BELLEVUE COLLEGE

STEM MAGAZINE

Explore how science and technology shape the world around us

Discover local pathways to STEM education and careers

Science Division | SPRING 2025

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STEM Magazine

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Greetings

Welcome to the Bellevue College STEM Magazine. As you turn these pages, you are about to embark on a journey into the exciting world of Science, Technology, Engineering, and Mathematics. Whether you're fascinated by the endless possibilities of artificial intelligence, the innovative designs inspired by nature in biomimicry, the wonders of the night sky, or the future of science itself, this magazine offers a glimpse into the boundless opportunities awaiting you at Bellevue College.

At Bellevue College, we believe in the power of curiosity and the importance of asking big questions. The world around us is full of mysteries, challenges, and potential for discovery—an invitation to those with passion and determination to make their mark. Our STEM programs are designed to nurture your intellectual curiosity, foster creativity, and provide the tools you need to become the innovators and leaders of tomorrow.

As you consider joining us, know that here at Bellevue College, you're not just preparing for a career; you're shaping the future. Every experiment you conduct, every idea you explore, and every discovery you make is a step toward something bigger. The next great scientist, engineer, or tech visionary could be reading this right now—so why not you?

I hope this magazine inspires you to dream big, ask bold questions, and take that first step toward an extraordinary future in STEM. Welcome to the journey!

Dr. Emily Heffernan
Dean of Science, Bellevue College

Dr. Rob Viens

How Geology Guides the Path of Evolution

Artist concept of the early Earth. Image: NASA's Goddard Space Flight Center Conceptual Image Lab

While life on Earth often appears fragile and delicate—and in many ways it is—it is also amazingly tough. Delicate hummingbirds can be devastated by the loss of their habitat, a sudden cold snap can wipe out an entire vegetable garden overnight, and populations of large mammals can be hunted to extinction in just a few decades. Yet, despite the vulnerability of individual organisms or even entire species, life on Earth as a whole is incredibly tenacious and resilient.

A built-in safeguard in Earth's biosphere is the ability for populations of organisms to adapt to change through evolution. Populations have variation, and when conditions change, those individuals with variations or traits that are better adapted to that new environment survive and pass on those traits. Thus, over many generations, populations can evolve and change.

The field of geology focuses on forces that shape Earth and what the long record of rocks and fossils tell us about its history. It shows us that geologic processes, especially those that are relatively rapid, can create an environment that is "hostile" to life. As a result, species that are not able to adapt go extinct, leaving only their fossils behind in the long book of geologic time. However, there are always some species and individuals whose traits allow them to survive the bottleneck and evolve into something new. It is through these evolutionary bottlenecks that geology guides the path of evolution.

Rocks, fossils, and Earth chemistry provide evidence that, throughout its four-and-a-half billion years, the planet has experienced some significant changes. No matter how extreme, each time, life has always come out stronger (eventually) on the other side. Life has survived meteorite impacts, poisoning of the atmosphere, global ice ages, anoxia (lack of oxygen), massive volcanic eruptions, and at least five major mass extinction events since the evolution of multicellular life. Some of these geologic events were so extreme that they resulted in the loss of more than 90% of species on Earth. And, each time, those who survived set the stage for the next phase of life on Earth.

Let's take the dinosaur extinction event as an example. Approximately 65 million years ago the earth was hit (on the Yucatan Peninsula in Mexico) by a 10 km rock from space. The heat generated as this asteroid passed through the atmosphere would have ignited global wildfires. The impact, which was partially in water, sent a tsunami that washed over the entire southern seaboard of North America. The choking cloud of debris that was ejected into the atmosphere would have globally blocked the sun for several years, cooling the climate and shutting off photosynthesis—the very foundation of the food chain. The waves (including shockwaves of energy, as well as tsunami), fires, cold, darkness and lack of food were bad news for most organisms. As a result, more than two thirds of the Earth's species went extinct.

What would it take to survive during the years of cold and darkness that followed the 65-million-year-old impact? Survival would require the ability to stay warm, being able to eat a variety of food (including teeth and a gut to process any food you find), and being a smaller size that allowed for burrowing and hiding in small, protected spaces. This, more or less, describes the characteristics of the mammals who had been living in the shadow of their dinosaur cousins for millions of years. They survived the bottleneck and began the "Age of Mammals" that we still live in today.

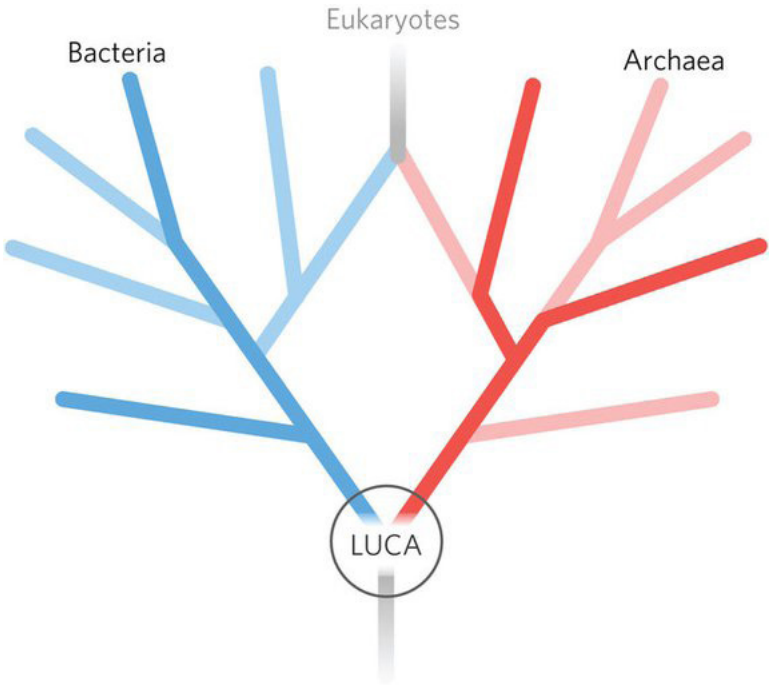
Interestingly, it was also an evolutionary bottleneck almost 200 million years earlier that gave the original archosaurs—the ancestors to the dinosaurs—the competitive advantage to dominate terrestrial ecosystems for millions of years. While it tends to get less attention, one of the largest mass extinction events in Earth's history occurred about 250 million years ago and led to the extinction of upwards of 95% of the species on Earth. That bottleneck opened the door for the survivors to evolve into dinosaurs (and ultimately their descendants—birds).

Numerous other examples exist throughout Earth's history that show how geologic change provides the evolutionary pressures that lead to major leaps in evolution. The so-called "Snowball Earth" phase of Earth's history was a time between about 600–800 million years ago during which we were in a global ice age. It was so extreme that glaciers periodically extended to the equator and the surface of the ocean was covered with ice. At the end of this "snowball" ice age, the Earth warmed up and multicellular animals appeared in the fossil record. Not surprisingly, the ability of cells to work together and differentiate tasks was likely an advantageous strategy that got these early animals through this extreme ice age.

One of the most dramatic, and possibly the most significant, examples of geology as a driving force of evolution may go back to the origin of life itself.

Evidence suggests that LUCA, the Last Universal Common Ancestor of all life on Earth, was a heat-loving archaea—a bacteria-like organism that belongs to one of the three main domains of life (the other two are the bacteria and the eukaryotes). Archaea are often called extremophiles, because of their ability to withstand extreme temperatures, pressures, acidic conditions, salinities, etc. If life exists elsewhere in our solar system, it is likely to resemble these tough little critters. The early Earth, over 4 billion years ago, would have been an extreme environment, too.

Giant asteroid impacts could have created evolutionary bottlenecks that decided the path that evolution should take. Image: Don Davis



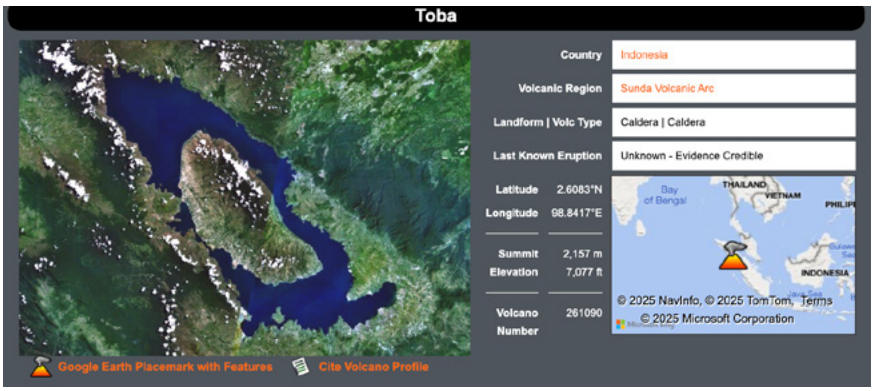
A schematic of the two-domain tree, with eukaryotes evolving from endosymbiosis between members of the two original trunks of the tree, archaea and bacteria. Image: Weiss et al/Nature Microbiology.

Life may have evolved multiple times on the young Earth, taking many different forms. But the heavy bombardment of the Earth's surface by left over debris from the formation of the solar system likely sterilized the surface over and over again. Most life that may have originated would have been wiped out. Yet, the archaea with their ability to survive in extreme conditions, would have been able to survive deep underground and withstand the relentless bombardment at the surface. All life, including us, are the descendants of these survivors of that bottleneck.

Humans are not immune from geology-driven bottlenecks. In the 1990s evidence surfaced suggesting that Homo sapiens suffered a near fatal extinction about 75,000 years ago at the hands of a massive volcanic eruption. The eruption, of an Indonesian volcano named Toba, blasted 3000 km3 of ash and debris high into the atmosphere. (For comparison, the 1980 eruption of Mt. St. Helens released 1 km3.) Volcanoes of this magnitude—especially those that erupt near the equator and release significant amounts of sulfate particles—can have a profound impact on global temperature, which in turn can lead to crop failure, starvation, disease and increased death rates. Evidence suggested that the Toba eruption led to a global winter that lasted six to 10 years, and DNA research suggested that human populations dropped to as few as a thousand individuals somewhere around this same time. This correlation led to a hypothesis suggesting that Toba was the cause of a massive bottleneck in human evolution. Humans had to adapt in order to survive—and these adaptations gave them a competitive advantage over other species. Research continues on this topic with some studies based on archeological evidence countering that more humans survived this event than originally thought. But it does not rule out that past (or future) catastrophe can create bottlenecks in human evolution.

Today, science provides clear evidence that we are dramatically changing our environment, including the climate. We are on a path to cause a new bottleneck—a mass extinction on par with the meteor that led to the demise of the (non-avian) dinosaurs and so many other species 65 million years ago. History tells us that life will adapt, and new species will evolve as a result of this human-caused bottleneck. How life will evolve

Global Volcanism Program, 2025. St. Helens (321050) in Volcanoes of the World (v. 5.2.7; 21 Feb 2025). Distributed by Smithsonian Institution, compiled by Venzke, E. doi.org/10.5479/si.GVP. VOTW5-2024.5.2 Image credit: ***volcano.si.edu/volcano.cfm?vn=261090***



remains to be seen but given our dependance on so many of Earth's species, it is very likely we will be around to see what comes out the other side.

Geology provides us with an amazing way to study the Earth and gives us a big-picture perspective of our place in the universe. In painting a picture of the history of the Earth, geology pulls together biology, physics, chemistry, ecology, paleontology, astronomy, and much more. If this sounds appealing, you might consider studying geology for fun, as an elective, or even to get on the path toward a geoscience career.

Further Reading

How Geology Tells the Story of Evolutionary Bottlenecks and Life on Earth (NASA)
astrobiology.nasa.gov/news/how-geology-tells-the-story-of-evolutionary-bottlenecks-and-life-on-earth/

Looking for LUCA, the Last Universal Common Ancestor (NASA)
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How an asteroid ended the age of the dinosaurs (Natural History Museum of London)
www.nhm.ac.uk/discover/how-an-asteroid-caused-extinction-of-dinosaurs.html

Snowball Earth: The times our planet was covered in ice (Astronomy Magazine)
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Frank Lee

Nature's Innovators: How Animals Are Shaping Our World

When you think of cutting-edge technologies, animals might not be the first thing that comes to mind. But as Patrick Aryee's fascinating book, "30 Animals That Made Us Smarter," reveals, nature is the ultimate innovator. From tiny insects to majestic marine creatures, animals have inspired incredible advancements in science, engineering, and design. This process, known as biomimicry, involves studying nature's solutions to solve human challenges, and the results are astonishing.

Percy Shaw, a British inventor, patented the cat's eye road reflector in 1934 after nearly running off the road at night because he couldn't see the edges. He realized his car's headlights reflected off a cat's eyes, giving him the idea.

Eyeshine from the tapetum lucidum of a cat.

Cats and Road Safety

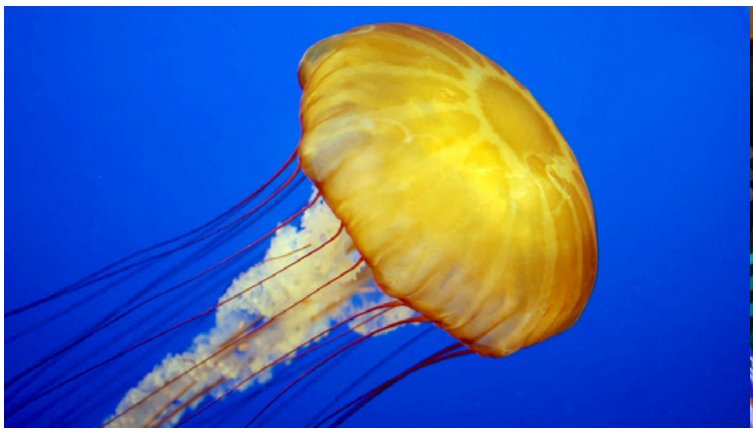
Cats' eyes are an amazing part of their anatomy, designed for low-light vision. The secret behind their night vision lies in the tapetum lucidum, a layer of tissue located behind the retina. This structure acts like a mirror, reflecting light that passes through the retina back into the eye, giving the light another opportunity to be absorbed by the photoreceptor cells. This helps them to see in dim light and is the reason for the distinctive glow in their eyes when light hits them at night. The tapetum lucidum is a key skill for nocturnal hunters to spot prey in the dark.

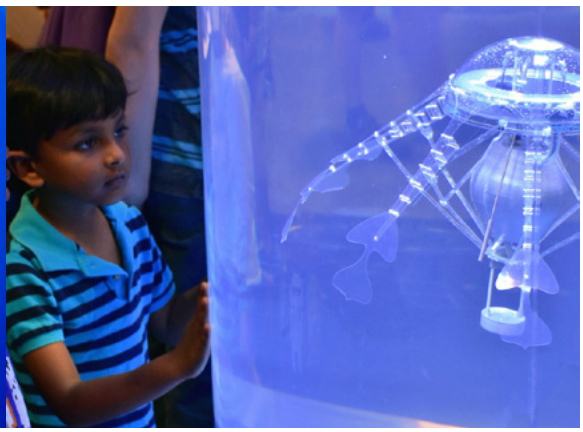
Tapetum lucidum inspired the design of road reflectors, which are crucial for improving visibility and safety at night. Just as the tapetum lucidum reflects light to enhance vision, road reflectors bounce back

headlights from vehicles, helping drivers see road markings, signs, and hazards in low-light conditions. The reflective surface of road markers works in a similar way, using a layer of glass beads or microprisms that direct light back toward its source. This biomimicry of the cat's eye has revolutionized road safety, making driving at night safer.

Jellyfish have existed for over 500 million years! They are one of the oldest living creatures on Earth, existing long before dinosaurs.

Roboticists at the Max Planck Institute for Intelligent Systems in Stuttgart took some advice from the real oceanic experts—nature itself. They have developed a jellyfish-like robot which can navigate complex environments and remove smaller plastic waste without even having to touch it.





Jellyfish and Underwater Robot

The world's most efficient swimmer is the boon jellyfish. It has inspired an underwater robot that is safe enough to use in coral reefs and aquatic archaeological sites. Moon jellyfish are known for their translucent, bell-shaped bodies, which pulsate rhythmically to propel them through the water. Their propulsion mechanism is a result of a unique method of movement, where their bell contracts and expels water, creating thrust that pushes them forward. This efficient, low-energy propulsion system has led to the development of bio-inspired underwater robots. By mimicking the moon jellyfish's natural locomotion, scientists are working on creating robotic propulsion systems that could be used for underwater exploration, research, and even deep-sea mining.

These robotic systems, known as "soft robots," are designed to replicate the movements of the jellyfish. They use flexible, deformable structures and advanced materials to create undulating motions that allow for smooth, energy-efficient movement through water. Unlike traditional rigid propellers or fins, jellyfish-inspired robots offer greater maneuverability and stealth, making them ideal for missions that require quiet and efficient movement.

The mouth parts are below the tentacles and the slugs eat using a radula which is a tongue-like organ that is covered with approximately 27,000 tiny tooth-like protrusions that are called denticles.

Slugs are hermaphrodites—every slug is born with both male and female reproductive parts and any slug is capable of laying eggs, though self-fertilization can occur.

Slugs smell through their eyes.

Slug Slime to Super Glue

Slug slime, produced by various species of slugs, is a remarkable biological substance that has properties that are useful in scientific and industrial applications, particularly in the development of super glue. Slugs belong to a class of animals known as gastropods, which includes snails and conchs. For slugs, without a shell, their slime helps them move through small crevices. Their slime is composed of proteins, carbohydrates, and water, forming a viscous, sticky, strong and stretchy substance that allows slugs to glide across surfaces. The slime is viscous and can numb the mouth, making it taste particularly unpleasant—this helps protect themselves from rough surfaces, predators and dehydration.

Researchers have studied slug slime to understand its unique properties, especially its ability to adhere to a variety of surfaces, including wet and oily environments. This has inspired innovations in adhesives, particularly in the design of super glues. By imitating the molecular structure and composition of slug slime, scientists have developed new types of adhesives that are durable and capable of bonding to challenging surfaces such as body organs for medical applications for wound healing.

Woodpeckers can experience forces of 1,200 to 1,400 g's—about 14 times more g-force than what it takes for a human to get a concussion.

