


 The logo for SWENEXT features the letters 'SWE' in a dark blue, sans-serif font, followed by 'NEXT' in a larger, light blue, sans-serif font. The letter 'E' in 'NEXT' is highlighted in a bright yellow-green color.


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What is Biomedical Engineering?

Biomedical Engineering is the combination of biology, engineering, and medicine. This combination has led to some amazing inventions and life-saving ideas like artificial organs, surgical robots, prosthetics, new medications, and so much more! People who are Biomedical Engineers solve problems to make life better for everyone.

Have you ever had to get a shot at the doctor's office? The needle hurts, doesn't it? But it is important to get these shots because they keep us from getting really sick. The needle is part of a syringe, which holds the medicine that we get with our shot. A Biomedical Engineer designed that syringe and that needle. The needle is designed so that we can get our shots without getting hurt too bad. We just need a Band-Aid. Then after about a day, the shot doesn't hurt anymore! The syringe is designed to make sure that it stays clean before we use it. It is also designed to keep from leaking the medicine everywhere.

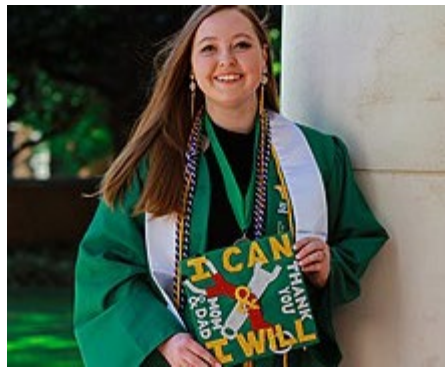
Biomedical Engineering is a pretty new field, but it is super important! Biomedical Engineers don't just design these syringes. They also design machines that we use in hospitals today, pacemakers to keep our hearts healthy if they stop working right and prosthetics like robotic hands for amputees.

Biomedical Engineering Spotlight

Meet Haley, a Master's Student in

Texas

Haley is studying to earn her master's degree in Medical Sciences at the University of North Texas Health Science Center. She previously earned her bachelor's degree in Materials Science and Engineering at the University of North Texas in Denton, Texas.



Haley has always been interested in Biomedical Engineering, and she hopes to use her knowledge in medical sciences and Materials Science & Engineering **to help others live their best lives!**

What made you decide to study Biomedical Engineering?

"I was inspired to go into Biomedical Engineering by being a patient myself when I was a kid. I have a pacemaker, an electrical device that regulates my heart rhythm. Without this piece of technology, I would not be alive. Without the engineers who designed it, I would not have the quality of life that I do now!

When I was thinking about studying engineering, I read about pacemakers and their history. A long time ago, patients who had pacemakers had to be hooked up to a machine that was plugged into a wall. They could not go anywhere or do anything. My pacemaker is very small and has a battery the size of a quarter and it lasts for ten years. It makes it so that I can still go to school and hang out with friends.

I chose to go into Biomedical Engineering because I felt that I should use this second chance at life to help others. I was lucky to have a really good Computer Science teacher, who pushed me in the right direction. **I really love STEM and have never doubted that it was the right place for me.**"



Meet Malena, a Biomedical Engineering student in Pennsylvania

Malena is a Biomedical Engineering student in her third year of a five-year program at Drexel University in Philadelphia, Pennsylvania. She hopes to graduate in two years.

Tell us about Biomedical Engineering

"Biomedical Engineering is both engineering and medicine. Any computer you see in a hospital room or a tool used in surgery was probably designed by a Biomedical Engineer. Many medications and diagnostic tests have been created by Biomedical Engineers. Even clinical research for diseases like cancer is done by Biomedical

Engineers.

When you choose to study engineering, you learn how to solve problems so that after you graduate, **you can solve almost any problem and design something that has never existed before.**"

Meet Harmanpreet, a Biomedical Engineering Student in New York

Harmanpreet is a senior in Biomedical Engineering at the University of Buffalo, SUNY. She hopes to graduate this year.



