

Stories of

Women of Color In STEM



Smithsonian
Science Education Center



The Smithsonian Science Education Center

(SSEC) is an education organization within the Smithsonian Institution. The SSEC's mission is to transform *K-12 Education Through Science™* in collaboration with communities across the globe. The SSEC promotes authentic, interactive, inquiry-based K-12 STEM teaching and learning; ensures diversity, equity, accessibility, and inclusion in K-12 STEM education; and advances STEM education for sustainable development. The SSEC achieves its goals by developing exemplary curriculum materials and digital resources; supporting the professional growth of K-12 teachers and school leaders; and conducting outreach programs through LASER (Leadership and Assistance for Science Education Reform) to help schools, school districts, state education agencies, and ministries of education throughout the world implement inquiry-based science education programs.

The Smithsonian Institution was created by an Act of Congress in 1846 “for the increase and diffusion of knowledge...” This independent federal establishment is the world's largest museum, education, and research complex and is responsible for public and scholarly activities, exhibitions, and research projects nationwide and overseas. Among the objectives of the Smithsonian is the application of its unique resources to enhance elementary and secondary education.

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Introduction

Dr. Carol O'Donnell

Director
Smithsonian Science Education Center

Growing up in inner city Pittsburgh in the 1960's and 70's, I was always tinkering—designing something new and putting my “inventions” in a little notebook. I also loved observing the world around me. In my small backyard, I was always experimenting—studying native plants during the day and observing the stars at night. I didn't know much about being a scientist or engineer back then. I just knew that I loved making, testing, experimenting, and inventing.

In high school, I got my first job at a library as a “Page.” I would put books back on the shelf when people returned them, fix books that were broken, and help people find book titles that interested them. Books played such an important part in my life. And it was through books that I was first introduced to what it meant to be a “real scientist.”

I don't recall having any women scientists in my life, though. At least not until I went off to college. That's when I got my first job at a museum—the Carnegie Museum of Natural History in Pittsburgh. They had just built the Benedum Hall of Geology and the Hillman Hall of Geology and the Hillman Hall of Minerals and Gems. I fell in love with the history of our planet, and went on to get a Masters Degree in Geosciences with a focus on planetary geology.

I also had a second full-time job in college working in the Gastroenterology Lab at the hospital (yes, I worked a lot

“Who knows? One day, you might be like Robin, or Antonia, or Youyou or Carly, or Gladys and “do” STEM, too.”

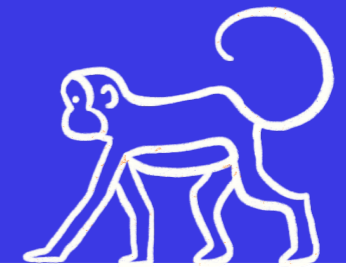
back then). Mary Mylo was the lab's Director, and I will never forget her. Other than my mother, Mary Mylo was my first “real mentor.”

Today, I direct the Smithsonian Science Education Center at the Smithsonian Institution. I also teach astronomy part-time for the George Washington University Physics Department (yes, I'm still working a lot). The books and the stories of women in STEM, the STEM mentors and role models I met along my journey, and hard work—they all helped me to achieve my goals.