Woodpeckers and Helmets

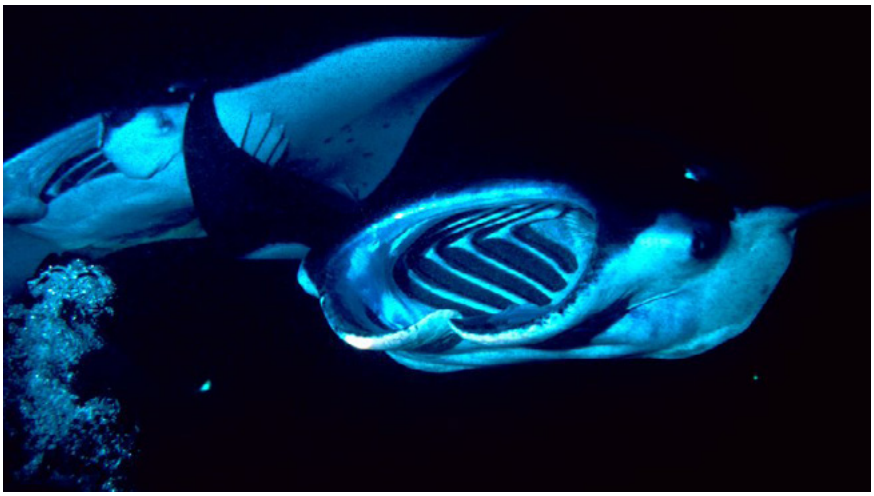
Woodpeckers can hammer repeatedly on trees without damaging their brain. Could this lead to new designs for bicycle helmets and black boxes? Woodpeckers repeatedly strike trees with great force without damaging their brains. This incredible feat is made possible by their unique anatomy, particularly their spongy bone structure. The bones in a woodpecker's skull are much more flexible and spongier than those of other birds, which helps absorb and dissipate the high g-forces they experience while pecking. The spongy bone structure is also used to generate drumming sounds for communication with other woodpeckers. These forces, which can reach up to 1,000 times the force of gravity, would cause brain damage in most animals, but woodpeckers' specialized bone structure and muscle design protect them from injury.

This ability to withstand high-impact forces has helped the design of safety devices, including bicycle helmets and airplane black boxes. Bicycle helmets are built with a combination of rigid outer shells and a spongy foam layer inside, which absorbs impact forces to protect the wearer's head during crashes. Similarly, the protective casing around an airplane black box incorporates advanced materials that can withstand extreme forces and temperatures, ensuring that critical flight data survives crashes. Both of these innovations mimic the shock-absorbing properties of woodpecker bones, ensuring safety in high-impact situations.

Manta Ray and Pollution Solution

Manta rays are remarkable filter feeders, using their wide mouths to capture plankton and small organisms from the water. Their feeding process involves swimming through the water with their mouths open, allowing water to flow through their gills while filtering out food particles. This natural filtration method has inspired researchers to develop potential solutions for the growing issue of ocean microplastics pollution.

Microplastics, tiny particles of plastic that result from the breakdown of larger plastic debris, have become pervasive in oceans, posing significant threats to marine life and ecosystems. The manta ray's filtration system offers a bio-inspired solution. By studying the way manta rays filter water, scientists are working on developing artificial filtration systems that mimic this efficient method of capturing small particles. These systems could be used in large-scale ocean cleanup efforts, designed to remove microplastics from the water without disrupting marine life.



Manta rays' filtration system causes particles to glide over its straining system, rather than going through, preventing clogging.

Which animal has the fastest snapping jaw? If you're guessing a shark or perhaps an alligator, you'll have to think smaller.

The trap-jaw ant (Odontomachus bauri), which lives in Central and South America, moves its mandibles (mouth parts) at 115 to 207 feet per second.

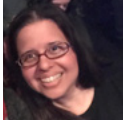
Ants and Energy

Trap-jaw ants are known for their incredible jaw mechanism, which allows them to snap their jaws shut at remarkable speeds. This rapid movement is powered by a unique system of stored energy. The ants store energy in a specialized structure known as a "spring mechanism" in their mandibles, which is triggered when they release the tension in this stored energy. The force generated by this release is enough to capture prey or defend against predators. Trap-jaw ants can snap their jaws with speeds of up to 230 miles per hour, making them one of the fastest movements in the insect world.

This efficient use of stored energy has caught the attention of robotic engineers. By studying how trap-jaw ants store and release energy, researchers are developing similar systems for use in robots. These bio-inspired mechanisms can be applied to robotics, particularly in the design of grippers or cutting tools that require fast, high-force movements. For instance, robots used in tasks like picking up objects, disarming explosives, or even surgical tools could benefit from such energy-efficient mechanisms, improving speed and precision.

Further Reading

"30 Animals That Made Us Smarter: Stories of the Natural World That Inspired Human Ingenuity." Aryee, P., Bright, M., and Harper, L. (2022). Island Press.



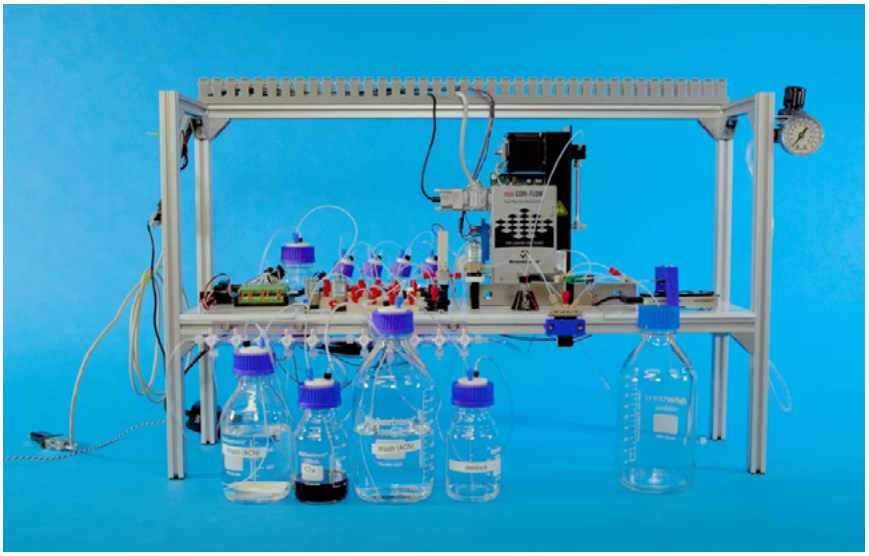
Dr. Stacy Alvares

How DNA Could Change the Way We Store Data Forever!

Cells need four types of biological molecules—carbohydrates, lipids, proteins, and nucleic acids—to keep life going. Back in the early 1900s, scientists weren't sure whether nucleic acids or proteins carried a cell's genetic information.

In 1952, Alfred Hershey and Martha Chase finally settled the debate, showing that DNA is the material passed down through generations, determining an organism's genetic makeup. Before that, scientists thought proteins, which have 20 building blocks, were more likely to carry genetic information because the huge variety of combinations seemed more likely to explain differences between species. But it turns out that DNA, made up of just four building blocks—adenine (A), guanine (G), cytosine (C), and thymine (T)—can create all the genetic variation we see in nature.

Now, 75 years later, scientists are using these same four DNA bases to store digital information. This new technology, called DNA drives, is still developing, but it works by encoding information in DNA, much like how genetic information is stored in cells. In cells, DNA bases are read in sets of three, which form proteins with specific jobs. With DNA drives, digital data, usually stored as 0s and 1s, is converted into combinations of A's, C's, G's, and T's. These sequences are then turned into a DNA molecule and stored in a sealed card. If stored in a cool, dry place, DNA drives can last for thousands of years, unlike regular hard drives, which usually last about five years. Plus, DNA takes up much less space! In fact, University of Washington Associate Professor Luis Henrique Ceze says that if all the digital data on the internet in 2016 were stored in DNA, it could fit in a shoebox.



In 2018, researchers built this first prototype of a machine that could write, store, and read data with DNA.

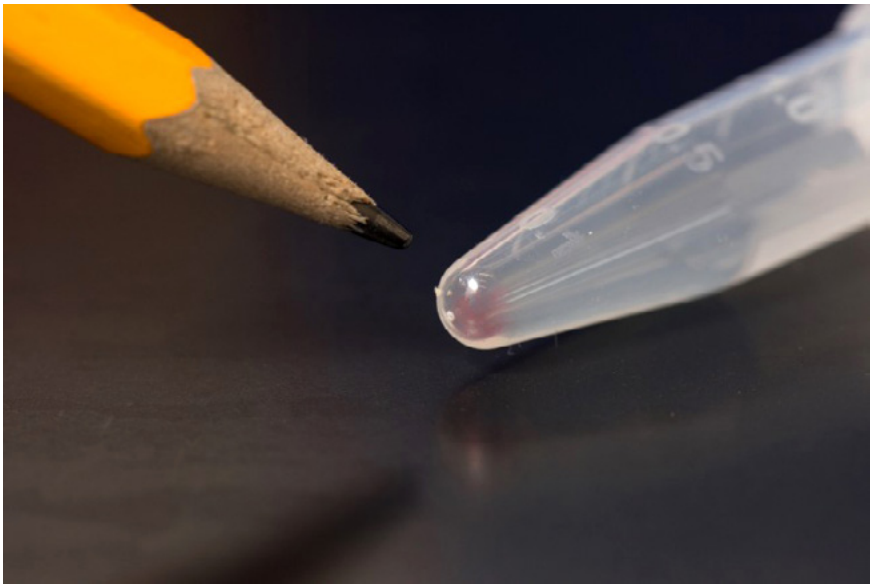
DNA drives also have a smaller environmental footprint because, being biological, they can be naturally broken down and recycled. However, there are still challenges. While the cost of making DNA has gone down since the 1980s, it's still expensive to create enough DNA to store data—like 2MB of data, which costs around $7,000. Also, retrieving information from DNA requires special equipment, costing about $2,000, and the process destroys the part of the DNA that was read. But there is hope: researchers are working on ways to read only the part of the DNA that's needed, without damaging the rest.

This technology is still developing, but it has huge potential. For example, DNA is incredibly stable. The oldest DNA sequenced so far is about 2 million years old! In the future, DNA drives could store data like movies, music, or news articles, providing a time capsule for future generations. DNA sequencing technology is getting cheaper, and new methods are being developed to synthesize DNA drives more affordably. Companies like Biomemory are even working on using cells to create DNA for these drives. As the world generates more data, finding a cheap, durable, and sustainable way to store it will be essential—and DNA could play a big role in that.

Your DNA Could Store an Entire Library

A single gram of DNA can hold 215 petabytes (215 million gigabytes) of data—that's enough to store every book ever written and still have space left!

All the movies, images, emails and other digital data from more than 600 basic smartphones (10,000 gigabytes) can be stored in the faint pink smear of DNA at the end of this test tube. Image: Tara Brown Photography/ University of Washington



The Oldest DNA Ever Sequenced is 2 Million Years Old

Scientists extracted 2-million-year-old DNA from Arctic permafrost, proving that DNA is one of the most stable and long-lasting information storage molecules on Earth.

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Dr. Jacqueline Gapinski

BC Pathways

BC Pathways is a series of supports and programs that are designed to help you:

- Choose a broad academic or career goal based on your strengths and interests
- Create an education plan to achieve your goals
- Feel supported along your way

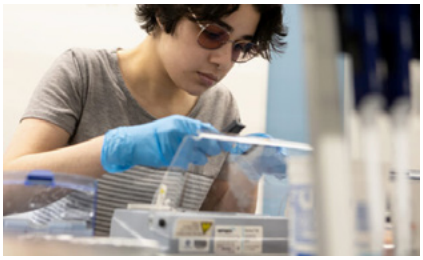
What are Pathways? Pathways are broad areas of study. There are eight Pathways including:

Business

Health Sciences

Humanities & Communication

Social Sciences, Public Service & Community Engagement



STEM (Science, Technology, Engineering & Mathematics)

Technology and Data

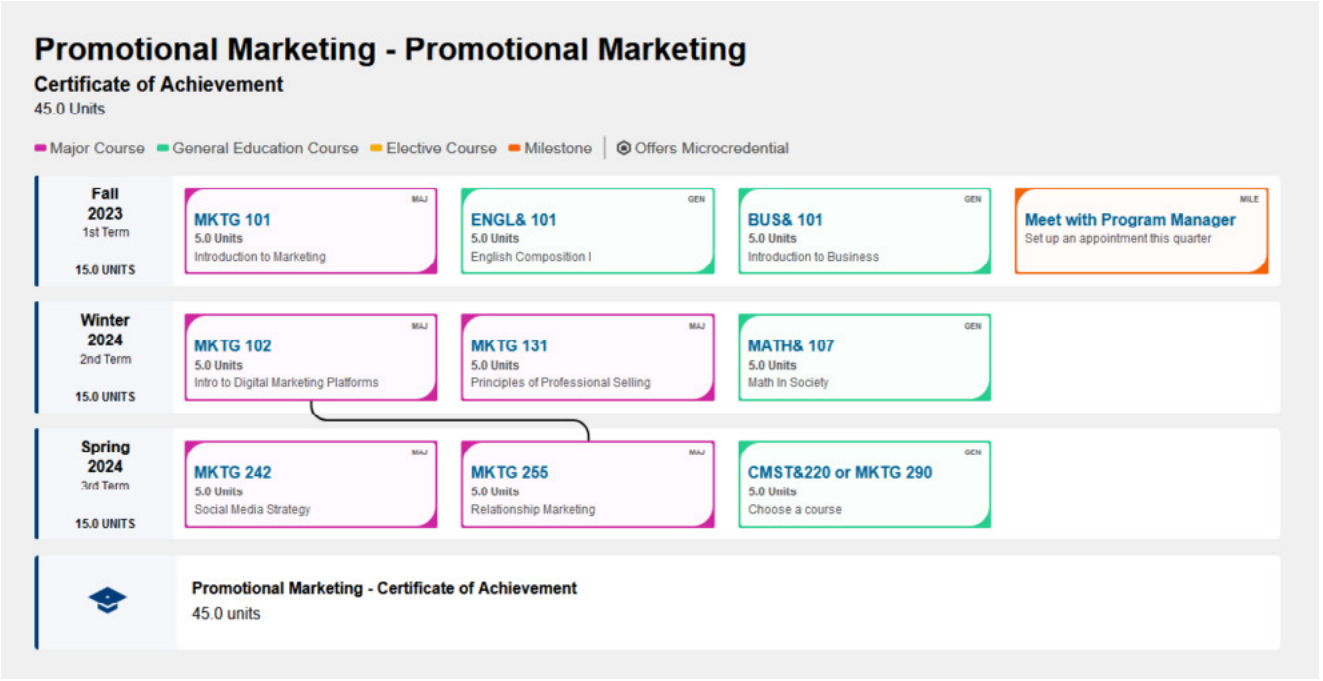
Transitional Studies

Visual & Performing Arts

What are Focus Areas? Focus areas are specific areas of emphasis within a Pathway. These allow you to explore coursework, develop useful skills, and prepare for your career and educational goals. For example, engineering is a focus area within the STEM Pathway.

What are Tracks or Concentrations? Tracks are more tailored course sequences to prepare a student for a specific field within a discipline. For example, within engineering, there are multiple tracks including civil engineering, biomedical engineering, and mechanical Engineering.

Course maps are a new resource for prospective and current Bellevue College students. They show a sample sequence of courses for each degree or certificate at Bellevue College, across our eight BC Pathways (areas of study). Check out the course maps for your area of study here: ***coursemaps.bellevuecollege.edu***



Learn more

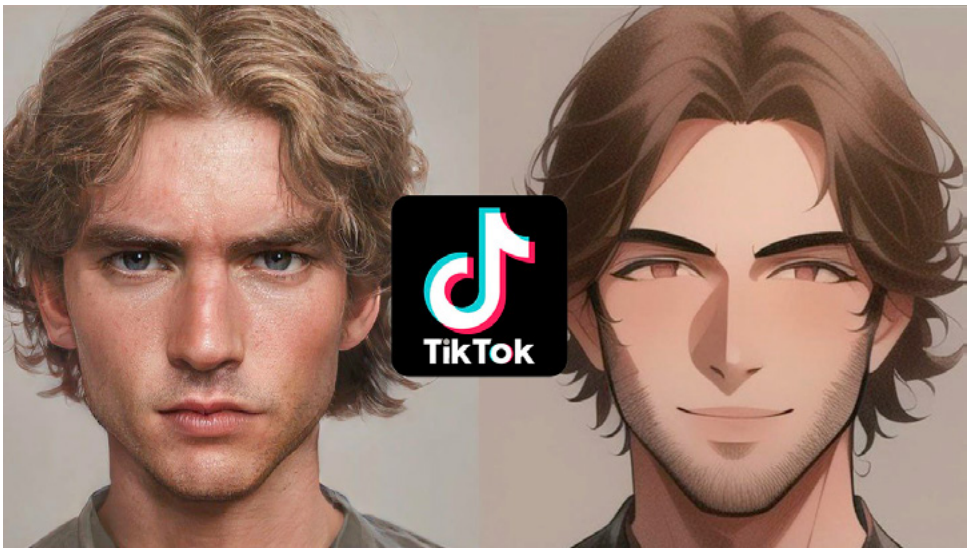
- Online at ***bellevuecollege.edu/academics/bc-pathways/***
- Attend Exploring Pathways events each quarter to learn about options
- Take a First Year Seminar class
- Connect with Advising to make an education plan
- Explore other resources at the Center for Career Connections

Dr. Fatma Cemile Serçe

Face Filters
Fun or a Digital Illusion?

Scroll through TikTok or Instagram, and you'll find a world where flawless skin, perfect jawlines, and sparkling eyes are just a tap away. AI-powered face filters have become a huge part of social media, transforming our faces in real-time. Sometimes subtly, sometimes dramatically.

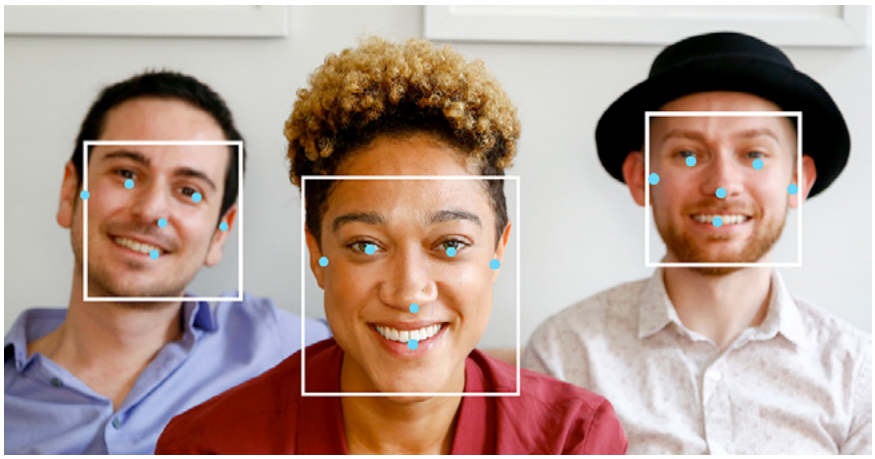
Manga Filter



What started as a fun way to add dog ears or silly effects has evolved into hyper-realistic beauty enhancements and even full-on face swaps. But have you ever stopped to think about how these filters work? In this article, we'll dive into the science behind these filters. Artificial Intelligence (AI) face filters are fun effects you can add to your face on apps like TikTok and Instagram. They use AI to detect your facial features and change how you look. Whether it's smoothing your skin, changing your eye color, or even swapping faces.

