



Team 5081F

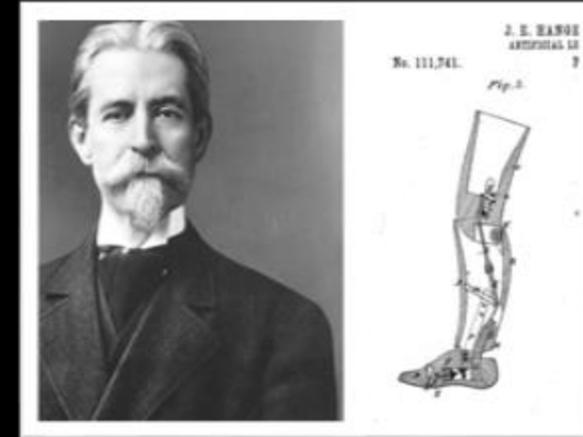
The Blue Knights



KNIGHTS

Biomedical Engineers

For this year's STEM Career Readiness Online Challenge we have chosen the career of Biomedical Engineering. Biomedical engineering is using engineering, biology, and biomechanical principles to design, development, and evaluate biological tools and health systems. Our team chose this career specifically because it focuses mainly on the engineering design process but, also allows us to make a difference in the healthcare system. We all love biology and are all extremely intrigued by this career. According to the website titled, *ONETonLine*, "Apply knowledge of engineering, biology, and biomechanical principles to the design, development, and evaluation of biological and health systems and products, such as artificial organs, prostheses, instrumentation, medical information systems, and health management and care delivery systems." The field is constantly evolving as new prototypes and tools are constantly invented.



This is James Hanger the inventor of the first prosthesis that is shown above.



This is Robert S. Langer an award winning biomedical engineer who is a Professor at M.I.T.

Involvement in Vex IQ Robotics

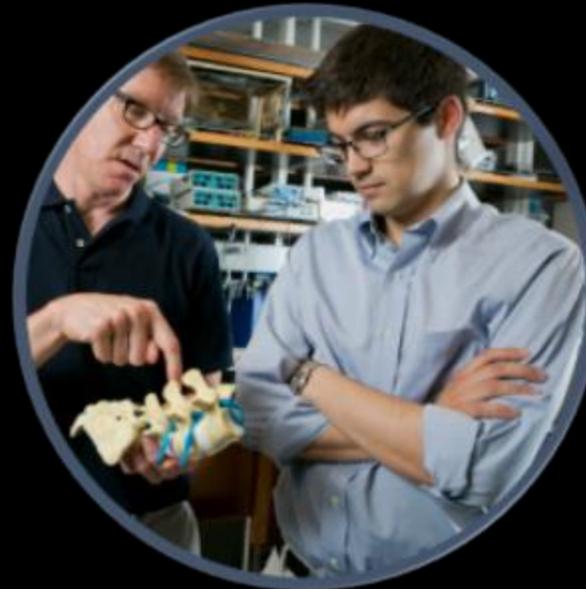
Our involvement in competitive robotics is preparing us for this field by teaching us a variety of critical skills such as dealing with failure, effectively designing prototypes, research, creativity and programming. Additionally, learning how to properly use the notebook will help us later on when we have to record our observations and publish. According to the source titled, *ONETonLine*, "Design and develop medical diagnostic... Deductive Reasoning... Inductive Reasoning... Processing Information... Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data... Complex Problem Solving... Judgment and Decision Making" Each of these skills are constantly used by biomedical engineers and by all the students on our team.