What do you love most about your school and its Biomedical Engineering Program?

"I love that there are tons of research opportunities for students. It is very helpful to do research because you learn what you like and what you don't like in your field.

Biomedical Engineering is used everywhere and there are lots of choices to make. By doing research, I found out that I didn't really like medical imaging or cell culture experiments. And I learned that I really like working with medical devices like implantable cardiac devices."

Why Girls Make Great Engineers

Having diversity in any field is a great thing. Girls can bring great ideas to their engineering teams because they see things differently than boys. Engineering does not discriminate. Nobody thinks in the same way. There are lots of things you can do in engineering. Engineering is for everyone who is interested in solving important problems.

Some of the smartest engineers are females. They are able to solve problems in a cool new way that no one else thought of. This is true for anyone of any gender and of any ethnicity. Female engineers have been making history for over 100 years!

Emily Roebling was the first woman field engineer and technical leader of the Brooklyn Bridge. She took over and helped when her husband, Washington Roebling, became paralyzed and could not work. Emily was in charge of making sure that everything went right when designing and building the Brooklyn Bridge. Her hard work as a project manager led to its completion in 1883.



Edith Clark was the first woman to graduate with a



master's degree in Electrical Engineering from the Massachusetts Institute of Technology in 1919. Edith held a patent for her invention, a graphical calculator. She was the first woman to deliver a paper before the American Institute of Electrical Engineers in 1926. She worked for General Electric until 1945. Then she became the first female Electrical Engineering professor in the U.S. at the University of Texas in Austin. Her hard work on circuits earned her an Achievement Award from the Society of Women Engineers.

Dr. Ayanna Howard is the chair of the School of Interactive Computing in the College of Computing at Georgia Tech. Dr. Howard has more than 200 publications. She studies artificial intelligence, robotics, and computer vision. Before teaching at Georgia Tech, Dr. Howard was a senior robotics researcher and deputy manager in the Office of the Chief Scientist at the NASA Jet Propulsion Laboratory at the California Institute of Technology. She also founded **Zyrobotics**, which is a company that makes education mobile robots for kids and those living with disabilities.



These are just some of the many female engineers who have made a difference. If you are always thinking, always trying to solve problems and want to do things that can change the world, then engineering could be for you. The things you have learned, the hard things you might have gone through and the way that you think could help you create something amazing. Who knows, maybe you could make history, too!

Did you know that December 3rd is International Day of Persons with Disabilities?

International Day of Persons with Disabilities (IDPD) was first proclaimed in 1991 by the United Nations. This day is important because it aims to make sure that persons with disabilities have the same rights as those who do not have disabilities. We recognize IDPD so that we can increase awareness of what life is like for persons with disabilities in every aspect of political, social, economic and cultural life. This year's IDPD theme is focused on empowering persons with disabilities for inclusive education, jobs, housing and other rights. Persons with disabilities are also making a huge difference and paving the way for others.

Meet Victoria Garcia! Victoria Garcia is a NASA

engineer, who also happens to be deaf. Victoria studied Mechanical Engineering at Rensselaer Polytechnic Institute. She liked working with her hands and fixing things. As she got older, she got more curious and bolder.



When she was first applying for jobs after graduation, Victoria had a hard time. This was in 2005. She had to use a service that would type out what the interviewers asked her. She would type her answer and the employee at the relay service would then tell the interviewer her answer. It was not an easy thing to do because not many employers liked interviewing this way. This made it more difficult to even get an interview. She often missed out because of it.

Victoria's hard work in school and at a previous internship got her an internship at the Kennedy Space Center at NASA. She got her master's degree in Mechanical Engineering at Georgia Tech. Then NASA contacted her for a job. They understood that she had a disability and were happy to help make the interviewing process easier. They did an email interview with her, which was easier for everyone. She then got a job at the Marshall Space Flight Center in 2008 and now uses her skills to work as a system engineer. She makes sure that all of the different teams that work on electronics, design or propulsion work well together and do a good job.