Here's a simple breakdown of how AI face filters work:

- Face Detection
- Facial Landmark Detection
- Filter Application



Face Detection

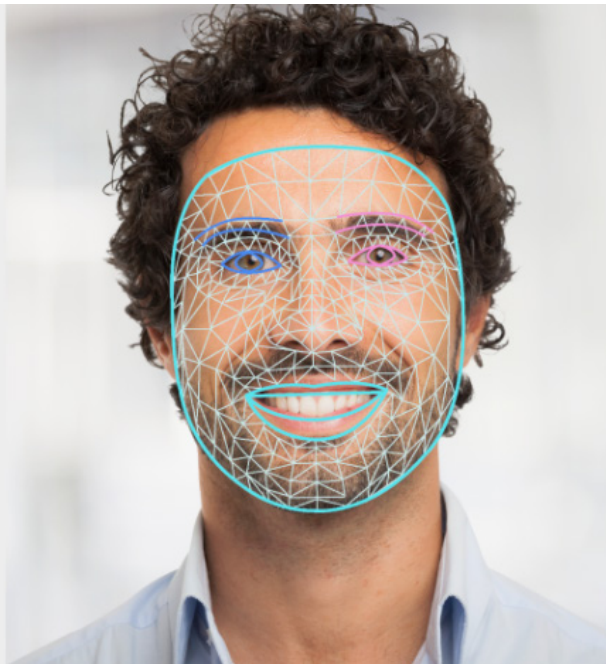
The AI scans the image or video to find a face. Detecting faces in photos and videos is a tricky task because every person looks different. Factors like skin tone, hairstyles, facial expressions, lighting, and even face angles can make it harder for AI to recognize a face accurately. Some advanced face detection systems can still work well even if part of the face is covered, the lighting is low, or the person is looking sideways.

Most modern face detection systems use machine learning to recognize faces. They are trained on thousands of images to learn what a face looks like and can quickly spot one in real time.

Older methods relied on finding specific facial features (like eyes, nose, and mouth) and building a face model from them. These systems were simpler but struggled with poor lighting or partially hidden faces.

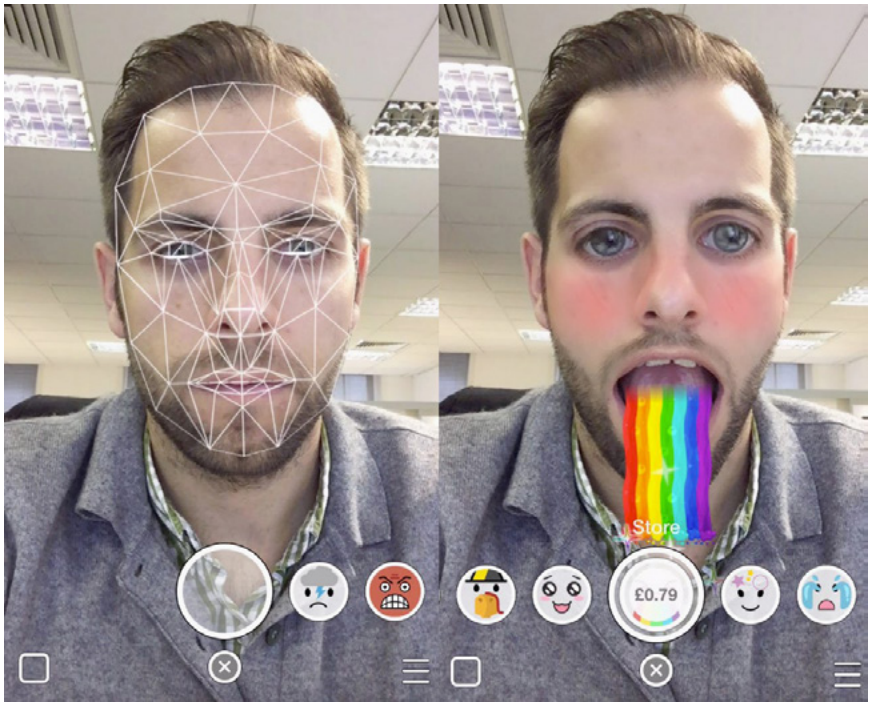
Facial Landmark Detection

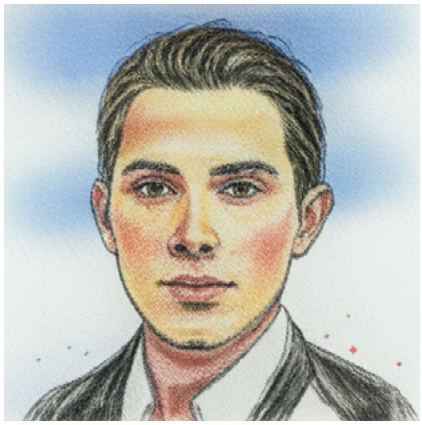
Face landmark detection is a technique that identifies key points on a face, such as eyes, nose, mouth, and jawline. These landmarks help AI track facial movements, apply filters, and recognize expressions in real time. Behind the scenes, these facial landmarks are stored as a structured set of coordinates. Each point is represented by (x, y) values in a 2D image or (x, y, z) values in a 3D space. If it's a video, the system updates these points frame by frame to follow facial movements.



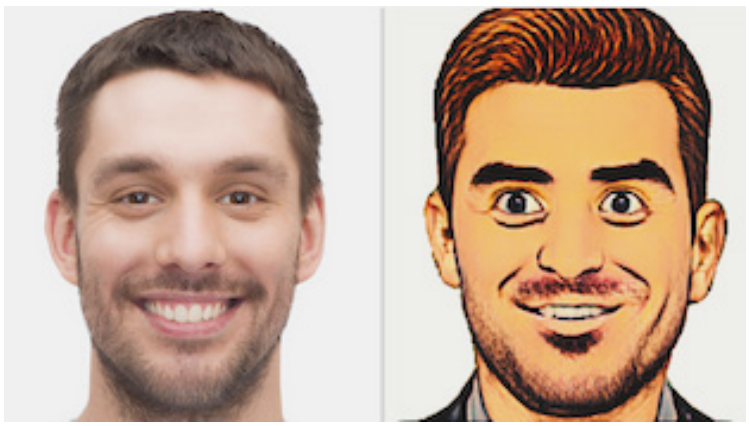
Filter Application

Once the model detects key points on a face, it applies the filter by aligning the effect with these landmarks. The model analyzes the incoming face and adjusts the filter based on its training data. Factors like facial structure, angles, lighting, and even expressions affect how the filter appears. The AI doesn't simply copy and paste the same filter onto every face—it transforms it using mathematical operations to match the detected landmarks accurately.





Here are some other filter examples, like color sketch, color ink, oil painting, and avatar effects generated using Google AI solutions.



This is just a quick introduction to how AI face filters work. If you want to dive deeper, check out the references below.

ai.google.dev/edge/mediapipe/solutions/guide

banuba.com/blog/face-detection-algorithms-guide/

Dr. Fatma Cemile Serçe

Two imaginary celebrities that were dreamed up by a random number generator

What is GAN?
Generative Adversarial Network

A Generative Adversarial Network (GAN) is a cool deep learning technique in artificial science where two computer neural networks work together (but in a competitive way!) to create new, realistic data. Think of it like creating new images or music based on a collection of examples.

Here's how it works:

One network tries to make new data by tweaking an existing piece of data (like a photo or a song) and creating something new. The second network has the job of figuring out whether the new data is real (from the original dataset) or fake (created by the first network). The two networks keep improving over time: the first network gets better at creating realistic data, and the second network gets better at spotting the fake stuff. Eventually, the system becomes so good that the second network can no longer tell the difference between the fake and real data. It's like a game of "who can trick who," where both networks keep learning and getting better until they're almost impossible to tell apart.

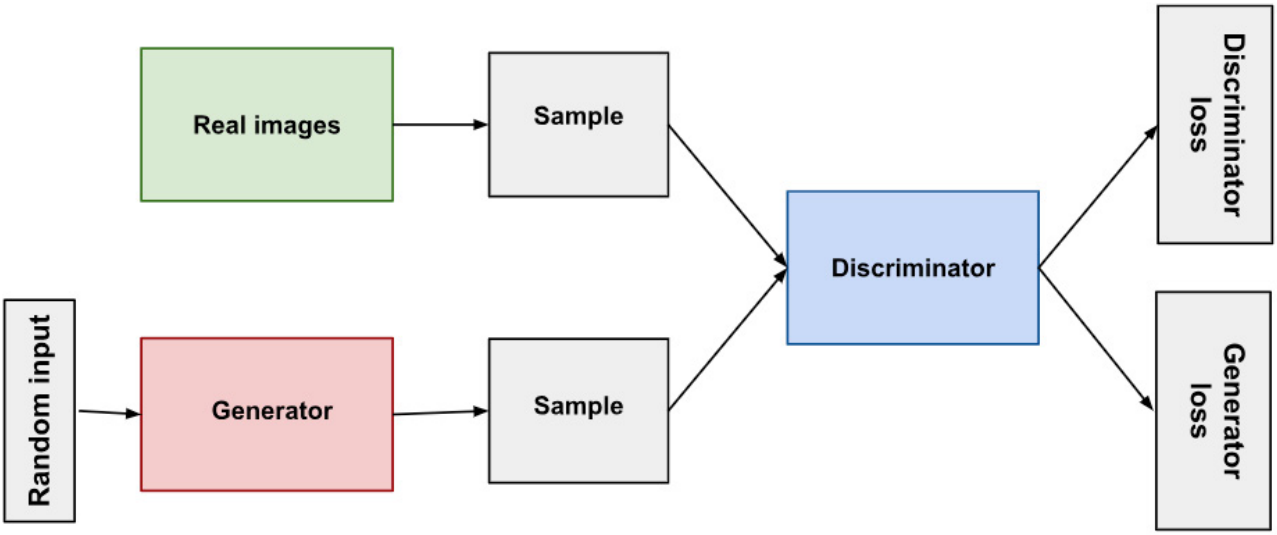
GANs have many cool uses in different industries. Here are a few examples:

Creating Realistic Images. GANs can generate realistic images from text or by modifying existing ones. They're used in video games and movies to create lifelike characters, animals, or even landscapes.

Making Training Data. In machine learning, GANs help create new data based on real examples. For example, they can generate fake transaction data to train fraud detection systems, helping the system learn to spot bad transactions.

Filling in Missing Information. GANs can also guess and complete missing data. For example, they can create images of what's underground by studying surface data, which is useful for things like mapping energy resources.

Creating 3D Models from 2D. GANs can turn two-dimensional images, like photos or scans, into three-dimensional models. In healthcare, they're used to create 3D images of organs from X-rays, which helps doctors plan surgeries more accurately.



GAN Model. *developers.google.com/machine-learning/gan/gan_structure*

How does GAN work?

A Generative Adversarial Network (GAN) is made up of two deep neural networks: the generator and the discriminator. They work together like competitors in a game. The generator tries to create new data, and the discriminator tries to figure out if the data is real or fake.

Here's how it works:

- The generator looks at a set of real data (like pictures or sounds) and learns what makes it special.
- The discriminator also studies the real data to learn what makes it real, and it tries to spot any differences.
- The generator then creates new data with random changes (called "noise").
- The new data is passed to the discriminator to decide whether it looks like real data.
- The discriminator gives feedback to the generator, helping it make its next round of data look more like the real thing.
- The generator keeps trying to trick the discriminator into thinking its data is real, while the discriminator works hard to get better at spotting fakes.
- This back-and-forth continues until the discriminator can't tell the difference between real and generated data.

The generator tries to increase the chances of the discriminator making a mistake, while the discriminator works to reduce errors. Through multiple training rounds, both the generator and discriminator keep improving and challenging each other until they reach a balance. At this point, the discriminator can no longer tell the difference between real and generated data, signaling the end of the training process.

Fake or Real?

These images may look real, but they're actually fake. The website ***thispersondoesnotexist.com*** uses AI to generate hyper-realistic, computer-created faces that resemble real people—yet no one in these images actually exists.

All fake images generated by ***thispersondoesnotexist.com/***

AI Gahaku is an AI-powered application that turns selfies and landscape photos into paintings. Developed with deep learning algorithms, the app applies different artistic styles to images, allowing users to see themselves through the lens of classical and modern art movements.
Image: ***ai-art.tokyo/en/***

AI Gahaku, an AI Artist

Imagine creating stunning pieces of artwork without lifting a brush. The website ***ai-art.tokyo/en/*** lets you do just that! By using GANs, this platform transforms photos or even text descriptions into unique works of art. Whether it's turning your selfie into a painting or generating an entirely original scene based on your words, the AI blends creativity and technology to produce amazing results. This is a perfect example of how AI isn't just about solving problems—it's also a tool for artistic expression, showing how technology can push the boundaries of what's possible in the world of art.

In your STEM journey, AI can be a powerful tool in fields you may not have expected like creativity and design!

Further Reading

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developers.google.com/machine-learning/gan/gan_structure

Dr. Ishaani Priyadarshini

Moflin: The AI Pet That's More Than Just a Friend

Do you remember the time when you asked your parents for a dog or a cat? They probably said something like, "It's a big responsibility! You'll be at school all day, who will take care of it?" Back then, it seemed like your dream pet was always out of reach. But what if there was a way to have a companion, a friend, without worrying about feeding, walking, or cleaning up after them? Enter Moflin, the AI-powered pet that's here to change the way we think about mental health and companionship.

In recent years, mental health has become an important topic, especially among students. The pressure to perform in school, deal with social challenges, and navigate personal stress can sometimes feel overwhelming. So, what if technology could offer a solution that's both comforting and supportive? Moflin, an AI pet, can not only fill the role of a companion but also help people manage their mental well-being.

Who created Moflin?

Moflin was developed by the collaboration of Japanese company Vanguard Industries and Casio, which introduced this robotic companion to the world. Initially, Moflin gained popularity through crowdfunding campaigns, receiving overwhelming support from backers who saw the potential of an AI-powered emotional companion. With the success of these campaigns, Moflin was officially made available to the public, becoming a symbol of AI-driven emotional support.

Understanding Mental Health in Students

Mental health in students is more important than ever. Between schoolwork, social media, and the transition to adulthood, young people today face unique stressors. According to studies, around **1 in 5 adolescents** experience a mental health disorder, ranging from anxiety and depression to more serious conditions like post-traumatic stress disorder (PTSD). The pressure to succeed academically, socially, and personally can take a significant toll on emotional well-being.

Sadly, there are still many stigmas around mental health, which can make it harder for students to seek help or even talk about their feelings. This is where innovative solutions like AI can step in.

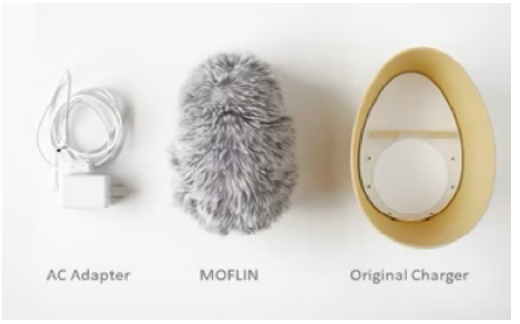
AI as a Companion: The Rise of Moflin

Imagine a world where you don't need to worry about the time and energy that comes with caring for a real pet, yet you still experience the companionship and support that animals provide. Enter Moflin, a soft, lifelike AI pet designed to respond to your touch, and name, and even develop a personality over time.

Unlike a traditional pet, Moflin doesn't need food, water, or constant care. Yet, it behaves in a way that makes it feel incredibly real, just like having a furry friend at your side. Moflin purrs when you pet it, reacts to your voice, and adapts its personality based on your interactions. Over time, it can become more in tune with your needs, offering comfort when you need it the most.

How does Moflin work?

Moflin operates using Vanguard Industries' proprietary AI technology and a unique 2D Emotion Express Map. This system allows the AI pet to develop and express emotions based on its surroundings and interactions with its owner. Moflin deciphers and learns from voice tones, movements, and physical interactions, adjusting its emotional responses accordingly. In its early days, Moflin behaves in a childlike manner, but as time passes, typically about a month, it forms deeper attachments and a unique personality shaped by its owner's behavior. If an owner frequently interacts with Moflin, petting it and speaking kindly, the AI pet registers these actions as positive emotions. Conversely, if ignored, Moflin will update its emotional log data, responding with more neutral or even sad behaviors.



How Moflin Can Assist with Mental Health

So, how does Moflin help with mental health? Research shows that interacting with animals, whether real or virtual, can significantly reduce stress and anxiety. Pets have a unique ability to provide comfort, companionship, and even a sense of purpose, without judgment. For students dealing with stress or loneliness, Moflin can provide the same benefits, without the logistical challenges of having a live pet.

- **Emotional Support** Moflin can sense your mood through your voice and actions. If you're feeling down, it might respond by becoming more affectionate or playful, providing the emotional boost you need. While it's not a replacement for human interaction or professional mental health support, having a pet-like AI companion can reduce feelings of isolation and offer an easy, low-effort way to alleviate stress.
- **Stress Reduction** Just like petting a real cat or dog, stroking Moflin can help lower cortisol (the stress hormone) and release oxytocin (the bonding hormone), providing a calming effect. In moments of high stress, like before an exam or during a rough day, Moflin can serve as a grounding presence to help you refocus.
- **Developing Emotional Intelligence** Over time, Moflin can build a relationship with its owner. Its adaptive personality means it learns how to respond to different moods, which helps students practice empathy and emotional regulation. This could be especially helpful for students who are still learning how to manage their feelings or who struggle with social interactions.
- **A Non-Judgmental Companion** One of the most powerful aspects of Moflin is that it is non-judgmental. In a world where students may feel pressure to be perfect or keep up appearances, Moflin offers a safe space to express feelings without fear of judgment. It's like having a friend who's always there for you, no matter what.
- **Encouraging Mindfulness** By interacting with Moflin, students can practice mindfulness and emotional awareness. Whether it's taking a moment to observe Moflin's movements or just spending some quiet time together, these moments of pause can help students de-stress and refocus their minds.

AI Pets vs. Real Pets: What's the Difference?

While nothing can fully replace the joy of having a real pet, Moflin offers some distinct advantages, particularly for students who may not be able to care for a traditional pet due to time or logistical constraints. Unlike live pets, Moflin doesn't require daily feeding or regular medical care. It's a low-maintenance alternative that still provides emotional support.

However, real pets offer unique emotional bonds and the opportunity for students to learn about responsibility and empathy in ways AI cannot. But Moflin can still offer a great introduction to the emotional support that pets can provide, with the added benefit of being customizable and adaptive.

The Future of AI and Mental Health

As AI technology continues to evolve, we can expect to see more innovations aimed at improving mental health, especially for younger generations. AI companions like Moflin are just the beginning. Researchers are exploring how AI can help with everything from managing anxiety to promoting positive mental health practices. As AI becomes more integrated into daily life, it could become an essential tool for students to manage stress and emotional well-being.

Images: ***crowdfund.news/crowdfunding-project/moflin-an-ai-pet-with-emotional-capabilities/***

Joe Hueffed

The Problem of Trust with Artificial Intelligence

The First AI-Generated Legal Ruling

In 2021, AI was used to generate a legal ruling in Colombia, raising ethical concerns about AI's role in justice and fairness.

"Seeing is believing," and "a picture is worth a thousand words." These are well-known sayings that are often true … except when they are false. With the emergence of artificial intelligence (AI), we must increasingly evaluate and question digital images and results created by computers.