Programming a Device



Conducting Research



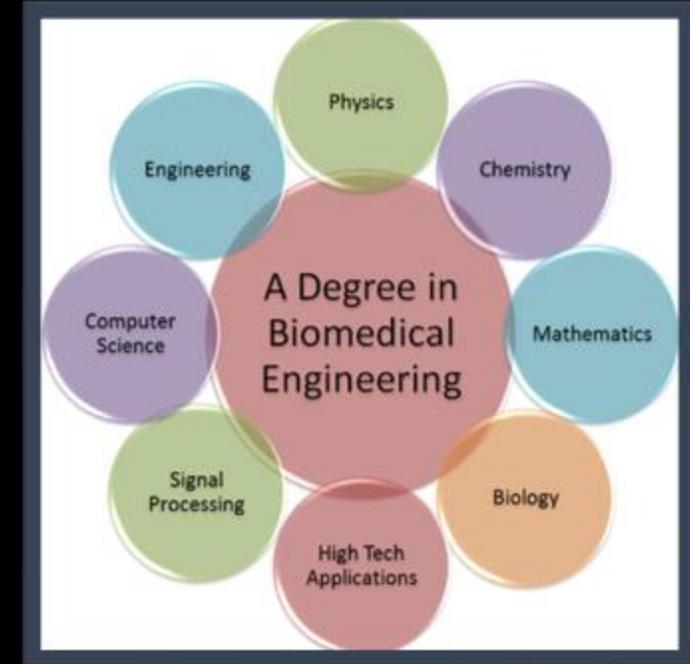
Designing Prototypes



Conducting Research

Required Fields of Study

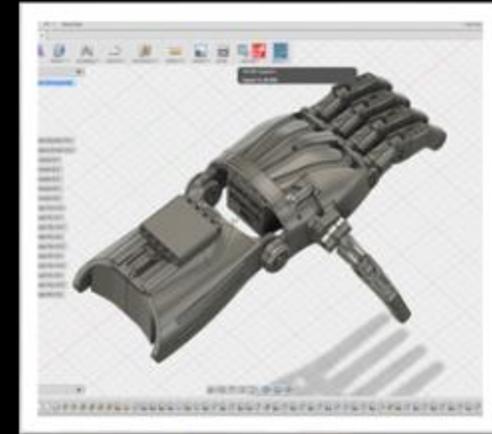
The fields of study that these engineers are required to know can vary greatly. They include electronics, physics, computing, mechanics, chemical, biology, to mathematics. Biomedical engineering allows you to have free reign over what you want to specialize and study. According to the website titled, *What Is Biomedical Engineering?*, "this requires in-depth knowledge of (electronic, mechanical, biological, etc.) as well as knowledge about the application for which it is to be used...requires knowledge of electronics, nanotechnology, materials science and biochemistry...expertise in mechanical engineering and material properties as well as biomechanics is essential." These engineers have many fields of science to choose from which makes the career very versatile.



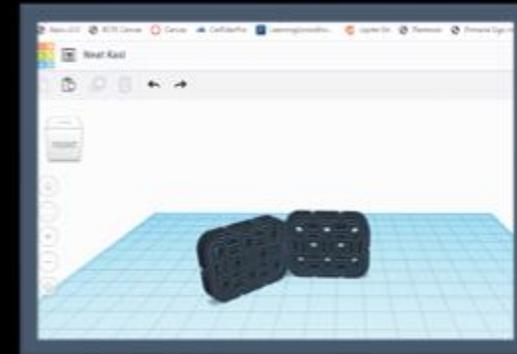
Biomedical engineers have plenty of freedom when it comes to choosing what field they want to specialize in.

Required Skills

The required skills that are necessary to become successful are active listening, complex problem solving, judgment, and decision making. These skills are taught in Robotics either by experience or by our coach, Fermin Vazquez. They also have to learn how to effectively use programs and software to build prototypes digitally. An example of a software used in biomedical engineering is Autodesk® Fusion 360™ and Tinker cad, which we also regularly use. According to the website titled, *Summary Report for:17-2031.00 - Biomedical Engineers*, "Critical Thinking, Active Listening, Complex Problem Solving, Judgment and Decision Making, Reading Comprehension, Analytical or scientific software Computer aided design CAD software, Development environment software, Medical software, Object or component oriented development software" In order to be effective as a biomedical engineer, these skills are imperative.