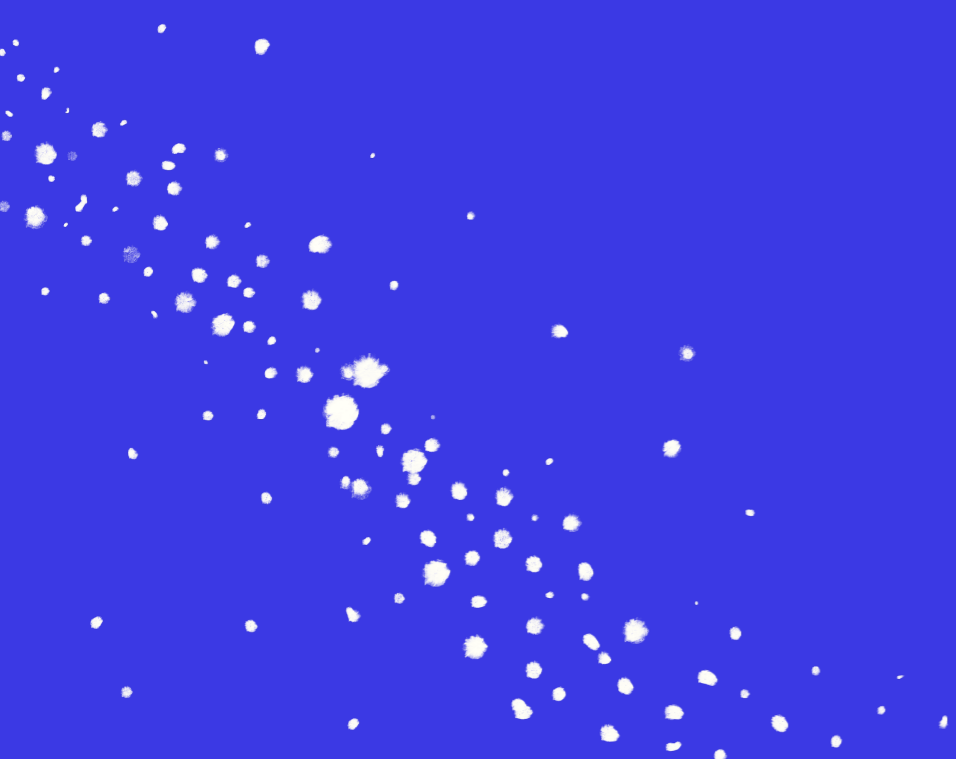
As a young girl, it is so important to see yourself in the role models around you and in the stories you read. Some people call this the “See/Do” theory. If you can see yourself in others, then you will believe you can do it, too. That is the purpose of this book.

I hope when you read the stories of these amazing women, you can “see” your future self. Then, strive to be the best you can be.

Who knows? One day, you might be like Robin, or Antonia, or Youyou, or Carly, or Gladys and “do” STEM, too.



Carly Hornberger



Carly Hornberger

Carly Hornberger's interest in animals in her youth turned into a passionate career at the Smithsonian's National Zoo.

Her childhood home near Crofton, Maryland, was surrounded by farm animals. She grew up near the U.S. Naval Academy's dairy farm, and she often kept a variety of pets, including chickens and geese.

"I've always loved animals," she said. "They were always in our lives and we always had a ton of pets. I think that's how I ended up in this career."

Carly's interest in animals also stems from her family's culture. Her mom is Native American and is a part of the Oneida Nation. Within the Oneida Nation, there are three clans: the Wolf Clan, the Bear Clan, and the Turtle Clan. Carly's family belongs to the Turtle Clan, which is traditionally responsible for taking care of the environment. "They would help take care of crops, animals, and things of that nature," she explained.



Carly Hornberger

Growing up, Carly had many passions. “I had a hard time trying to figure out how I wanted to combine all of my passions,” she said. She had an interest in animation and pursued art school. After determining art school wasn’t the right fit, she decided to study psychology at the University of Maryland.

Carly loved being creative and loved science. As she learned more about how human brains functioned, she became curious about animal behavior. This led her to take a class that focused on large primates.

“It was fascinating,” she said. That course exposed her to the fields of animal therapy and animal biology. As she continued to explore opportunities, she became a veterinary technician and, after moving to California, interned at the Los Angeles Zoo.



She eventually moved back to the Washington, D.C., area and began volunteering at the Smithsonian’s National Zoo.

Carly fell in love with working at the National Zoo and felt like it was the perfect fit. “I knew that’s where I needed to be, and I worked very hard and I made it in,” she said.

Carly is now an animal keeper at the Smithsonian’s National Zoo, where she works in the Great Ape Department. Animal keepers feed, clean, engage with, and observe animals to make sure they are healthy.

Primates are very intelligent animals who require many activities to help keep them mentally and physically active.