Evaluation of Digital Content

When evaluating digital images and information, we must consider several factors. First, review the source of the information. Can you identify and verify the source known or is it anonymous? For example, financial investment advice presented from a professional investment banker differs from investment advice that is anonymously posted to online forums and social media. Also consider the context of the digital information you're consuming. The source of the information could have potential motives and/or biases. Is the information part of an advertisement or political campaign? Would the individuals sharing and publishing the information have specific objectives, motives, and benefits to gain from people being exposed to the image or data? This is increasingly important today when social media influencers can profit from a large amount of followers. Similarly, political campaigns may become very popular or unpopular as a result of images and information shared and consumed in the public space. This may create motives to distort factual data by those who lead those campaigns or stand to benefit from a favorable vote.

AI Can Hallucinate

AI sometimes generates completely false information with great confidence, a phenomenon called **AI hallucination**. This means even AI-generated images and texts need fact-checking.

Algorithms are becoming powerful arbiters of our lives. Are they discriminating against you without you even knowing it?

– Safiya Noble

AI is Biased

Safiya Noble, a MacArthur Fellowship award recipient and renowned professor, has challenged the assertion that "algorithms are just math, and math can't be racist or biased." Noble says that to claim algorithms are "just math" is like saying humans are "just cell tissue" without thought and consciousness. Algorithmic bias may result from commercialism, cultural and value differences, as well as explicit racism.

With regards to Google and related AI tools, Noble reiterates Google is an advertising platform, not an objective library of information. As such, advertisers, not users, are the customers of Google. Search results are often prioritized and filtered based on monetary commercial value and paid sponsorship.

AI increasingly performs decision-making tasks. Often these tasks are based on foundational values. The algorithmic design and value hierarchy isn't naturally occurring; it originates with the original design and development of the system. Consider self-driving cars and navigational systems. A self-driving car may encounter ethical situations similar to a well known ethical thought experiment, the Trolley Dilemma. The car loses its brakes and must decide where to route and potentially crash. Turning left may result in injury or death to a group of children. Turning right may result in injury or death to a group of elderly senior citizens. The selected choice is not random; it likely results from values, metrics and decisions of the human developers who designed the system.

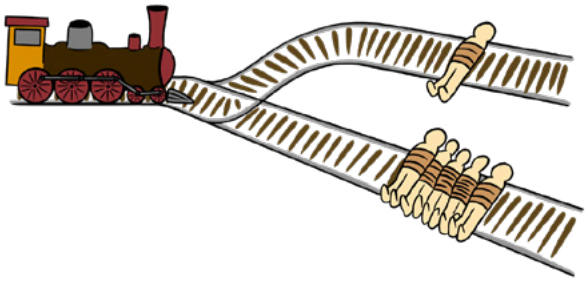
Machine learning is a branch of AI that uses algorithms to analyze and draw conclusions from patterns in data. The results include sorting and grouping objects. Machine learning uses patterns and conclusions to analyze and learn from more and more data. For example, a canine identification application may analyze photos of canine animals, and determine if each animal is a coyote, wolf, or domesticated dog. The analysis is based largely on generalizations, patterns and prior experiences. In purely statistical contexts, such a tool may prove useful. Yet, when applied to human social contexts, machine learning may produce dangerous and destructive results. Humans are taught to judge others based on individual traits rather than generalizations. A common form of human generalization is prejudice. For example, suppose individuals with long hair styles broke into my car twice; therefore, I may wrongly conclude people with long hair are likely car thieves. This logic would be unacceptable in a social setting yet it is essentially how machine learning identifies patterns.

Predictive policing algorithms provide another example of the danger of AI tools. Policing algorithms analyze data to construct predictions of high crime areas so that they may either prevent or respond to criminal incidents quicker through an increased presence in the area. Importantly, crime data on which the algorithms are based may be flawed. If police forces were to unjustly concentrate activities in particular ethnic, minority, or low-income areas, these prejudices would be magnified by predictive algorithms, which would direct even more police resources to the impacted areas. This could then become a self-fulfilling prophecy of predicted and actual arrests.

AI offers us vast potential to increase our analytical, computational, and algorithmic abilities. Another revolutionary tool, nuclear energy, may be used to generate energy for productive purposes, and conversely produce horrific weapons of mass destruction. Similarly, the power of AI may be harnessed for both productive and destructive uses. As the power and reach of AI expands throughout society, we must ensure humans provide guidance and oversight over the power of AI.

The Trolley Problem is real for AI

AI-driven self-driving cars might have to make ethical decisions in accidents, similar to the famous philosophical Trolley Problem—choosing who to save based on its programmed ethics.



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AI's Trust Problem
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Search Engines Like Google Are Powered By Racist, Misogynist Algorithms, Says MacArthur Fellow, Safiya Noble
wbur.org/hereandnow/2021/09/30/safiya-noble-internet-research

Algorithms of Oppression – A Conversation with Safiya Noble.
tminstituteldf.org/tmi-briefs-algorithms-of-oppression/

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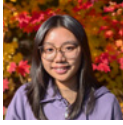

Yiyuan Xia
Student

Digital Immortality: The Ultimate Vision of the Information Age

The Dartmouth Summer Research Project on Artificial Intelligence, held in 1956, is primarily regarded as the birthplace of AI. In the back row from left to right are Oliver Selfridge, Nathaniel Rochester, Marvin Minsky, and John McCarthy. In front on the left is Ray Solomonoff; on the right, Claude Shannon. The identity of the person between Solomonoff and Shannon remained a mystery for some time. The Minsky Family

spectrum.ieee.org/dartmouth-ai-workshop

In a Silicon Valley laboratory, a paralyzed patient sent the tweet "Hello, World!" through a brain-computer interface—an achievement that not only transcended the limitations of human physiology but also opened the door to the digitization of consciousness. This technological revolution, driven by artificial intelligence, neuroscience, and information technology, is reshaping humanity's understanding of life's essence and pushing the ancient quest for immortality into the digital realm.

Digital immortality is the convergence of artificial intelligence, brain-computer interfaces (BCI), and information storage technology, aiming to extend an individual's thoughts, memories, and personality in the digital world through data storage, AI simulation, and consciousness uploading. Throughout history, humans have pursued immortality, from mythological tales to modern biotechnology, and digital immortality offers a possibility beyond biological carriers.

One of the core concepts of digital immortality, Informational Ontology, posits that information exists as an independent entity that can transcend physical substrates. Physicist Max Tegmark introduced the concept of "Substrate Independence," arguing that as long as the arrangement of information remains unchanged, consciousness can migrate between different carriers. (**Further Reading: *space.mit.edu/home/tegmark/crazy.html***.) In "Life 3.0," Tegmark suggests that if a computer could precisely replicate the neural networks and

information flow of the human brain, then a person's consciousness could potentially continue in the digital world.

Information is independent of its physical carrier. Tegmark asserts that the essence of consciousness lies in the way information is processed rather than in the medium that carries it. In other words, consciousness is like a computer program—it can run on different hardware and is not restricted to a specific physical form. Just as a news article can be printed on paper, stored on a computer hard drive, or retained in a human brain while maintaining the same content, the same principle applies to the brain's information patterns. If these patterns can be fully replicated onto another system, then this consciousness could theoretically "migrate" to a new carrier. (**Further reading: *scientificamerican.com/article/is-the-universe-made-of-math-excerpt/***. Mathematical Universe Hypothesis, which suggests that the universe itself is a structure of mathematical information.)

The physical carrier of computation can change. Traditional computers use silicon chips to perform computations, while the human brain processes information using neurons. The brain's thinking patterns and decision-making mechanisms fundamentally involve transmitting and processing electrical signals between neurons. If we could fully scan a brain's neural network and precisely simulate these neural activities within a computer, the simulated system could potentially be identical to the original brain. As long as the algorithm and structure of information processing remain unchanged, computation can occur across different substrates, and consciousness may follow the same principle. (**Further reading: *fhi.ox.ac.uk/brain-emulation-roadmap-report.pdf***. "Whole Brain Emulation," which aims to fully simulate a person's neural activity, enabling their consciousness to persist in a digital system.)

Casey Harrell, who has lost his ability to speak due to ALS, using the BrainGate2 brain-computer interface while seated in his mobility device. University of California Regents

scientificamerican.com/article/brain-to-speech-tech-good-enough-for-everyday-use-debuts-in-a-man-with-als/

Currently, multiple companies and institutions are exploring ways to achieve digital immortality. Synchron successfully enabled a paralyzed patient to send a tweet using only their thoughts. (**Further Reading: *synchron.com***.) HereAfter specializes in recording an individual's voice, stories, and personality traits, allowing loved ones to interact with an AI version of the deceased. (**Further Reading: *hereafter.ai***.) Peter Scott-Morga, a pioneer in digital immortality research, utilized AI and BCI to enhance his survival capabilities, striving to become a "human cyborg." His experiments demonstrate how technology can help transcend physical limitations, paving the way for future digital immortality.

However, despite its promising prospects, digital immortality faces numerous challenges and controversies. A fundamental question remains: does a digital clone truly represent the self? Even if AI can perfectly replicate a person's thought patterns and memories, it may still be nothing more than a sophisticated copy rather than a true continuation of the original consciousness. From a societal perspective, digital immortality raises profound ethical and legal concerns. Who has the right to access the data of the deceased? Should AI-generated versions of the deceased have legal status? Additionally, digital immortality may exacerbate social inequalities, as only the wealthy may afford full consciousness uploading, leaving the majority unable to access this technological advancement.

Humanity stands at the crossroads of a civilization-defining revolution. Digital immortality, as a new direction in the pursuit of eternal life, integrates AI, BCI, and information storage technologies, offering a potential means for consciousness preservation. However, this concept remains in its infancy, with unresolved technological, ethical, and societal challenges. As technology advances and society adapts, digital immortality may eventually become a reality, but it will inevitably introduce new dilemmas and profound questions. Neuroscientist Michael Gazzaniga has warned, "We must not only ask whether digital immortality is possible, but also whether it is worth pursuing." As technology pushes the boundaries of death, human civilization must establish new ethical frameworks. Perhaps true immortality does not lie in the infinite extension of consciousness, but rather in safeguarding the essence of humanity amidst the storm of technological progress.

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ALUMNI SPOTLIGHT

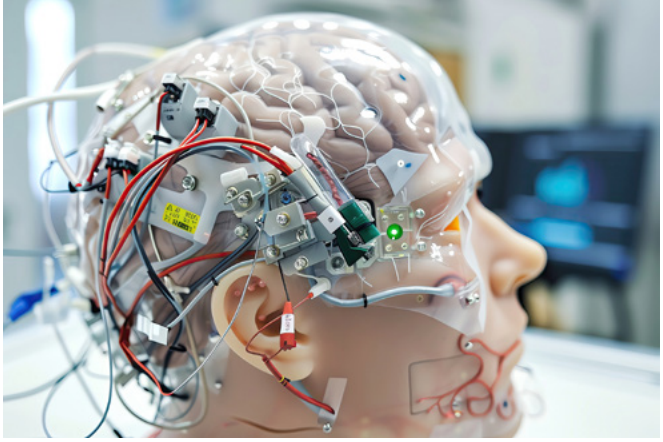
Bring Your Story to Life

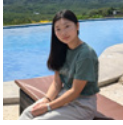
Erik Uri

BS, Computer Science, '18

Software Engineer, Microsoft

Erik pioneers cutting-edge technology and software solutions at Microsoft. From revolutionizing the digital image experience to enhancing business capabilities with Azure OpenAI Services, Erik is at the forefront of optimizing the potential of artificial intelligence.





Elika Wang
Student

Could Knowledge Ever Be "Downloaded" Instantaneously?

Remember that scene in "The Matrix" where Neo says, "I know Kung Fu" and downloads all of martial arts? What if that wasn't just sci-fi? Imagine being able to just downloa answers straight into your brain. We'd never have to pull all-nighters to cram for tests again! Sounds like every student's dream come true. With advances in neuroscience and tech, it could be closer to being a reality than we think.

Technology has already come a long way. Back in the day, computers took up entire rooms and still had less power than the phone in your pocket. Now we're putting technology on our faces with the trending Ray-Ban Meta glasses to merge the real and virtual worlds. And companies like Neuralink are working on neural implants—small devices that are surgically inserted into the brain to interact with neurons—called brain-computer interfaces (BCIs) that could let us control computers with just our thoughts.

But why stop there? What if these implants didn't just let you control your phone or prosthetic arm, but actually connected you to the internet? A literal computer in your brain. Imagine being able to download entire subjects, recall memories in perfect detail, or even experience things you never thought possible with just a thought. No more struggling through calculus.

As with any technological innovation, this comes with its own risks and ethical dilemmas. Overwhelming your brain with too much information too fast could cause cognitive overload. The brain can struggle to process and store that information efficiently, resulting in less understanding and remembering. It's like when you binge watch two seasons of anime and end up forgetting half of it. Forming strong neural pathways takes time and skipping that process might mean we lose the ability to think critically or truly understand what we learn. And then there's the problem of security. Devices get hacked all the time, so what's to stop people messing with your memories when your brain's connected?

Although the concept of downloading knowledge remains theoretical for now, technology is moving fast. Now that thought-controlled computers exist, what will future technology bring us? Maybe brain-to-brain texting. Or perhaps ChatGPT implants to compensate for all the brain cells that died. The future of everything might just be one download away.

Yutao Cai
Student

How Will the 'T' in STEM Affect Our Education and the Way We Learn

One of the most influential advancements in recent times is the emergence of conversational AI models. The most iconic model is ChatGPT, which emerged as an open-sourced model in November of 2022. However, within just the last few years, as more data is fed to the model, its accuracy has increased significantly, and it is able to provide detailed reasoning behind its results. This allows everyone to obtain information at a speed no one could have imagined. In addition, many extension tools or applications integrate ChatGPT or similar models to enhance their functionality. For example, SlidesGPT, a platform that can create presentation slides based on user prompts, or YouTube Summary with ChatGPT, a browser extension capable of providing concise summaries of YouTube videos. This indicates that there will be a massive transformation of how society works and operates. There are a variety of AI tools out there covering everything from education to personal care, many of which are open-sourced. This means studying will become much quicker and easier, and it will come down to efficiently utilizing different tools to get what one wants.

My vision of STEM, specifically technology, is that the education field will be the 'victim' of conversational AI model emergence. In the past, when fewer public learning resources were available, school was the primary place to acquire skills and knowledge. As we gain new knowledge, questions come up. We had to ask our teachers or search for it on the internet. The issue of asking teachers is time availability for both sides, and we might not be able to get a response or solve the problem immediately. Conversely, finding content on the internet can be challenging when our question gets too specific.

However, learning with conversational AI models avoids these inconveniences; they can efficiently gather available resources, accelerate learning speed, and make learning more flexible, personalized, and independent. There are already applications out there that can craft a curriculum-like learning plan, including a comprehensive list of chapters and topics with well-written content and equipped with a chatbot that can answer any questions we might have along the way. Continuous learning will always be at our fingertips, and it will significantly downplay the importance of traditional education.

With highly accessible information, the weight of college degrees will also be impacted, especially for STEM degrees. A college degree is viewed as one's expertise in specific areas and is a crucial determinant of landing a job offer. However, with the integration of candidate screening, in my opinion, a degree will only serve as a tag for entry to a job position, essentially just to meet the minimum requirements. Additionally, there are many online courses where you can obtain certification upon completion. In the near future, applicants might have many of these certificates along with their degree, but at the end of the day, it is how many tools we have in our toolkit and whether we know how to use them efficiently and creatively that lands us the offer (hard skill part).

The evolution of education and how we learn is inevitable under the benefits of these advanced AI models, and the first step we can take to get ourselves ready for this transformation is to explore and utilize these AI tools to optimize our learning process.

Drew Stone

XR Lab

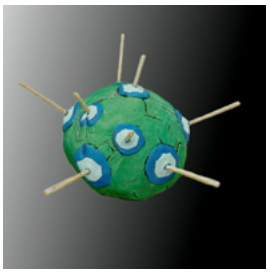
*In October 2023 the National Science Foundation awarded the Bellevue College XR Lab a significant grant to create **The Northwest XR EDU Network (NWXR EDU)**. Over the last year we've become a resource network for educators in the Pacific Northwest to learn about extended reality (XR) technologies. A goal is to help educators create virtual, augmented, and mixed reality tools for teaching and learning.*

We also provide workshops, training, and collaboration opportunities for higher educational faculty and staff. A recent success story is the creation and delivery of a DMA 294 course focused on "XR Development and Client Collaboration." The class is providing hands-on experiences with building immersive projects and working with real clients. The students' work will continue into spring quarter with DMA 295. Other exciting projects that take place in our XR Lab are the translation of physical sculptures of anatomy and biological cell structures into 3D models into virtual spaces. Students in Professor Reza Forough's anatomy and physiology class have been scanning their handmade sculptures and using a LiDAR scanner in an iPhone 15 Pro to convert these into digital artifacts that can be arranged in virtual spaces for posterity, and manipulation in immersive environments.

Visit the **Bellevue College XR Lab website** for more information about the National Science Foundation grant and how we can work with you to enhance your learning with immersive technology.

Dr. Reza Forough

Blending Hands-On Learning with VR Technology at Bellevue College



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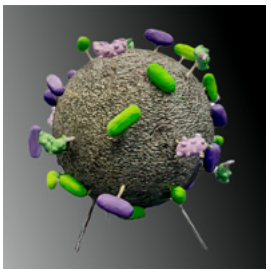

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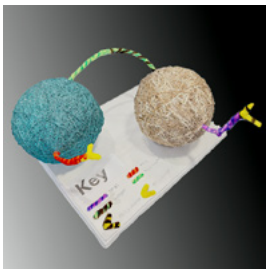

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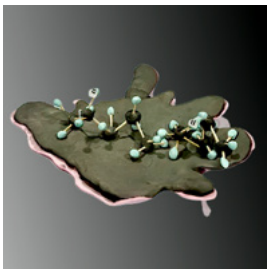
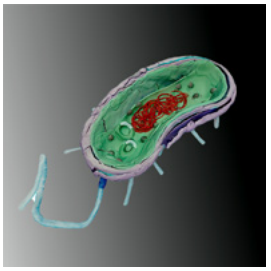


(d)

This composite image illustrates the fusion of traditional model building and advanced VR technology in project-based learning. **a–b)** Human viruses with their prominent surface spike proteins for attaching the host cells. **c)** A visualization of the mechanism of action of CAR-T cell therapy for cancer treatment. **d)** Engineered bacteria designed to metabolize oil spills for environmental cleanup. **e–f)** A cross-section image of a bacterium displaying its internal structures.



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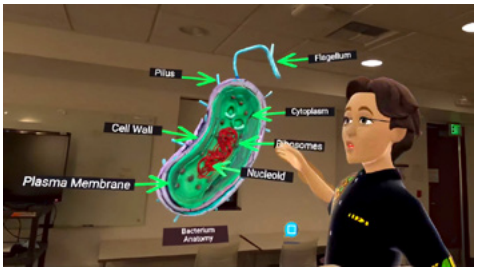


(f)

Bridging Hands-On Learning with Virtual Reality: A New Era in STEM Education

Dr. Reza Forough recently led a project-based model-building initiative in several anatomy and physiology and microbiology courses at Bellevue College. Students, working in small groups of four, constructed anatomical and microbiological models using inexpensive and recycled materials. This hands-on approach emphasizes learning through doing, which can strengthen their understanding and retention of the subject matter, while also enhancing other skills like teamwork and creativity.