This prototype was created by a biomedical engineer on a software called Autodesk® Fusion 360™



This prototype was designed by our team on a similar software called Tinker Cad. It gives builders the option of using an angled piece that provides structural support.

Projected Job Growth

Considering that biomedical engineering is growing slightly faster than the average engineering occupation, I think that the projected job growth will increase but not a drastic amount. According to the *U.S. Bureau of Labor Statistics*, from 2019-2029 it will increase by 5% which is 1% higher than the average for all occupations. The average salary is \$91,410, which will allow one to support their family and pay for expenses. According to the *U.S. Bureau of Labor Statistics*, "Employment of biomedical engineers is projected to grow 5 percent from 2019 to 2029, faster than the average for all occupations. Increasing numbers of technologies and applications to medical equipment and devices, along with the medical needs of a growing and aging population, will require the services of biomedical engineers." Biomedical engineering is a new and upcoming field, it is expected to grow and flourish in the next decade.

Projected Job Growth From 2019-2029

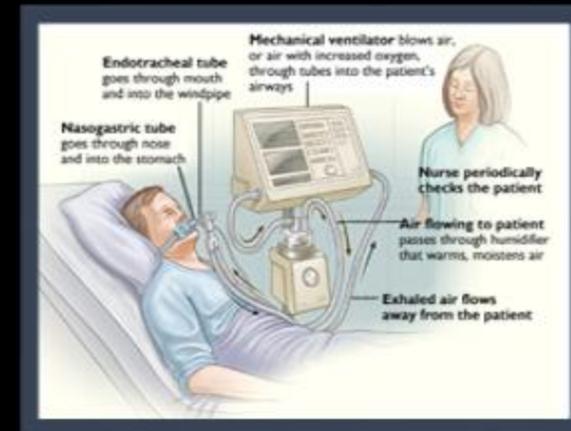
Biomedical Engineers	Increase by 5%
Engineers	Increase by 4%
All Occupations	Increase by 4%

Biomedical Engineers and COVID-19

An event that will cause Biomedical Engineers to have an increase in demand is COVID-19. This is because, doctors found errors in the machines that are used to help with breathing. For example, the mechanical ventilator was found to have many life-threatening flaws. Biomedical engineers would be the ones to fix these machines and perfect its ability to function. According to the website titled, *COVID-19 complications: High oxygen flow from ventilators changes microbiota, makes lungs vulnerable to damage*, "The scientists found that in the critically-ill patients, high flow oxygen from mechanical ventilation promotes the growth of microbes in the lungs which can result in pneumonia and abscess." Due to the issues caused by the ventilator, one can infer that this job may evolve and change over a short period of time. Click on this link for more information on the statistics of biomedical engineering, <https://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm>



The job of biomedical engineers is to fix and perfect machines and medical devices like the mechanical ventilator.



Graeme Clarke, a World Renowned Biomedical Engineer

A well-known scientist in this field is Graeme Clark. He is responsible for the creation of the Cochlear implants. Cochlear implants have revolutionized the way that many deaf and hard of hearing people live. He inspires us to learn more about this career by showing how just one medical invention can change the lives of hundreds of thousands of people, including some people we personally know. He also inspires us to have perseverance and to never doubt ourselves. He attributes his success to his father(who is deaf), the members of his team, the staff of cochlear limited, his international colleagues, family and friends. According to the video titled, *Graeme Clark honored with 2013 Lasker Award*, "our best chance was to use place coding...Over the next eight years, after a series of safety studies and the electronic design of the first fully implantable multi-channel cochlear implant, in 1978, I led perceptual studies" It took Clark almost a decade to come up with his final prototype after many trials and errors. This had a huge impact on us and taught us that to design a proper and functional prototype/robot it takes experience and many mistakes.



Professor Graeme Clark invented the Cochlear implant that is used worldwide today.



Displayed above is the cochlear implant.