2020 SWENext Awards Season – Apply Now

Do you live within a couple of hours of **San Diego, Buffalo or Des Moines**? Are you willing to travel to one of these cities early next year with your friends? If so, read on!

We are excited to announce the 2020 SWENext Awards and the DesignLab Community Engagement Challenge.

The **SWENext STEM in Action Award** recognizes girls in **grades 6-12** who are actively interested in STEM and doing something in their community about it (for example, raising awareness, mentoring students, participating in SWENext, etc.). STEM in Action Award recipients will attend the DesignLab event where they will meet women engineers, learn about careers in engineering, learn how to be a role model and watch the DesignLab presentations. They will also receive a certificate during the awards ceremony.

You must attend the DesignLab event in order to receive the award. See the dates of the event below.

We are using a rolling application process which means we will review your application and determine the award within two weeks of your application. Apply early so you can

save your seat at the DesignLab event! Learn more and apply today!

The DesignLab Event in San Diego will be held on February 1, 2020.

STEM in Action Award Application Deadline: January 5, 2020 - [STEM in Action Application](#)

The DesignLab Event in Buffalo will be held on March 28, 2020.

STEM in Action Award Application Deadline: March 1, 2020 - [STEM in Action Application](#)

The DesignLab Event in Des Moines will be held on April 18, 2020.

STEM in Action Award Application Deadline: March 22, 2020 - [STEM in Action Application](#)

Hands-On Biomedical Engineering Challenge

Biomedical Engineering is the application of engineering techniques to develop therapeutic technologies and devices. Biomedical Engineers may be called upon to design instruments and devices, to bring together knowledge from many sources to develop new procedures or to carry out research to acquire knowledge needed to solve new problems. Biomedical Engineers design artificial body parts, medical devices, diagnostic tools and medical treatment methods.



Biomedical Engineers also study which specific DNA sequences link to certain characteristics. This helps them as they investigate genetic disorders such as color blindness and cystic fibrosis. They also develop technologies that could manipulate or replace genes that are damaged or missing.

This month we're going to build a model of our very own DNA.

What You Will Need:

- toothpicks, approx. 25
- multicolored gumdrops, approx. 30
- paper plate, to work on so the table stays clean from loose sugar
- [DNA Worksheet](#)
- pencil

Definitions:

Phenotype – Observable characteristic, like eye color or hair color

Genotype – Set of genes

Base pair – Complimentary bases in DNA; Cytosine pairs with Guanine. Adenine pairs

with Thymine.

Using the Color Key, fill out the Genotype column on the DNA Worksheet based on your physical characteristics. Example: If you have BLUE eyes, put AGG in the spaces provided. One letter per space. Do this for all five phenotypes defined.

Once your genotype is filled out, determine the base pair for each line using the key provided and fill in the second column. Example: If you have BLUE eyes and have AGG in your genotype column, you will have TCC in the base pair column.

Using your DNA worksheet as a guide, build each "gene" in the first column of three bases by placing three gumdrops (of the correct colors) on one toothpick. Once all five "genes" from one column are built, repeat the process to build the corresponding base sequences from the second column of letters. Connect the base pairs by placing a toothpick between each of the three gumdrops — this creates five ladders for each gene.

Connect all the genes by sticking the end of the toothpicks with the gumdrops together. Be sure to keep the genes in the correct order and orientation. Gently twist the entire strand to shape the double helix.

You just built a model of your own DNA!

[A video showing all these steps can be viewed here.](#)

After your challenge is complete, we encourage you to share a picture of your DNA strand. Each month, a lucky winner will be selected from the submissions to win an Amazon gift card. Don't miss the chance! All it takes is a few minutes and a great picture. Email your picture to swenext@swe.org by January 4th.



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