Collaboration with the Bellevue College XR-Lab

To maximize the impact of this project, Dr. Forough collaborated with the XR Lab at Bellevue College. The XR Lab helped with the creation of a virtual gallery/museum showcasing students' work as students graduate, their work is preserved in a 3D digital format, allowing future learners to explore new designs and approaches in model-building. By building a virtual gallery to showcase handmade models, student creations are archived digitally.

The partnership expands learning opportunities for students through the integration of innovative technology at a low-cost. Virtual reality (VR) provides an immersive and engaging platform that enhances student interaction, facilitates complex concept visualization, and supports knowledge retention.

A special thanks to Bruce Wolcott and the incredible XR team for their continuous support, dedication, and expertise in making this project a reality. Their contributions have been instrumental in integrating VR technology into education, making learning more interactive and engaging.

Be part of this innovative learning journey and take advantage of Bellevue College's commitment to cutting-edge education.

Explore the virtual experiences:

Virtual Micro Gallery Tour – Featuring microorganism projects scanned and brought into a virtual walkthrough experience.

Virtual Tour of Student Human Anatomy Project – Showcasing detailed student anatomy models in a VR environment.

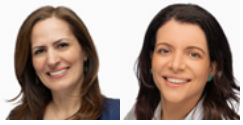
Video of XR in Anatomy & Physiology and Microbiology Teaching at Bellevue College – explaining how Professor Forough and the XR Lab team at Bellevue College take physical models that have been created in Anatomy and Physiology and Microbiology classes at Bellevue College and bring them into virtual reality galleries using a combination of Polycam and Shapes XR.

Benefits Beyond the Classroom

A key outcome of this collaboration is student participation in digital modeling and virtual space development. This initiative helps foster interdisciplinary learning opportunities. By blending traditional hands-on learning with cutting-edge VR technology, students gain critical skills applicable to both academic and professional domains.

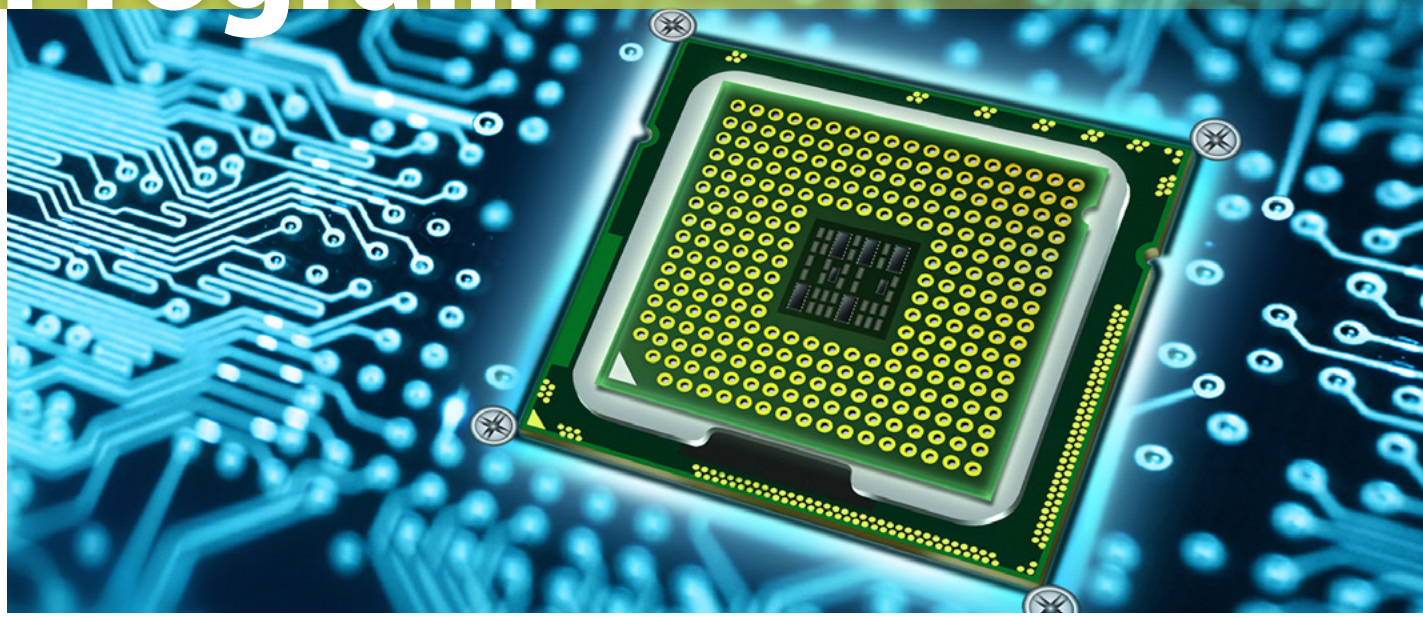
Courses Involved

- **Anatomy & Physiology I: Bio241**
- **Anatomy & Physiology II: Bio242**
- **Microbiology: Bio260**



Dr. Fatma Cemile Serçe and Dr. Sara Farag

Computer Science Program



Bellevue College offers an exceptional Computer Science program designed to meet students at any stage of their educational journey. Whether you're new to coding, transferring from another institution, or pursuing a bachelor's degree, Bellevue College provides accessible pathways to success in the technology-driven fields of today and tomorrow.

Getting Started – No Experience Needed

If you're new to programming, Bellevue College makes it easy to get started with CS 209: Introduction to Computer Programming for Beginners. This introductory course is designed specifically for students without any programming background, ensuring you can build a strong foundation for future studies.

Transfer-Friendly Courses

Students beginning with Bellevue College's Associate in Arts and Sciences (AAS-DTA) program can seamlessly transfer into the Bachelor of Science program. Foundational courses, including computer science fundamentals, calculus, and physics, provide the academic base needed for advanced studies.

Bachelor's Degree in Computer Science

The college's Bachelor of Science in Computer Science program is designed for those aiming to deepen their expertise. Small class sizes, hands-on projects, and affordable tuition make this program an excellent choice for aspiring technology professionals.

Bellevue College is notable for being the first community and technical college in Washington state to offer a traditional four-year BS degree in Computer Science. The program is tailored to provide individualized support, small class sizes (no larger than 28 students), and affordable tuition compared to other four-year universities in the state.

Shape Your Future in Technology at Bellevue College

Two Areas of Emphasis

Students enrolled in the bachelor's program can specialize in one of two cutting-edge emphases:

- **Data Science:** Master techniques in data analysis, machine learning, and big data systems to tackle complex problems.
- **Cybersecurity:** Develop expertise in protecting systems, conducting digital forensics, and combating cyber threats.

Whether you're starting from scratch or building on previous knowledge, Bellevue College provides the education and resources you need to succeed in today's digital landscape. If you'd like to explore more about the program, you can find additional details here: ***bellevuecollege.edu/cs/***

Mentors in Tech (MinT)

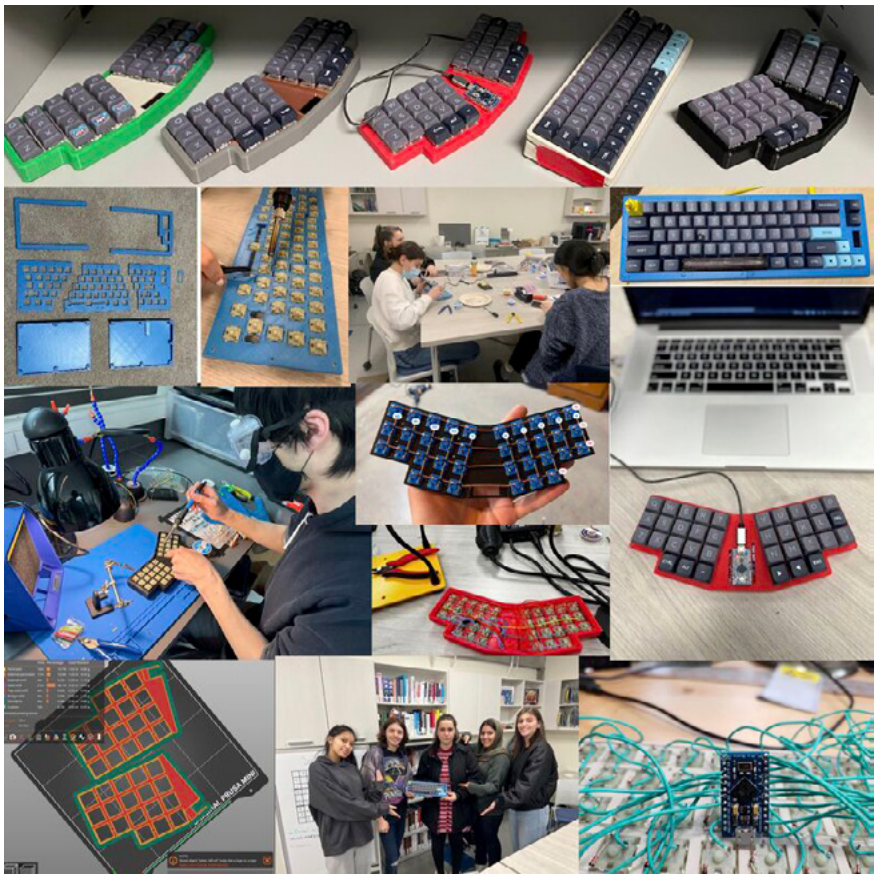
Computer Science Mentorship Opportunity

Bellevue College's Computer Science program is proud to partner with Mentors in Tech (MinT) to offer yearlong, structured mentorship for students preparing for tech careers. Through this collaboration, 60 junior and senior Computer Science students are matched with industry professionals who provide guidance, support, and real-world insights. Students also have access to paid capstone projects and tailored job connections. This mentorship experience helps Bellevue College students build confidence, make industry connections, and launch their careers with purpose.

Computer Science Career Highlights

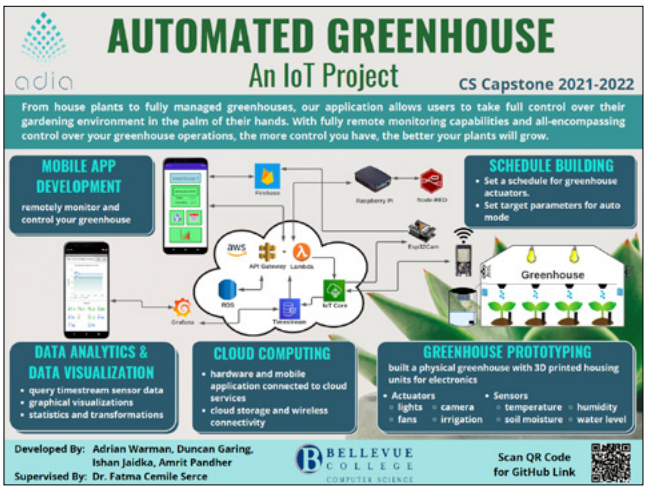
- **Diverse Career Paths:** Graduates are prepared for roles like software developer, data analyst, systems engineer, web developer, cybersecurity specialist, and IT support specialist across various industries, including technology, healthcare, and finance.
- **Specialized Expertise:** With emphases in data science, cybersecurity, and software engineering, students gain tailored knowledge to excel in high-demand tech fields.
- **Real-World Experience:** Internships, cooperative education, and a senior capstone project provide hands-on learning, bridging the gap between academic and professional environments.
- **In-Demand Skills:** The program focuses on cutting-edge topics like cloud computing, data science, and cybersecurity, keeping graduates ahead in the ever-evolving tech landscape.
- **Growing Job Market:** Careers in computer science are projected to grow significantly with strong demand for professionals skilled in programming, data analysis, and system security.

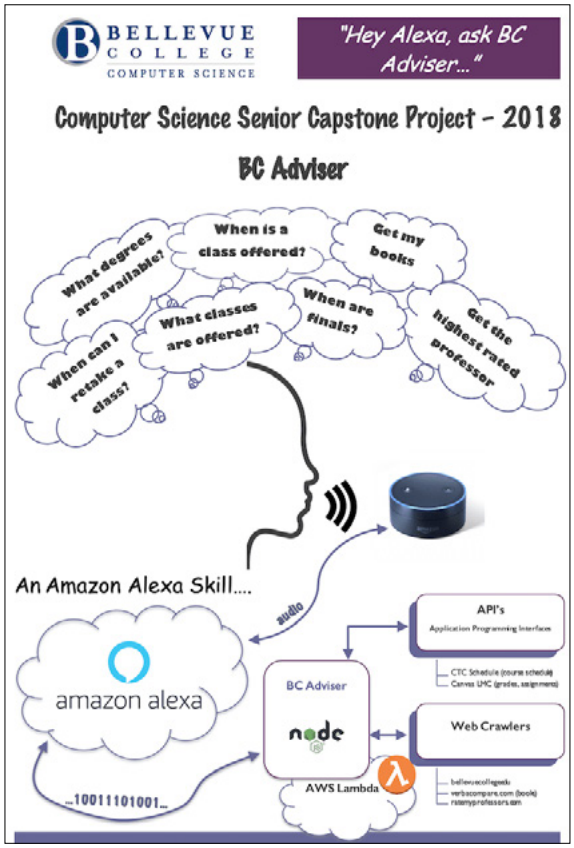
Learning by Doing: A Hands-On Project



Students in Dr. Fatma Cemile Serçe's CS 351 Computer Architecture class at Bellevue College showcased remarkable creativity and technical expertise by building their own custom keyboards. This hands-on project involved 3D printing and hand-wiring, reflecting the students' innovation and dedication. As a prime example of Bellevue College's commitment to fostering practical, forward-thinking learning experiences, it highlights the ingenuity and passion that prepares students to lead in technology.

Showcasing Innovation: Capstone Projects in Computer Science

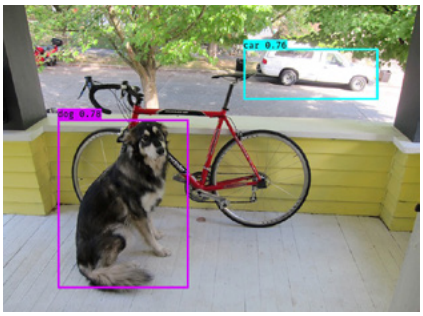




Bellevue College Computer Science Capstone Team
Wins Most Promising Innovation Award at Computer Vision Project Expo 2024

Bellevue Students Shine at Ready Tensor 2024

In December 2024, Bellevue College Computer Science students Igor Janotti, Frank Vanris, Trong Duong, Joseph Hoang were honored with the Most Promising Innovation award at the Ready Tensor Computer Vision Project Expo 2024 for their groundbreaking project, "Following Mechanics with Our YOLO Model." While YOLO is widely known to be "You Only Live Once," the model stands for "You Only Look Once" in this case. Their capstone project focuses on creating an autonomous robot that helps people with disabilities by carrying up to 50 pounds and following them intelligently. To make this possible, the team used the YOLO object detection model and Convolutional Neural Networks (CNNs), which help the robot recognize and track the person in real-time. CNNs are a type of AI that can understand images, like identifying people or objects. The robot uses a camera and a Raspberry Pi, a small computer, to process the images and make decisions on how to follow the user. By combining computer vision and deep learning, their robot can not only track and follow a specific individual but is also being developed to move autonomously between locations without human control. This innovative use of AI and robotics holds promise for enhancing mobility assistance and has garnered attention for its social impact and technical ingenuity. You can read more about their project and view the showcase ***app.readytensor.ai/publications/hdKQGDqLbZsZ*.**



Dr. Taesik Kim

Computer Science and the South Korean Immersive Media Innovation Convergence Project

Two years ago, the Computer Science department began to think about ways to expose Bellevue College students to other cultures, share different ways of thinking, and experience diversity. As a result, the department began collaborating with universities in Korea.

For more than a decade, the South Korean government has provided full support to university students to train in human resources within the IT field. Not only the government, but also large companies, such as Samsung and LG, have ran various programs to train young students to become global talents. One of the programs supported by the Korean government is the Immersive Media Innovation Convergence Project. This is a consortium of IT-related majors from seven Korean universities that will receive a total of $43 million from the government over the next six years to train talent in the field of immersive media.

The project aims to train professionals who can understand and utilize core immersive media technologies, such as augmented reality, virtual reality, extended reality, and human-computer interaction. It also calls for students to apply these media technologies in various academic fields, such as the metaverse, design, games, content, cultural arts, entrepreneurship, and management. Part of the project includes sending students overseas to work with students from other countries, fostering an international workforce through mentoring by professors from foreign universities and corporate experts.

In September 2024, Bellevue College signed a memorandum of understanding with Keimyung University, one of the central universities of the project. The first joint international education program at Bellevue College was held in January 2025. For Bellevue College students, it is a great opportunity to interact with

students from different majors to broaden their thinking and learn how to integrate different technologies. This project group will also pave the way for Bellevue College to establish educational programs with the Korean government and Korean companies.

In January 2025, 42 students from 11 universities in South Korea and 10 professors from 10 Korean universities spent two weeks at Bellevue College in collaboration with the Computer Science department.

1. NextGen Startup Challenge

As part of the visit, faculty created the NextGen Startup Challenge competition to keep students engaged. It fostered creativity and teamwork by uniting Korean and Bellevue College students in an exciting competition, enhancing global connections and innovative solutions over two weeks. Experts from Microsoft, Google, professors from Bellevue College's computer science department, and professors from Korea offered workshops and mentoring throughout the competition.

The competition focused on developing innovative solutions in areas such as:

- Content and apps using artificial intelligence (AI)
- Realistic content based on AR/VR
- Games
- Media art using realistic technology
- Autonomous driving
- Future mobility

Participants:

- Korean Students: 42
- BC Students: 40
- Bellevue College Professors: 6 (Mentoring for Korean Students)
- Korean Professors: 7 (Mentoring for Bellevue College Students)

A total of 11 teams participated in the event, and each team was composed of both Korean and Bellevue College students. On the last day of the event, each team gave a presentation and demonstration. They were then evaluated and awarded by 10 expert judges. The first-place winner was awarded a six-month international collaborative student project with research funding from Korea.

2. Coding Competition

Korean students teamed up with Bellevue College students to participate in a coding competition event that the Computer Science department regularly holds every quarter. A total of 13 teams (42 Korean students and 22 Bellevue College students) participated.

This coding competition was a chance to collaborate with international students, showcase their skills, and explore the limits of their creativity. The Computer Science coding competition was the perfect opportunity to shine and connect with fellow tech enthusiasts.

On the competition day, students formed teams of 3–4 with one computer per team. The coordinator introduced the platform and gave students about 15 to 20 minutes to work on the practice problems. Once they were ready, eight problems were released. The competition lasted six hours.