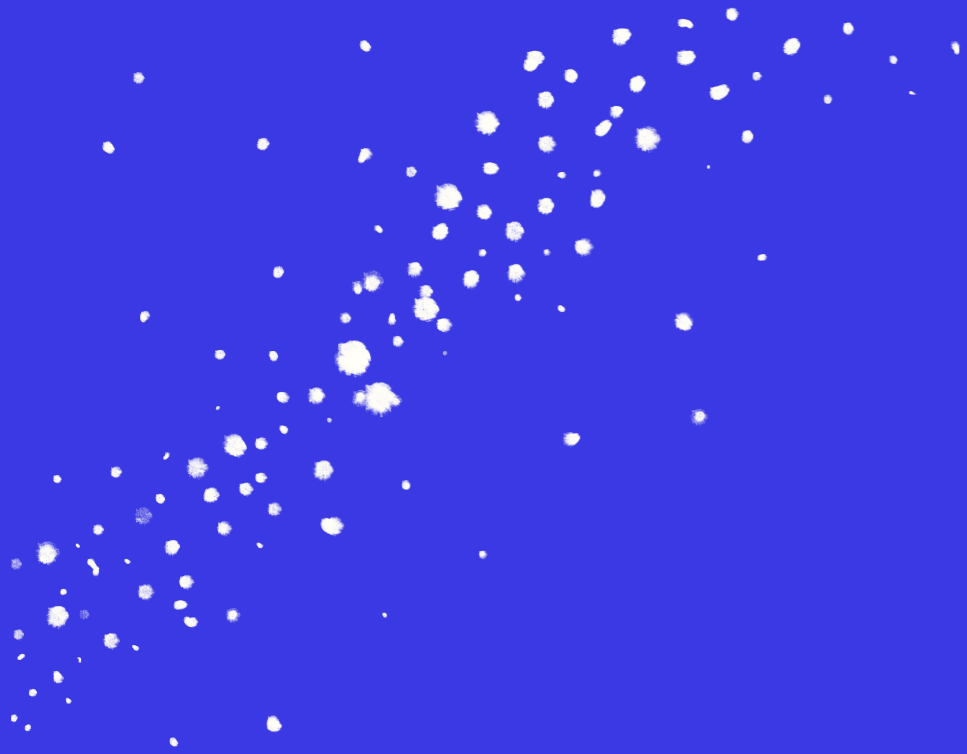


Carly Hornberger

“This helps the animals use natural behaviors they would have in the wild, like problem-solving or foraging,” Carly explained.

Carly loves to work with siamangs, a type of gibbon that are found only in southeast Asia. “They sing these beautiful songs, especially in the morning,” she said. “Their songs can actually echo for miles and are very important for claiming territory and bonding.”

Carly believes that it’s her duty to help take care of such special animals. She hopes her enthusiasm about primates encourages others to learn more about them.



Robin Kumoluyi

Robin Kumoluyi

Robin Kumoluyi dreamed of becoming a scientist long before she stepped into a laboratory. She grew up in New Jersey with a lot of curiosity. This curiosity about her environment sparked her interest in the world.

She began to ask how the things around her worked. This inquisitive nature led her to do some of her first science experiments before she was a teenager.

“My neighbors had a lilac tree in their yard, and I kept smelling this wonderful aroma,” Robin said. “I decided it was a good idea to climb the fence, go into their yard, pick flowers, and try to figure out how to make water that smelled like those flowers.”

“I traded dolls for a miniature microscope when I was about nine years old,” Robin said.



Robin Kumoluyi

The microscope was a birthday present. She used it to explore the world around her. “I wasn’t interested in dolls, I was interested in the world,” she explained.

Robin began to learn about microbiology in high school. She had a mentor who worked in the field. Microbiologists study living organisms that are too small to be seen with the naked eye, like bacteria. Time spent in the lab with her mentor deepened her interest in science. Robin also became an avid reader.

“Being able to see a microbiologist who looked like me, an African-American, in real life, was fabulous,” she said.

Knowing someone like herself fueled Robin. She pursued biology at Rutgers University. She planned to become a doctor. Then Robin fell in love with her microbiology classes. She decided to shift her career interests to microbiology.

“Being able to see a microbiologist who looked like me, an African-American, in real life, was fabulous”

Through her classes, she became fascinated by the process that uses microorganisms to make foods and medicines.

Running her first PCR (polymerase chain reaction) test merged Robin’s course work and interests. PCR tests amplify pieces of DNA. They are used to study genetic material. “Seeing something that you learn in school actually being applied in real life was fascinating to me,” she said.

These real-life uses inspired Robin to support people’s health through medicine. Robin’s grandmother struggled with diabetes. Seeing that inspired Robin to focus on developing quality and accessible medicine. She wanted to help people enjoy their lives.

Robin is now the Vice President and Chief Quality Officer, Pharmaceuticals, at Johnson & Johnson. In her role, she makes sure that the medicine her team creates is safe and effective for patients to use.

Robin Kumoluyi



“For me, it’s more about caring about people than it is about medicine,” she said. “I found that this was a way to care about people and support them on life’s journey by giving them something that made them strong and well.”

