2,000 servers requiring a large staff of IT technicians to maintain the system and assure they are secure and never go down. All information is stored in the Cloud, which users access through their portals.

EBSCO, like many IT companies, faces a dearth of US citizens with the skills needed for hiring. Even IT graduates from local colleges almost all are foreign nationals, requiring the purchase of H1B visa in order to hire. This is a costly reality for this industry that they would like to reverse. High Schools can help by offering computer science courses, A+ or networking certifications. Parents can also help by introducing their children to IT skills through on-line resources.

Critical Technical and Core Competencies
Identified by EBSCO Employers

Jobs in IT require High School students to complete courses in Algebra, Computer Science, Calculus, and other advanced Science courses. All jobs listed require a proficiency in English for report and email writing, documentation and specification writing. All of these jobs also require math at varying levels of intensity, depending on the position. Other skills needed include presentation, collaboration, problem-solving, initiative, follow-through and decisions making skills. All jobs at EBSCO require at least an Associate's Degree and most will require a Bachelor's or prefer a Master's Degree. Ninety percent of engineer hires have BA degrees and one-third of these have Master's Degrees.

Other North Shore IT Companies
- **Digital Bungalow** – Salem, MA
- **Amtex Systems** – Beverly, MA