3. MicroDegree Expo

Korean students exhibited 32 capstone projects completed in Korea. The purpose of the exhibition was to get feedback on their work from Bellevue College students to upgrade their skills for better development. A total of 20 Bellevue College students participated in the evaluation and gave feedback. Although the event was primarily for Korean students to get feedback from students of the same age, it was also an opportunity for Bellevue College students who participated in the evaluation to broaden their thinking about the process of developing different projects.

What's Next?

Bellevue College and Korean universities are continuing to plan international programs, including the following:

Summer Internships for Bellevue College Students

Bellevue College students will intern at Korean IT companies for seven weeks during summer vacation in 2025. Currently, five Korean companies have confirmed that they will host Bellevue College students for internships. Initially, we will send four to five students and will continue to expand the program in the future.

Future Programs

The Korean universities are planning to invite some Computer Science professors to Korea to discuss future educational programs. The vision is for these programs to be jointly conducted with Korean universities with the support of the Korean government. These programs will include establishing a system where students from Korea, France, Vietnam, China, India, etc. can take online courses with Bellevue College students. They will also establish how Bellevue College students will receive support from the Korean government or companies, and how to attract Korean government projects to Bellevue College.

The Korean students also wanted to invite the professors who provided valuable mentorship and feedback during the NextGen Challenge to present their updated deliverables and receive feedback and mentorship. Surveys following the event showed that the feedback from Bellevue College Computer Science professors had a significant impact on the Korean students.

Dr. Jacqueline Gapinski

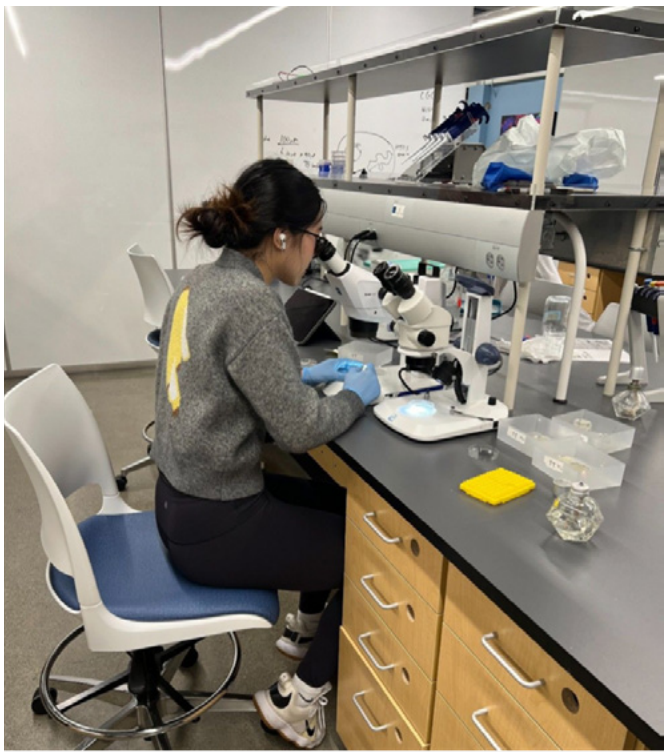
Molecular Biosciences Program

Do you like doing experiments in your lab classes? Have you ever wondered about how cells function together in our body or what happens during the development of diseases like cancer? Molecular biosciences open up the door to discover what is going on at a cellular and molecular level within our cells. This interdisciplinary field of science uses biology and chemistry to study the network of chemical reactions and biological processes that connect molecules in living organisms. Degrees in molecular biosciences will prepare you to pursue a career in a variety of fields including biomedical research, genetics, medicine, pharmacy, forensics, or even food science (to name a few). Bellevue College offers both an associates degree (Associate of Applied Science – Transfer (AAS-T) Molecular Science Technician) and a Bachelor of Applied Science (BAS) in Molecular Biosciences. Interested? Visit ***bellevuecollege.edu/molecularbio*** *for more information.*

Career highlight

Research technicians play a critical role in biomedical research labs in universities and research institutions. Their daily activities include conducting experiments, collecting and analyzing data, preparing reagents, maintaining lab equipment, keeping track of inventory, placing orders for lab supplies, and ensuring safety compliance. Oftentimes, research technicians assist other scientists with the practical aspects of the research projects. The exact roles and responsibilities of research techs may vary from lab to lab.

Patent agents are scientists and engineers that are licensed to prepare patent applications for inventors or companies. It can be a highly paid position inside of a company or at a law firm. You do not have to be an attorney to do this, and you get to interact with other talented scientists and engineers in a wide range of technologies. If you love science, have an interest in the law, and enjoy writing, then this is a great career option.

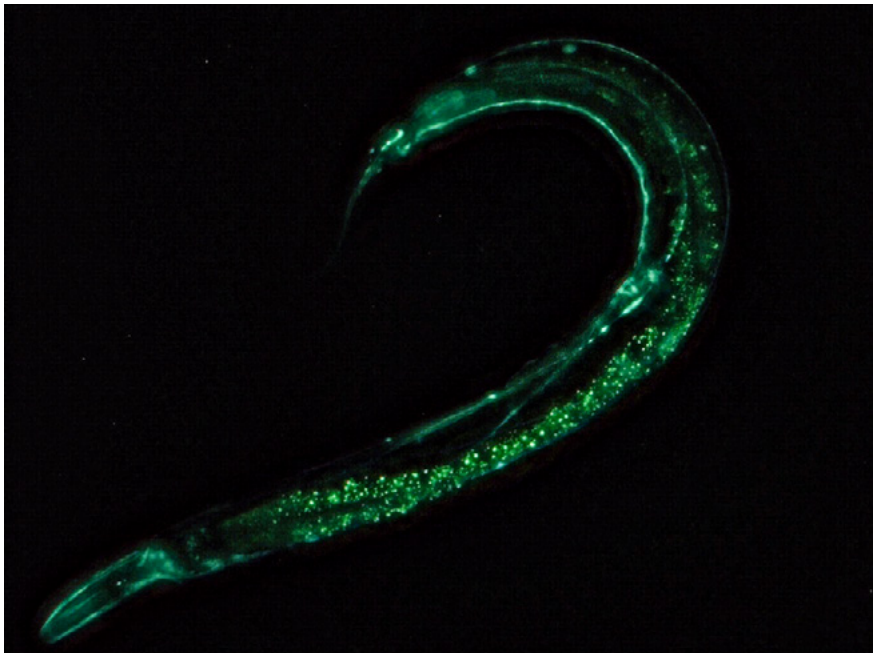


Patent are employed by the government and are trained by the Patent Office in patent law. A scientific or engineering degree is required, but one does not need to be an attorney. Remote work is possible as well as assignments at one of the five regional patent offices. Learn more: ***uspto.gov/jobs/become-patent-examiner***.

Fun fact

Early in his career, Albert Einstein was a patent examiner in Switzerland.

Green fluorescent protein labeled neurons in C. elegans.
Image: Mitch Gardner, Class of 2026, Molecular Bioscience Bachelor's Program]



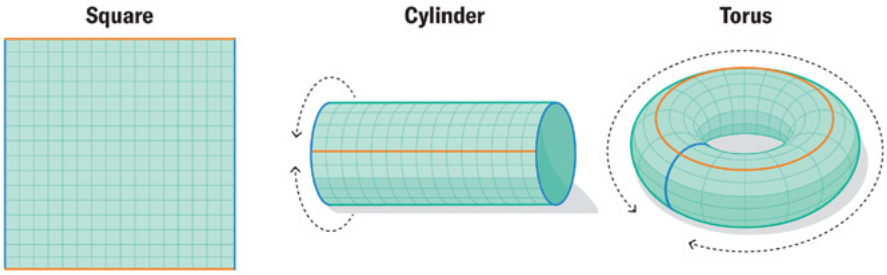
Spotlight on Research – MBS Capstone Research Projects

Neurodegenerative diseases are a group of diseases that affect cells in the brain and peripheral nervous system and can lead to a progressive decline in brain and nervous system function. Neurodegenerative diseases, including Alzheimer's disease, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis (ALS), and multiple sclerosis, affect millions of people worldwide. Senior students in the Molecular Biosciences program are using a tiny worm, called Caenorhabditis elegans, to try to better understand the molecular pathways that contribute to neurodegenerative disease development. C. elegans a genetic model organism that has been used to study a lot of human diseases. They are small (1 mm in length) free-living roundworms that are found in soil. There are many features that make this worm a very useful model for studying human disease, including their transparent anatomy, stereotypical development, fully sequenced genome, and available tools to manipulate all of their genes and to create "models" of the human diseases. For example, one student is using a model of the Alzheimer's disease in which the human variant of the disease has been expressed in the muscle of the worm. As this protein becomes aggregated, it causes paralysis which is a visible phenotype in the worm. Our lab has used other genetic tools to "knockdown" genes in pathways that have been implicated in Alzheimer's to see if there is an improvement in the paralysis or if the gene knockdown makes the paralysis worse. These interacting pathways may help to unravel the molecular mechanisms or even to identify new therapeutic targets?.

Dr. Tom Crawford

Are You Living on a Donut?

How do we know the shape of the earth? Or for that matter the shape of the universe? The mathematical field of topology works with "weird" shapes of any dimension.



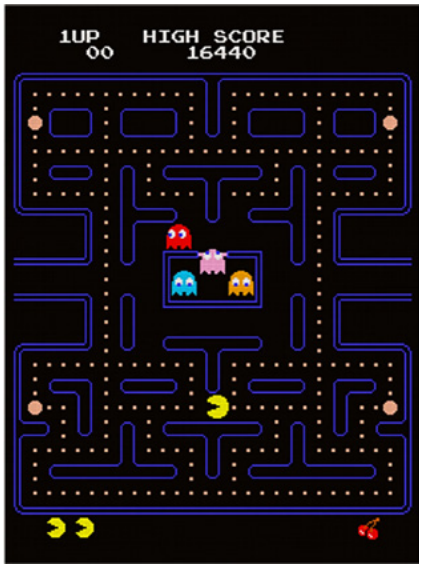
Two Dimensions

We live in a three-dimensional world, but if we're talking about the ground that we walk on we can model it as a two-dimensional surface. Looking around, it seems like if you keep going in any direction you can keep going forever (ignoring mountains and oceans, etc.) Mathematicians would call this kind of space "euclidean" or flat. However, if we actually tried this on earth, after a long trip of simply going in a straight line, we'll end up where we started. You may be thinking "that's because we live on a globe," which is correct for many, many reasons, but is a sphere the only shape that has this "back to where you started" property?

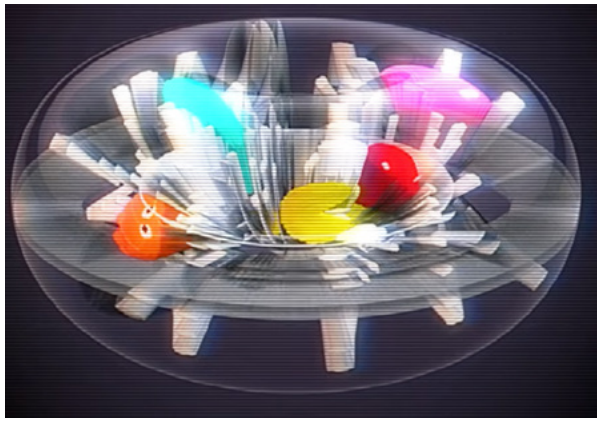
When the video game character Pacman walks to the right, off of the edge of his map, he appears on the left side. With a little more walking he can return to where he started. Imagine treating Pacman's 2D world as a piece of paper and bending it in 3 dimensions, left side to right side, to make a cylinder. From our perspective, it looks different. But it's all the same to Pacman, who can keep moving to the right around and around. On some Pacman levels, it is also possible to walk past the top and appear on the bottom. Let's take our cylinder and bend it to attach the top circle to the bottom circle. We're left with a donut (technically called a torus).

As an outside observer used to a 3D world, we can make sense of a strange 2D surface by bending it through the third dimension. But what does Pacman's universe look like to Pacman, trapped in his 2D world? Without the walls blocking his line of sight, if he looks to the right, he'd see another copy of

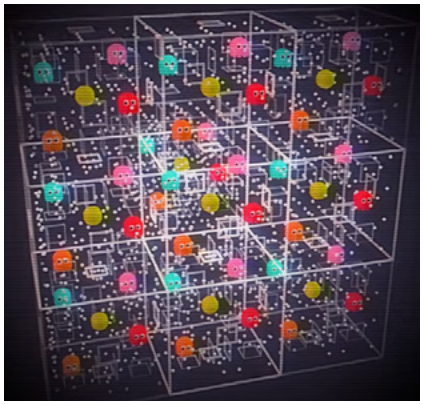
"Pac-Man" is the most successful arcade game of all time. Courtesy Bandai Namco
cnn.com/style/article/pac-man-40-anniversary-history/index.html



When viewed as a whole, a torus can be described as a flat, rectangular area—or folded and rolled into a donut shape. Lucy Reading-Ikkanda
scientificamerican.com/article/how-many-holes-does-the-universe-have/



himself, and beyond that yet another copy. Same with looking up, or even at an angle. If you've ever been in a hall of mirrors, you've seen this effect: you're surrounded by images of yourself.



Beau Janzen @reasonformath Pac-Man and Shape of Universe
youtube.com/@reasonformath

Three Dimensions

Go up a dimension to 3D. Just like Pacman's world wraps around in two different directions, we can imagine a 3D space where all directions wrap back on themselves. Suppose you're in a room and you have access to portals (like a Minecraft portal or a Portal portal) so that when you pass through the left wall of the room, you come out the right wall. Same with the front and back and with the top and bottom. As with the 2D version, one way of understanding this is to bend the room to glue the opposite sides together to form what is called the three-torus, a "higher dimensional" version of a torus. Unfortunately, this is nearly impossible to picture because it needs a fourth dimension to fold through. What would it look like from inside this space? Just like before, we would see copies of ourselves in all directions.

Amazingly, this is a legitimate possibility for the shape of the universe. Some scientists propose that space itself might be connected in such a way that traveling far enough in one direction could bring you back to where you started, just like Pacman or a 3-torus. While we don't have direct evidence of this yet, studying cosmic background radiation and the large-scale structure gives us clues. For example, astronomers look for repeating patterns in the cosmic microwave background (the faint radiation from the Big Bang) to see if light has wrapped around the cosmos.

Geometry and topology help us explore the different possible shapes of anything, including the shape of our universe. In many ways, the true shape of our universe is fundamentally un-knowable. It probably isn't actually a donut, but it just might be something just as strange.

Maria Guadalupe Lizana

The Women Behind Major Calculations

Williamina Paton Stevens Fleming
1857–1911

Nowadays, computer programming in astronomy is widely used to perform complex calculations in a matter of minutes or maybe hours. Different data reduction tools are used to analyze images and plots very quickly, too. However, this was not the scenario in the late 1800s and early 1900s, when computers did not yet exist.

In 1877, Edward Pickering, an American astronomer, became so mad at his male assistants, that he ended up hiring his own maid, **Williamina Fleming**, to do calculations and process astronomical data, which back then was obtained using photographic plates and by hand. In the end, Pickering gathered about 80 women, nowadays known as the "Harvard Computers. "These women were underpaid, but it started to pave a way for women to be included in astronomy over time.

The work of many of these women is still used to this day in modern astronomy. Fleming played a major role in discovering the very weird nature of white dwarf stars, the dense remnant cores of stars similar to the sun, after they have finished their evolution. She also initiated a way to classify stars, together with Pickering.

Then, later on, **Antonia Maury** and **Annie Jump Cannon** simplified that classification of stars, called the "Harvard" classification of stars. This system is the base of the stellar classification that is used today.

Another notable member was **Henrietta Leavitt**. She measured the brightness of stars through photometry, analyzing what are known as Cepheid variable stars. Those are stars that change periodically in brightness and

Antonia Maury
1866–1952

Annie Jump Cannon
1863–1941

Henrietta Swan Leavitt
1868–1921

Cecilia Helena Payne
1900–1979

were in a nearby galaxy, the Small Magellanic Cloud. All of those stars were more or less at the same distance from Earth. She discovered that the apparent or measured brightness depended on the period of the variability of the star. Therefore, if the stars were all relatively at the same distance, then their absolute or "true" brightness or luminosity, should also depend on their period. This way, she came up with a relation between the period and luminosity for these types of stars, that nowadays is used to determine distances to even further galaxies.

Although not part of the Harvard Computers group, a few years later, **Cecilia Payne**, became the first woman to earn a Ph.D. degree at Harvard, using as a reference the stellar classification from the group. She analyzed stellar spectra, where stars had many absorption lines, but that did not mean they were made of many different elements but rather corresponded to atoms being ionized due to different temperatures. She found that the sun and the Earth do have similar relative amounts of heavy elements, such as silicon or carbon, but that hydrogen and helium were far more abundant in stars, which made her conclude that hydrogen is the most abundant component in stars, and therefore in the universe. Her doctoral thesis is described as the "most brilliant thesis ever written in astronomy."

There have been, of course, many other women in astronomy whose work is just now being recognized as it should have been back then, such as **Caroline Herschel**, **Maria Mitchell**, **Vera Rubin**, **Jocelyn Bell**, **Nancy Roman**, among many others. Each one of them has paved the road for the huge gender gap in this field to reduce slightly. For example, five women have won the Nobel Prize in Physics, and three of them have won it after 2015, but there is still so much more to do. The way more women get into the field is by seeing others do it, and it is slowly getting better.

Caroline Herschel
1750–1848

Maria Mitchell
1818–1889

Jocelyn Bell
1928–2016

Nancy Grace Roman
1925–2018

Vera Rubin
1948

Future Reading

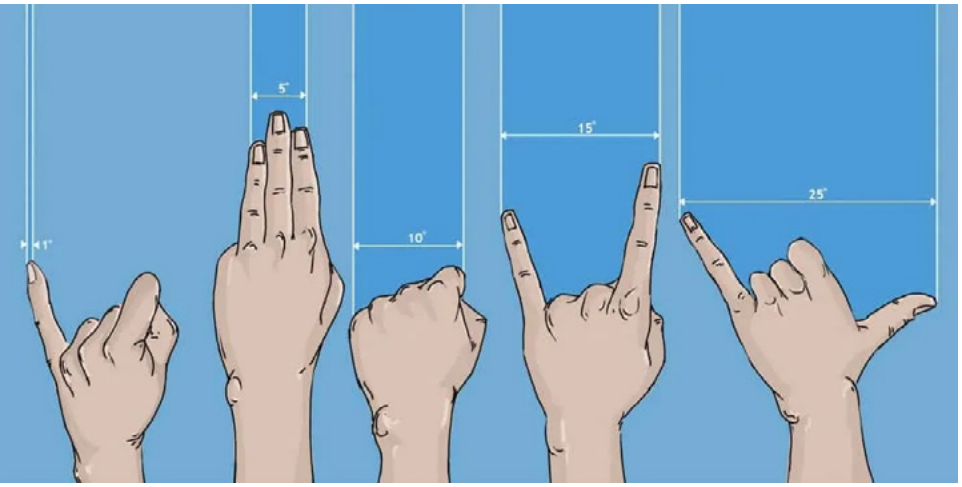
Harvard Computers

astrobites.org/2019/11/04/the-harvard-computers/

savingplaces.org/stories/how-three-women-computers-made-history-at-the-harvard-observatory

smithsonianmag.com/history/the-women-who-mapped-the-universe-and-still-couldnt-get-any-respect-9287444/

space.com/34675-harvard-computers.html



Maria Guadalupe Lizana

Did you know you can use your hand as a measuring tool of astronomical objects?