Robin’s goal of helping others with their health grew during the COVID-19 pandemic. She became committed to tackling health care inequities.

“I was extremely moved and motivated by the level of health care disparities uncovered during the COVID-19 pandemic,” she said. “We always knew that health care disparities were there, but the pandemic really highlighted them to a point of disbelief.”

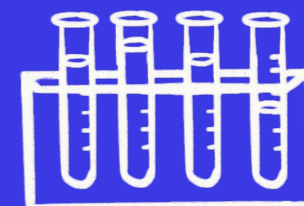
Robin Kumoluyi

“For me, it’s more about caring about people than it is about medicine”

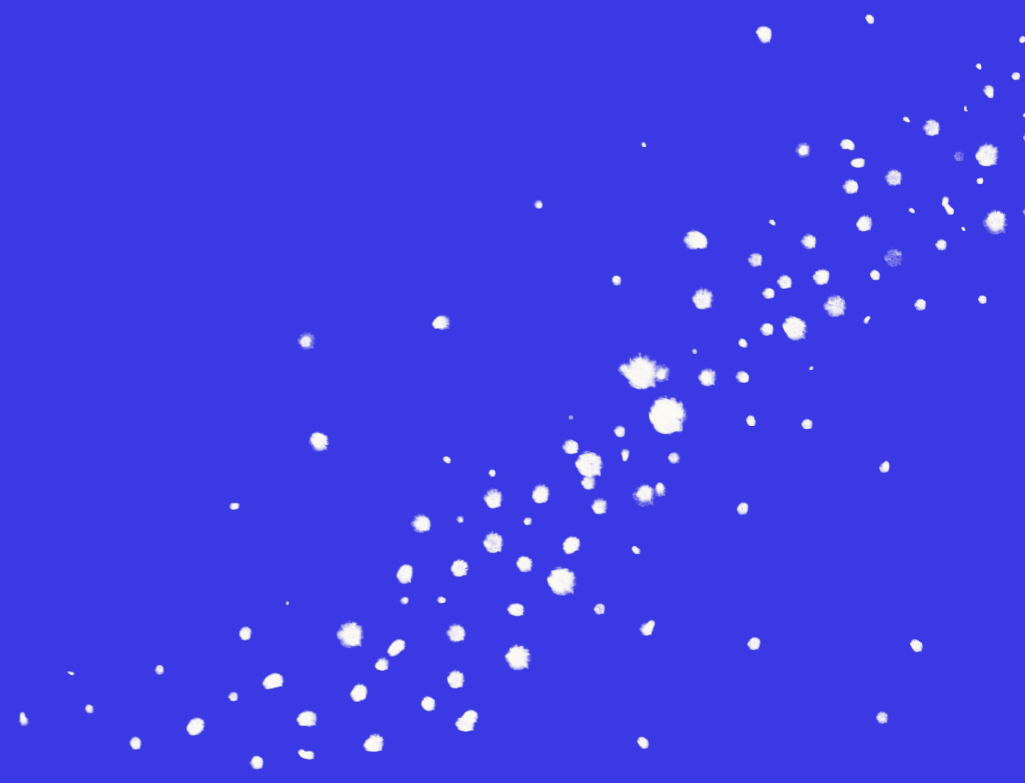
Robin and her team helped in delivering Johnson & Johnson’s COVID-19 vaccine to patients around the world. She described the moment as “a once-in-a-lifetime opportunity that will impact the world.”

Robin hopes to continue to develop quality medicines, fight health care inequities, and mentor young people who are interested in science.





Tu Youyou



Tu Youyou

Sometimes solutions to our own problems inspire us to help others overcome theirs. Tu Youyou's battled an infection as a teenager. This fueled her interest in medicine. Her discoveries would go on to save millions of lives.

Youyou was born and raised in Ningbo, China, in 1930. Her family valued education and sent her to the best schools in their region. While Youyou attended high school, she contracted tuberculosis. Tuberculosis is an infection that affects the lungs. She missed two years of school while she was being treated.

Youyou's recovery inspired her career in medical research. She was accepted into the Medical School of Beijing University.



Tu Youyou

She decided to study pharmacology. She learned how herbs and plants could be used as cures for certain illnesses.

Her curiosity about finding new treatments would lead to one of the world's most effective medicines against a disease spread by insects.