Summary

All things considered, biomedical engineering is a very fascinating and wondrous career. Thanks to VEX IQ we are already being prepared for this career in the future and careers similar to this one. We complete many of the same tasks that they do and we are perfecting our skills in the engineering/design process and the scientific method. This job is also expected to grow and make new opportunities' for young students like us and others in our generation to excel in. Additionally, we have learned many valuable lessons from the scientists who work in this field. We have learned to always trust our instinct, the only way to improve your design is to make mistakes, and when a mistake is made you need to gather your observations and make an even better design. Our team,(5081F), has been working together for almost 2 years now and have proven that similar to other biomedical engineers, we can build anything we put our minds to. These engineers inspire us to work harder and as a result, our team qualified for the Virtual 2020 VEX Robotics Worlds Competition the previous season.



Team 5081F, when we won the excellence award

Blue Knights, Team 5081F
Annabelle Acevedo, Omar
Mustafa, Noah Rubin, 8th Grade
VEX IQ Online Challenge STEM Career
Readiness; Biomedical Engineering

Citations in APA Format

1. *Summary Report for: 17-2031.00 - Biomedical Engineers*. <https://www.onetonline.org/link/summary/17-2031.00>.
2. Lucas, J. (2014, September 25). *What Is Biomedical Engineering?* <https://www.livescience.com/48001-biomedical-engineering.html>.
3. Duke. *Biomedical Engineering*. https://bme.duke.edu/sites/pratt.duke.edu/files/bme_innovation_device_class_1.jpg.
4. U.S. Bureau of Labor Statistics. (2020, September 1). *Biomedical Engineers : Occupational Outlook Handbook*. U.S. Bureau of Labor Statistics. <https://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm>.
5. *Mechanical Ventilator*. www.nhlbi.nih.gov/sites/default/files/images_311. Accessed 1 Oct. 2020.
6. Quora. *A Degree in Biomedical Engineering*. qph.fs.quoracdn.net/main-qimg-8226ce7edfa518a92624854e38616fe8. Accessed 1 Oct. 2020.
7. U.S. Bureau of Labor Statistics. (2020, July 6). *17-2031 Bioengineers and Biomedical Engineers*. U.S. Bureau of Labor Statistics. <https://www.bls.gov/oes/current/oes172031.htm>.
8. James Hanger. http://ichef.bbci.co.uk/wwfeatures/624_351/images/live/p0/2t/8r/p02t8rj6.jpg.

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9. *Robert S. Langer*. <https://static01.nyt.com/images/2012/11/25/business/25-LANGER/25-LANGER-jumbo.jpg>.
10. *COVID-19 complications: High oxygen flow from ventilators changes microbiota, makes lungs vulnerable to damage - Health News , Firstpost*. Firstpost. (2020, August 18). <https://www.firstpost.com/health/covid-19-complications-high-oxygen-flow-from-ventilators-changes-microbiota-makes-lungs-vulnerable-to-damage-8723411.html>.
11. CochlearGlobal. *Graeme Clark honoured with 2013 Lasker Award*. https://www.youtube.com/watch?time_continue=32&v=eJUKeoUhh0I&feature=emb_logo.
12. *Cochlear Implant*. (2019). <https://2rdnmg1qbg403gumla1v9i2h-wpengine.netdna-ssl.com/wp-content/uploads/sites/3/2019/07/cochlearImplant-464470338-770x553-300x200.jpg>.
13. *Cochlear Device*. <http://i2.wp.com/www.nciua.org.uk/wp-content/uploads/2014/05/Cochlear-device.jpg>.
14. *Graeme Clarke*. <https://www.afr.com/content/dam/images/h/1/6/f/i/4/image.related.afrArticleLead.620x350.h16c6e.png/1539124923005.jpg>.
15. *Professor Graeme Clarke*. https://goodreadingmagazine.files.wordpress.com/2015/07/index1_450.jpg?w=300&h=241.