Simple Ideas to Observe the Night *(and Day)* Sky from Home *(or Nearby)*

In the sky, we measure distances between objects using degrees or radians (arc seconds), not miles or kilometers. This is because the night sky is imagined as a projection of the Earth, which is roughly a sphere, so we measure angles. If you do not have a computer tool to get astronomical images to measure the distance between objects, you can use your hand and fingers.

Here you have a few easy steps you can follow. With these examples, you will be able to measure how far a star or planet is from another in the night sky:

1. Extend one arm and make a fist, then close one eye and point your fist to the sky.
2. A star on one end of your fist will be 10° apart from a star on the other end of your fist.
3. Now, extend your thumb and little finger, and keep your other fingers curled down. The distance between the top of your thumb and the top of your little finger is about 25°.
4. If you now extend only your little finger (keeping your arm extended), it will give you about 1° of separation between objects.

These measurements, of course, are approximate, but work as a reference. The first object you can experiment with is to measure the size of the full moon or measure how big a constellation is, such as the Big Dipper.

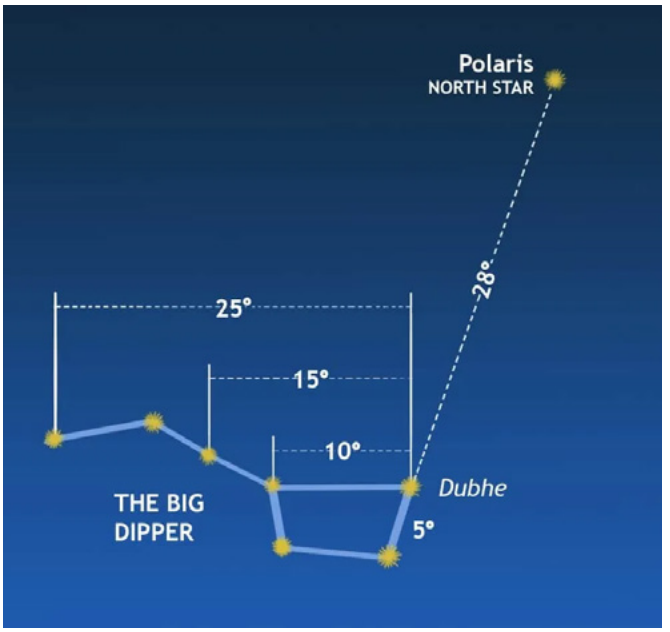
Fun Fact

The Big Dipper is made up of seven stars that form a distinctive shape resembling a ladle or spoon, and it's one of the most recognizable star patterns in the northern sky. Additionally, the two stars at the end of the "bowl" of the Big Dipper (Dubhe and Merak) are often called the "pointer stars" because they point directly to the North Star, Polaris. This makes the Big Dipper an excellent navigation tool for finding true north!

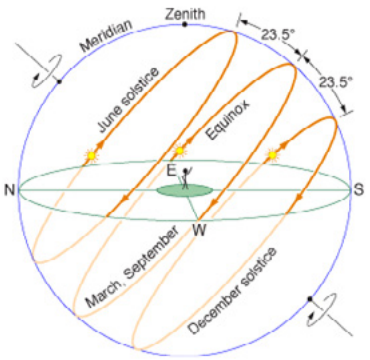
Another interesting experiment is related to the sun. We tend to think that the sun always rises from the east and sets towards the west. However, this is not completely accurate, unless you are very close to the Earth's equator. There are only two times of the year (can you think when that is?), when the sun actually rises exactly from the east and sets to the west, but the rest of the year is a little north or south from those points, depending on the season and your hemisphere. For this, you will need either a compass or a very good orientation:

1. Determine where north, east, south and west are from your location.
2. Check out the time the sun rises or sets from where you are on a certain day, using an application or website, such as Time & Date or even your phone's weather app.
3. Go outside at either of those times and check where the sun is rising or setting. Write the day, time and cardinal point down.
4. Repeat this a month later, two months later, and so on, until you recognize a pattern.
5. If you are in the northern hemisphere, ask someone in the southern hemisphere to do this experiment too and then you can compare your results.

lovethenightsky.com/how-to-measure-angles-in-the-sky/



The only time of the year when the sun rises from the east and sets to the west is during the March and September equinoxes, and in both hemispheres. That is why we have longer days in summer and shorter days in winter too—the sun does not "travel" the same distance in the sky all year long.

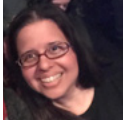


The sun appears to move along with the celestial sphere on any given day but follows different circles at different times of the year: most northerly at the June solstice and most southerly at the December solstice. At the equinoxes, the sun's path follows the celestial equator. ***physics.weber.edu/schroeder/ua/sunandseasons.html***

Further Reading

Measuring the sky

timeanddate.com/astronomy/measuring-the-sky-by-hand.htmlImages



Dr. Stacy Alvares

Project STEM: Empowering the Next Generation of Innovators Through Hands-On Learning

Project STEM is an outreach project founded by two Bellevue College students, Amir Awad and Omar Khalil. They were inspired to create this project when they noticed the number of STEM majors are on a slow decline. They hypothesized that a limiting factor for this trend could be that students feel STEM concepts are difficult and thus may view entering a STEM field as something intangible to them. For this reason, Omar and Amir created a STEM module that provides elementary school students a hands-on opportunity to learn about energy transformations through toy car building. In their activity, they split kids into two groups. In one group, Omar explained the concepts behind a battery as students made a battery powered car. In the other group, Amir explained (at a very broad level) how solar panels can be used to transform solar energy into other forms of energy as kids made solar powered cars. After the students made their cars, the groups came together to see how one type of car compared to another in various challenges and races.

Omar and Amir have already seen some of the positive outcomes based on their efforts. Over the past six months, they have taken Project STEM into three classes where they have engaged with about 50 students. By far, both Amir and Omar feel the most rewarding part of the experience is watching the kids interact with their material in a fun and interactive way. Omar has seen some of his own experiences building cars with rubber bands now being reflected as the kids build their cars, and Amir loves that the kids often want to continue to play with their products past the time allotted for the activity. They both also strive to make their activity fully accessible by encouraging all students to participate and accommodating special needs when possible.

Based on these experiences, Amir and Omar are ready to see Project STEM grow. Amir's core belief behind the project is that when a student teaches a concept to another student, the concept becomes more relatable to both. Thus, Amir and Omar are looking for other students who may want to be part of their team. They are also in the process of making a general rubric for a Project STEM module with the hopes that those students who join may have some creative freedom in designing their own hands-on STEM project for elementary school students. Ultimately, Omar and Amir would love to see Project STEM become a more established outreach opportunity on campus, and possibly as a baby step to having this type of organization at many colleges throughout the local community and technical college system.

If you are interested in being part of Project STEM, Amir and Omar would love to hear from you! Here is their contact information:

Amir Awad:
amir.awad.141@gmail.com

Omar Khalil:
omar_h_khalil@live.com

My name is Omar Khalil. I graduated high school last year and now attend Bellevue College. This is my third year at Bellevue college as I was a full-time Running Start student in my junior and senior year of high school. I am planning on studying public health. My interests are in the science field, as I find it extremely interesting. My goal is to spark passion for the younger generation about STEM and persuade them to find it just as fascinating as I do.

My Name is Amir Awad. I was raised in Seattle but am from Palestine. Growing up I have always been surrounded by STEM topics particularly due to my father's career in sustainable energy. I hope to play a role in creating STEM content that ignites a passion in the youth and would love to see more people walk this path with me.

Rizikatu N. Mohammed

My Journey in Cybersecurity and STEM

My journey in cybersecurity and STEM has been fueled by resilience, passion, and a drive for continuous learning. It all began at Bellevue College, where I started with an associate degree in information technology. While working toward this degree, I enrolled in the college's STEM to Sterm program, a special cohort program that supports students working toward careers in STEM. Through STEM to Stern, I learned that Bellevue College offered a Bachelor of Applied Science in Cybersecurity. I knew I had found my career and the perfect place to continue my education.

In the second year of my associate degree, I was fortunate to be selected for the NASA Community College Aerospace Scholars (NCAS) program, where I contributed to the Artemis project with the mission of sending the first woman and woman of color to Mars and beyond. This experience solidified my love for technology and problem-solving. I then engaged in a valuable hands-on learning experience with an internship at Betacom 5G Network, where I worked on networking, troubleshooting, and security.

In addition to my required classes, I earned certifications, such as CompTIA Security+ and AWS Cloud Practitioner, and I am currently pursuing the AWS Solutions Architect certification to expand my expertise in cloud security. My federal financial aid work study job at the Center for Career Connections has enhanced my communication skills, teamwork, and customer service, with the added benefit of being the recipient of resume reviews and mock interviews from the career experts who staff the center.

The Bachelor of Applied Science in Cybersecurity program fulfilled my hopes and expectations. The small class sizes, strong relationships with professors, and supportive community made it the ideal environment for my growth.

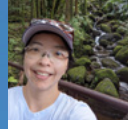
Outside of my coursework, I have been actively involved in the organization Women in CyberSecurity (WiCyS) and participating in Capture the Flag challenges has fueled my drive to promote diversity in tech. Capture the flag challenges are exercises in which participants attempt to find text strings, called "flags", that are secretly hidden in purposefully vulnerable programs or websites. This year, I was awarded a scholarship to attend the spring WiCyS conference in Dallas.

I am also honored to receive four internship offers. After careful consideration, I'm excited to be interning with Amazon as a security engineer intern this summer, 2025.

As a woman in a male-dominated field, I understand the importance of representation and mentorship. The support from my professors, mentors, and professional networks, along with the connections I've made through LinkedIn, WiCyS, Women in Tech, and Women to Watch, has been crucial to my growth. Balancing academics,

internships, and my role as a single mother has been challenging, but it has strengthened my resilience and determination. I am committed to securing digital environments, breaking down barriers, and contributing to a more inclusive future in cybersecurity.

STEM in Pop Culture



Winnie Li

According to the Oxford Dictionary, pop culture is "modern popular culture transmitted via the mass media and aimed particularly at younger people." In other words, it's the stuff that defines a generation—movies, memes, viral trends, and the characters we can't stop talking about. As STEM continues to shape pop culture, we see its influence across various media, from viral internet trends to blockbuster films. While Hollywood often bends the rules of science for dramatic effect, some films make an effort to stay true to scientific principles.

Here are a few standout examples from movies, games, and music where STEM takes the spotlight.

STEM in Movies

"Interstellar"

Hollywood loves bending the rules of science for dramatic effect, but some films get surprisingly close to reality. "Interstellar" is a standout example! The film tells the story of Cooper, a former NASA pilot thrust into a critical mission to save humanity. With Earth facing dramatic environmental changes, Cooper and a team of skilled astronauts set out on an interstellar journey through a wormhole near Saturn, searching for a new habitable planet. For those unfamiliar with wormholes, they can be thought of as cosmic shortcuts connecting distant galaxies. During their exploration, they face unique challenges, including the distortion of time caused by the immense gravitational pull of a nearby black hole. Meanwhile, back on Earth, Cooper's daughter, Murph, works tirelessly to solve the equations needed to ensure humanity's survival. What makes "Interstellar" stand out is its grounding in real science. Guided by renowned physicist Kip Thorne, the film is celebrated as one of the most scientifically accurate in its genre. Its depiction of black holes, particularly Gargantua, showcases an exceptional attention to detail. Using Einstein's equations, the visual effects team created a stunning simulation of gravitational lensing, demonstrating how light bends around the black hole. This blend of scientific rigor and cinematic artistry brings a new level of realism to the sci-fi genre.

Fun Fact

In "Interstellar," the software to create the black hole, Gangantua, is a full implementation of Einstein's equations in 40,000 lines of C++ code. It rendered thousands of 23-megapixel IMAX frames on a 32,000-core render farm at about 20 core-hours per frame [1].

[1] Gravitational lensing by spinning black holes in astrophysics, and in the movie "Interstellar", Oliver James, Eugénie von Tunzelmann, Paul Franklin and Kip S Thorne. 2015 IOP Publishing Ltd. Classical and Quantum Gravity, Volume 32, Number 6. Citation Oliver James et al 2015 Class. Quantum Grav. 32 065001 DOI 10.1088/0264-9381/32/6/065001

STEM in Games

Self-Aware AI NPCs

Imagine you're deep in a mission in Black Myth: Wukong, battling your way through a horde of mythical creatures in a dense, foggy forest. After an intense fight, you finally defeat the last enemy and make your way back to the Elder Monk, a Non-Player Character (NPC) who usually just repeats the same two lines:

"You have done well, warrior. But the path ahead remains treacherous."

"May the wisdom of the ancients guide you."

The same words. Every. Single. Time.

But what if, this time, he reacts differently? What if he notices that you hesitated in the last fight and says, "You struggled against the White-Furred Demon… were you afraid?" Or maybe he references a past mission, reminding you of a strategy that worked before. What if you could actually have a real conversation with him—one that wasn't pre-scripted? And it's not just the Elder Monk, every NPC you meet adapts, learns from your choices, and even develops unique personalities over time. Instead of robotic, one-note responses, we might see NPCs who change over time, challenge your decisions, or even form opinions about you based on how you interact with them.

STEM in Music

Taylor Swift's Eras Tour Light Show: The Science Behind the Spectacle

If you went to Taylor Swift's Eras Tour, you'll know that it was a masterpiece, in more ways than one. One of its most stunning features is the synchronized light-up wristbands worn by every audience member, creating dazzling waves of color that ripple through the stadium. These wristbands use radio frequency and Bluetooth technology, receiving signals that trigger specific colors and patterns in perfect sync with the music.

Behind the scenes, sophisticated software coordinates lighting cues with each song, ensuring seamless integration with pyrotechnics, stage visuals, and even fireworks.

But that's just the beginning. The show also incorporates cutting-edge augmented reality effects, massive LED screens with real-time visuals, and even kinetic stage platforms that shift and transform throughout the performance. Motion capture technology allows Swift's movements to be mapped and enhanced with dynamic visuals, while AI-driven sound engineering optimizes acoustics for every seat in the stadium. This blend of entertainment and engineering transforms a typical concert into a fully immersive experience, demonstrating how STEM is revolutionizing live music.

Further Reading

Interstellar (includes some cool visuals too)
theteenmagazine.com/the-ultimate-review-of-interstellar-what-makes-it-a-sci-fi-masterpiece

Self-Aware AI NPCs:
naavik.co/digest/ai-npcs-the-future-of-game-characters/

Taylor Swift
steamnews.org/articles/technology/are-you-ready-for-it-the-technology-behind-taylor-swifts-eras-tour

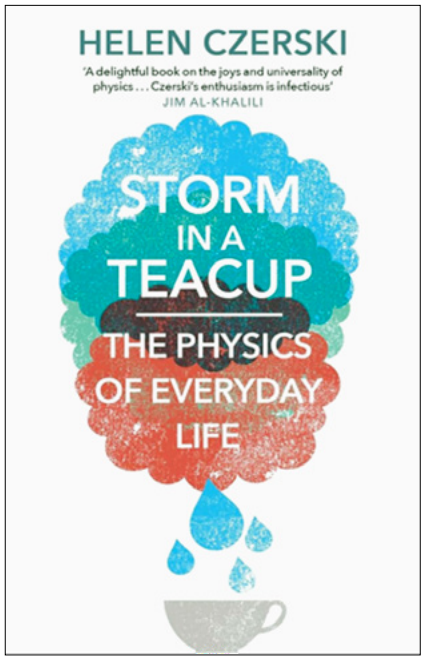
Elena Maans-Lorincz

Explore STEM Through Your Local Library!

Before choosing your path in STEM, or any field, it is always good to get a feel for what is going on in that field or what it might be like to work in a particular job or career. One of the best ways to do that is through casual reading. You may not know it, but a resource right in your community that you can use, is your local library branch. Both Seattle Public Library and King County Library have amazing collections of books, ranging from non-fiction titles about the latest research and discoveries, to memoirs.

An awesome, and often little known secret, is the librarians at your branch love to be asked questions, any questions. If you want to know more about a career, or research, or are just curious about learning something more than what is part of your current courses, you can ask your librarian. A neat feature of libraries is that even if what you are looking for isn't on the shelf, they can try to get it from another library branch or even a neighboring library system.

The books recommended in this edition are available at both local public library systems, and some are in a variety of formats including eBook or audio book through an app called Libby.



Book Title

"Storm in a Teacup: The Physics of Everyday Life"

Book Authors

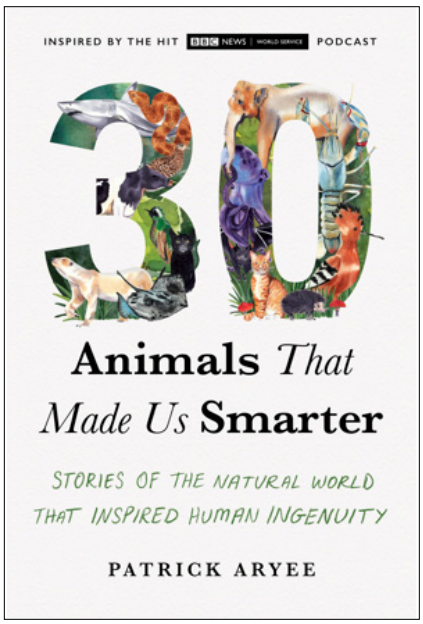
Helen Czerski

Short Description

Explore physics and science on an everyday scale, and a global one. This book looks at the word of physics around us and relates the simple concepts to much larger occurrences and impacts of physics.

Why It's Recommended

This book is a wonderful introduction to seeing the principes of physics in your kitchen, and everyday life, and then bringing that into the larger concepts of physics and science.



Book Title

"30 Animals That Made Us Smarter: Stories of the Natural World That Inspired Human Ingenuity"

Book Authors

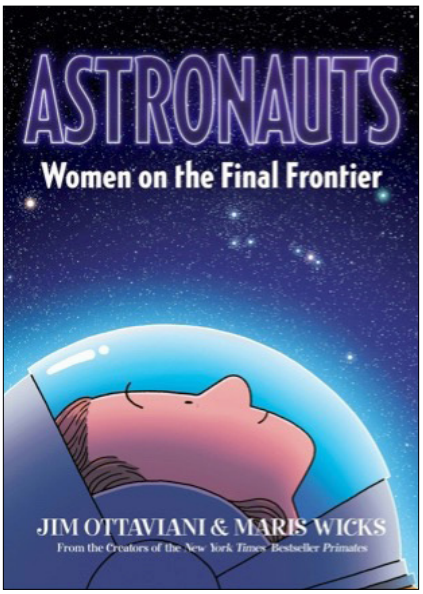
Patrick Aryee

Short Description

This book is a companion to a popular BBC Podcast series of the same name. Finding answers to engineering problems, many scientists have found the solution in nature. Often animal physiology is the inspiration for improving our lives as well.

Why It's Recommended

Whether you are a fan of the series or not, this is a fun read. This book is a really good dive into both the world of zoology and engineering. It explores solutions that have been found by studying specific animals, and the engineering problems they applied those animal inspirations may surprise you.



Book Title

"Astronauts: Women on the Final Frontier"

Book Authors

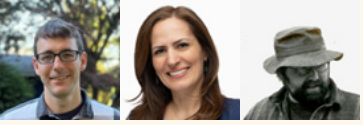
Jim Ottaviani

Short Description

Explore the true story of some of the first female astronauts through this engaging graphic novel. The book follows the first mixed gender crew of a NASA space mission.

Why It's Recommended

Reading about STEM is helpful when pursuing a career path and field of study, but what also helps is learning more about those who have been trailblazers. Graphic novels are a fun way to explore STEM concepts, but also to explore the lives of famous Scientists.



Dr. Tom Crawford, Dr. Fatma Cemile Serçe, and Dr. Rob Viens

Puzzle Corner

1. Considering the dates written in DD/MM/YYYY format, where each digit is used only once a day with this feature. When was the last time it happened? When will it happen first?

2. Four

   Five

   Nine

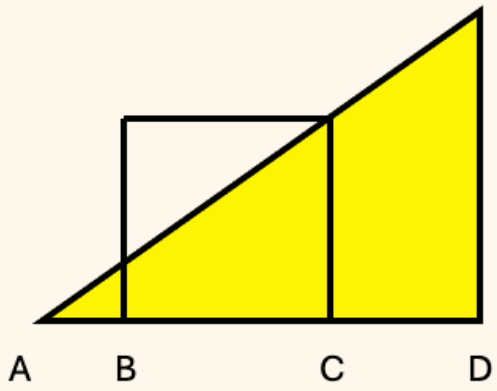
   Eleven

   Fourteen

   ?

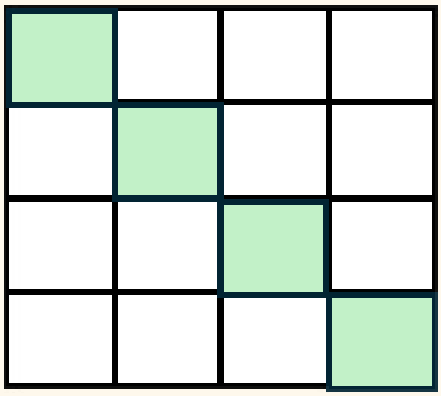
   What number comes next in the sequence?

3. A square is drawn on a right triangle as shown in the figure. The areas of the square and the right triangle are equal. Given that the length of CD is three times the length of AB, find the side length of the square in terms of AB.



4. A bottle with some water weighs 25 ounces. After half of the water is emptied, the weight of the bottle drops to 15 ounces. What is the weight of the empty bottle?

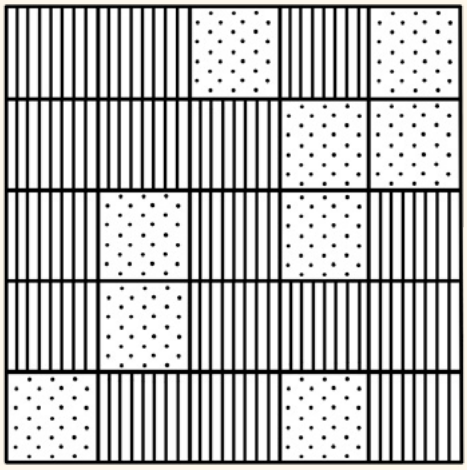
5. Place the 16 numbers from one to 16 into the squares. You can start by placing the number one in any square. For all subsequent numbers, you can place them in a square that is adjacent (horizontally or vertically) to the previous numbers. What is the minimum sum of the four numbers on the diagonal shown in green?



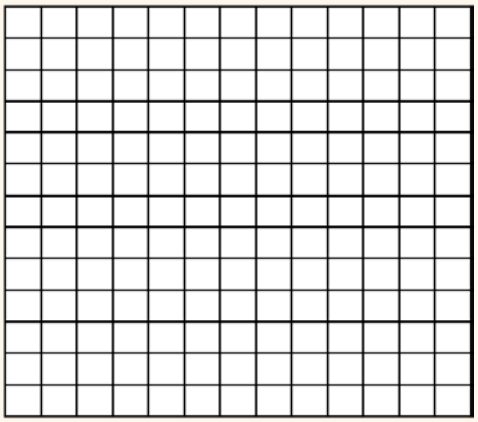
6. Seven scientists all shake each others' hands. How many handshakes took place? What if there were 20 scientists? 100?

PUZZLE CORNER

7. **It is your job to draw the districts for the Square-topia council elections. The districts must each contain five squares, must not overlap and must be contiguous (each square must share an edge with another square in the district). You happen to be a member of the Dot Party. Can you draw the districts such that the Dot Party wins more districts than the Line Party?**



8. **Mrs. Perkin's Quilt You are given a paper with the following 13x13 square grid. Your goal is to cut it into smaller squares, but you can only cut along the straight lines given, and by the end ALL pieces must be squares. What is the fewest number of pieces you can end with?**



9. **Connections is a word game where players group 16 words into four categories based on shared themes or relationships.**

DIRAC	NEWTON	ARCHIMEDES	GAUSS
BERGMANN	KLEIBER	CHARLES	LAGRANGE
BOYLE	EULER	KEPLER	HENRY
THORSON	AVOGADRO	VAN VALEN	PYTHAGORAS

It is the Law!

10. There are inhabitants of an island on which there are three kinds of people:

    Knights who always tell the truth

    Knaves who always lie

    Spies who can either lie or tell the truth.

    You encounter three people, A, B, and C.

    You know one of these people is a knight, one is a knave, and one is a spy. Each of the three people knows the type of person each of other two is.

    For this situation, if possible, determine whether there is a unique solution and determine who the knave, knight, and spy is: A says "C is the knave," B says, "A is the knight," and C says "I am the spy"

11. The game of Poison! Play with a friend. Start with 10 pennies (or scraps of paper, or blank checkboxes, etc.). On your turn, remove either 1 or 2 pennies. Whoever takes the last penny loses (it's poisoned!) Would you rather go first or second?

12. Can a chess knight visit every square exactly once?

PUZZLE CORNER SOLUTIONS

1. First Time: 25/06/1987
   Last Time: 17/06/2345

2. Eighteen

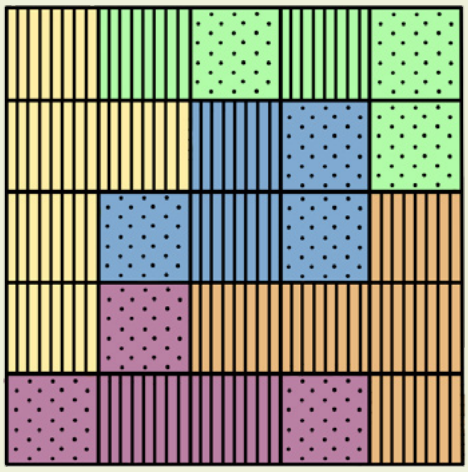
3. The side length of square is 8xAB

4. 5 ounces

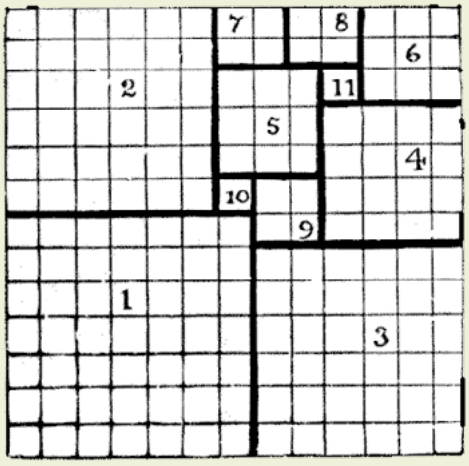
5. 20

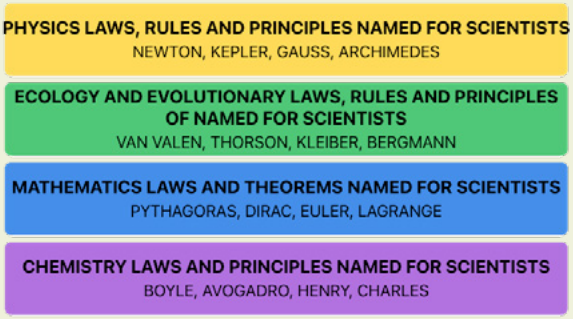
6. So 21, 190, 4950

7. Pink, blue and green districts will win.



8. Mrs. Perkin's Quilt

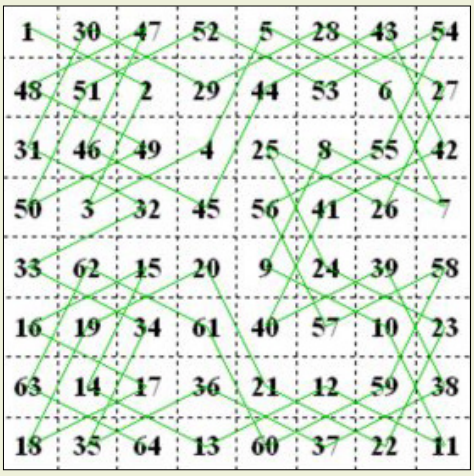


9. 

10. The person A is the Knight, B is the Knave, and C is the Spy.

11. It is better to go second!

12. Yes



Meet the Minds Behind the Magazine

Drew Stone Born and raised in the Pacific Northwest, Drew holds a Master of Communication in Communities and Networks from the University of Washington. He brings years of experience in active and collaborative gaming, filmmaking, visual and performance arts, instructional design, and professional VR event production. He has worked as a VR consultant with Microsoft and Locuisum, helping shape social immersive experiences. Funded by a National Science Foundation grant "The Pacific Northwest Open Extended Reality Initiative" Drew is passionate about expanding the reach of the XR Lab through the NWXR Edu Network and making it a recognized leader in XR innovation. His goal is to "put the Bellevue College XR Lab on the map!"
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Elena Maans-Lorincz is a Michigander, who graduated from Dominican University for both her Bachelor of Arts and her Master of Library and Information Science. Since 2016, she has been the outreach librarian at Bellevue College. Her work at Bellevue College is centered on being a conduit between the library and the greater campus and regional community.
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Dr. Emily Heffernan is the dean of the Science Division at Bellevue College. She holds a Master of Science and Ph.D. in Entomology, both from the University of Florida. Her academic accomplishments include a Fulbright Fellowship, dozens of scientific publications, and the OUSTA Award (recognizing Outstanding Undergraduate Science Teaching from the National Science Teachers Association).
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Dr. Fatma Cemile Serçe is a senior computer science professor at Bellevue College with over 25 years of experience in higher education. She holds a Ph.D. in Information Systems from Middle East Technical University, specializing in Intelligent Agents. Dr. Serçe is the founding faculty member of the first Bachelor of Science in Computer Science program offered at technical and community colleges in the state. She is also a co-author of a Turkish textbook on C++ programming. Since 2016, she has been dedicated to teaching and mentoring students at Bellevue College, contributing to the growth and development of the Computer Science program.
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Frank Lee has been teaching engineering at Bellevue College since 1990. Frank attended the University of Washington, earning both an undergraduate and master's degree in mechanical engineering. At Bellevue College, Frank has served as the Engineering program chair since 1990, maintaining course curriculum currency and mentoring adjunct faculty. Frank has been active in faculty leadership, serving four years as a faculty association officer including two years as president. In addition, Frank coached the college's women's soccer team for three seasons.
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Guadalupe (Lupe) Lizana is from Chile and has a master's degree in astronomy from the University of Groningen, in the Netherlands. During her short academic career, she studied the morphology of distant galaxies in the universe through various surveys. She was doing a Ph.D. and was working as a teaching assistant when she realized that teaching was more fulfilling than research, and therefore she started to lean towards education and outreach in science.
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Dr. Ishaani Priyadarshini is a faculty member in the Computer Science department at Bellevue College, with expertise in AI and data science. She has a Ph.D. from the University of Delaware and has conducted postdoctoral research and lectured at the University of California, Berkeley. She is also a data science course facilitator at Cornell University. Her work focuses on AI for social good, applied machine learning, and ethical AI.
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Dr. Jacqueline Gapinski is a faculty member and program chair of the Molecular Biosciences program at Bellevue College. She received her Ph.D. in biochemistry and molecular biology from Johns Hopkins University and completed a postdoctoral research fellowship at the National Institutes of Health. During her postdoc, she used the transparent worm called C. elegans as a model organism to study centrosome duplication. She has been an instructor at Bellevue College since 2016 and is passionate about bringing authentic research experiences to students.
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Joe Hueffed works as a project manager implementing corporate ERP systems for human resources, finance, and supply chain. He teaches as an adjunct professor in the Computer Science department at Bellevue College. Joe has an Bachelor of Arts, Master of Business Administration from Seattle University, and is enrolled in the EdD program in interdisciplinary leadership at Creighton University.
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Raji Sundar is a biology instructor and an instructional designer at Bellevue College. As an educator and instructional designer, she incorporates current research and pervasive topics in the curriculum to help her learners understand the importance of these topics by connecting them to real-world experiences.
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Dr. Reza Forough graduated with a bachelor's and master's degree in biological science from Northern Illinois University and a Ph.D. in genetics from George Washington University. He has over 35 years of experience in research, teaching, and leadership in academic settings including American Red Cross Holland Laboratory, University of Washington, Texas A&M University, and Bellevue College. Professor Forough is deeply passionate about promoting STEM education and mentorship for college and high school students. To support this mission, he has established connections with local high school advisors and is actively mentoring several high school students in a bioinformatics research project.
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Dr. Rob Viens is a geologist and a senior professor of geology and environmental science at Bellevue College, an Earth historian and a natural philosopher. He earned his Ph.D. at the University of Washington, studying the glacial and climate history of southeast Alaska. After several years leading the Science Division and Bellevue College Academics Affairs, Rob has returned to his passion of teaching and studying geologic history in the Pacific Northwest. ***rob.viens@bellevuecollege.edu***

Sandra Emerson loves math and loves teaching math at Bellevue College. She received her master's in mathematics and bachelor's in journalism from the University of Houston. After moving to Washington nine years ago, Sandra began teaching at Bellevue College as an adjunct and now is an assistant professor of mathematics. Sandra enjoys hiking, reading, and genealogy.
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Dr. Sara Farag is an experienced educator and software engineer with a Ph.D. in Computer Science from Deakin University, Australia. She is a faculty member and Program Chair in the Computer Science Department at Bellevue College, where she has taught since 2017. Dr. Farag previously held teaching roles at Deakin and Swinburne Universities and worked in software engineering across several Australian companies, blending academic and industry experience to support student success.
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Dr. Stacy Alvares received her Ph.D. from the University of Washington Molecular and Cellular Biology Program. After receiving her Ph.D., she explored the genetics behind pathways that make a cell immortal using a little roundworm known as C. elegans. Throughout these positions, Stacy took many opportunities to teach general biology, genetics, and cell biology at surrounding community colleges. She has been at Bellevue College since 2018 where she loves engaging students in open research projects through coursework. She has also been an advisor for the Bellevue College Biology Club and received Advisor of the Year for 2022–2023 from the Associated Student Government.
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Dr. Taesik Kim has been a faculty member in the Computer Science department at Bellevue College since September 2016. He has 23 years of experience as a professor in the Computer Science and Game and Mobile Contents departments in Korea. He earned a Ph.D. in Computer Science with a focus on artificial intelligence and optimization from North Dakota State University; a Master of Science in Computer Science from Minnesota State University-Moorhead; and a Bachelor of Science in Computer Science from Keimyung University in Korea. His major areas of research include analysis of human behavior based on artificial intelligence, and AI in mobile apps.
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Dr. Tom Crawford is an assistant professor of mathematics at Bellevue College with a passion for geometry and topology. He completed his undergraduate degree at Williams College, where a summer research experience sparked his interest in knot theory, the mathematical study of knots. He earned his Ph.D. at Boston College where he studied hyperbolic 3-manifolds—3D shapes that bend back onto themselves. Tom is excited to share his love of math, puzzles, and math puzzles.
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Wentao Chen, a seasoned computer science professional, holds a Master of Science in Computer Science from Yale University. With over two decades of industry experience, his expertise spans diverse domains, including data structures, algorithms, data analysis, data modeling, distributed systems, and Wcloud computing.
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Winnie Li is currently a professor of computer science and data analytics and serves as the program chair for the Bachelor of Applied Science in Data Management and Analysis at Bellevue College. She earned her Bachelor of Science in Computer Science and Engineering from the University of California, Davis, and an Master of Science in Statistics from California State University, East Bay. Before joining Bellevue College, Winnie held various roles at Clearwire, the City of Bellevue, and Microsoft, where she gained extensive industry experience in software development, data analytics, and technology management. Outside of work, she enjoys hiking, kayaking, reading, drawing, playing the piano, and traveling with family and friends.
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THANK YOU

Special Thanks to Our Students at Bellevue College

Elika Wang is currently a junior at Issaquah High School. Some of her favorite things include science fiction, robotics, space, dark humor, dance, and all things crafty. She plans on going into aerospace engineering.

Rizikatu N. Mohammed is a cybersecurity enthusiast and Bachelor of Applied Science in Cybersecurity student at Bellevue College. With a strong background in IT and hands-on experience from internships at Betacom 5G Network and Bellevue College, she has earned industry certifications such as CompTIA Security+ and AWS Cloud Practitioner. She is an active member of Women in CyberSecurity (WiCyS) and a passionate advocate for diversity in tech. Rizikatu will be interning with Amazon as a security engineer intern in summer 2025. She is committed to securing digital environments while inspiring the next generation of cybersecurity professionals.
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Yiyuan Xia is currently a student at Bellevue College, actively involved in STEM-related clubs and student leadership. She is serving as the president of the Chinese Student Association. She has a strong interest in engineering and data science, along with experience in organizing large-scale events. She is passionate about exploring innovations that shape the future of science and technology.

Yutao Cai plans to transfer to the University of Washington to major in computer science. He is as passionate about all tech-related topics. In his free time, he enjoys playing table tennis, singing, and watching videos. One of his all-time favorite singers is Jay Chou.

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ALUMNI SPOTLIGHT

Bring Your Story to Life

Michael Muir

BAS, Molecular Biosciences, '19
Director of Invertebrate Research, Ora Biomedical

Michael runs a lab in a Puget Sound startup company. Seeking ways to improve health and longevity, the lab developed an innovative process that uses WormBot-artificial intelligence to combine *C. elegans* worms, robots, and AI to offset the diseases of aging.

Your story is waiting to unfold at Bellevue College

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- 23 Professional/Technical Degrees
- 15 Baccalaureate Certifications
- 55 Associate Certifications

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