In 1969, Youyou was selected to lead Project 523. It was a secret effort to find a treatment for malaria. Malaria is a serious disease caused by a parasite that infects some mosquitoes. People usually get malaria when they are being bitten by an infected mosquito. The disease makes them very sick. They often have high fever and flu-like symptoms.

Youyou and her team used ancient Chinese texts and traditional remedies. They identified plants that worked against the parasite. Her team found that sweet wormwood was the best cure, because the leaves of the plant contained a disease-fighting extract.

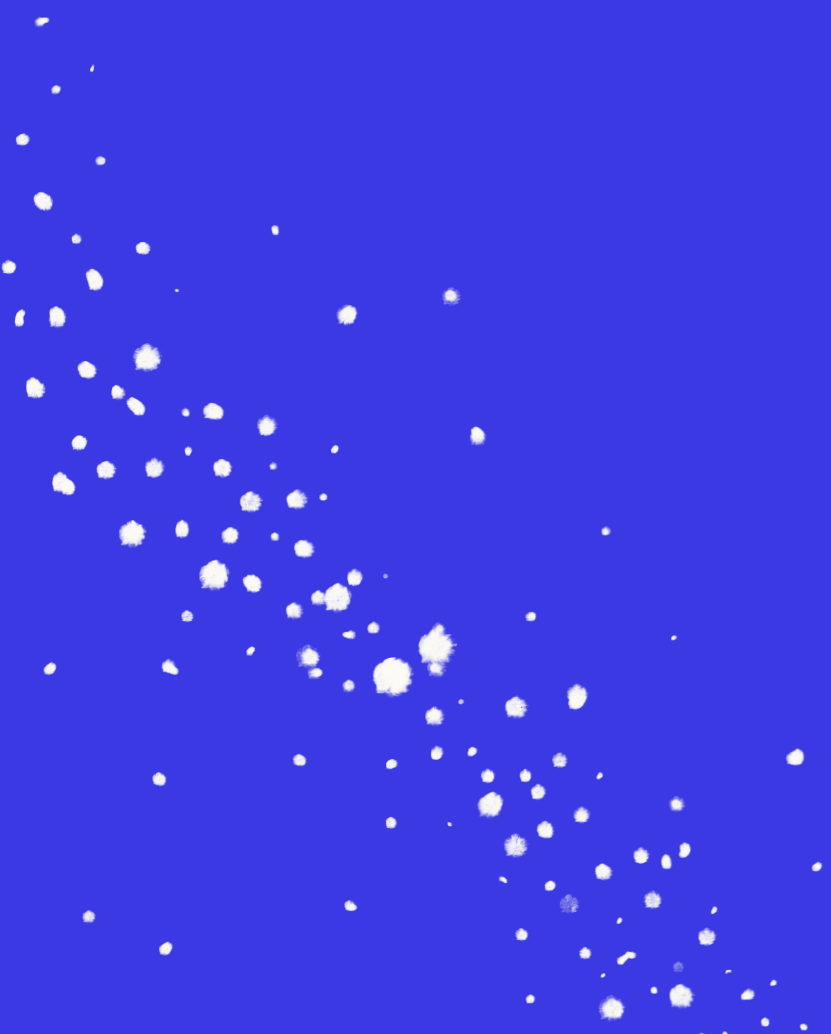


China had rules about sharing research. But a few years later her work became available around the world. It was recommended by the World Health Organization to fight malaria.

In 2015 YouYou became the first Chinese woman to win a Nobel Prize. She is now the Chief Scientist at the China Academy of Traditional Chinese Medicine in Beijing.



Gladys West



Gladys West

Have you ever used a GPS for directions? If you have, you can thank mathematician Gladys West.

She laid the foundation of the technology that we use today on our phones and in our cars.

Growing up in Dinwiddie, Virginia, Gladys' parents had big dreams for her. They worked hard to ensure her success. She became a great student. Home economics was one of her favorite subjects, and she briefly thought about pursuing it as a career. In the 1950s, it wasn't common for women to pursue careers in math or science.



Gladys West

However, Gladys was encouraged by her teacher to pursue a career in mathematics. The teacher thought it would provide many job opportunities. Gladys went on to Virginia State University and got her degree in mathematics. She began her career in 1956 at the Naval Proving Ground in Dahlgren, Virginia. “We were taught to do our best and reach for the highest,” she said.

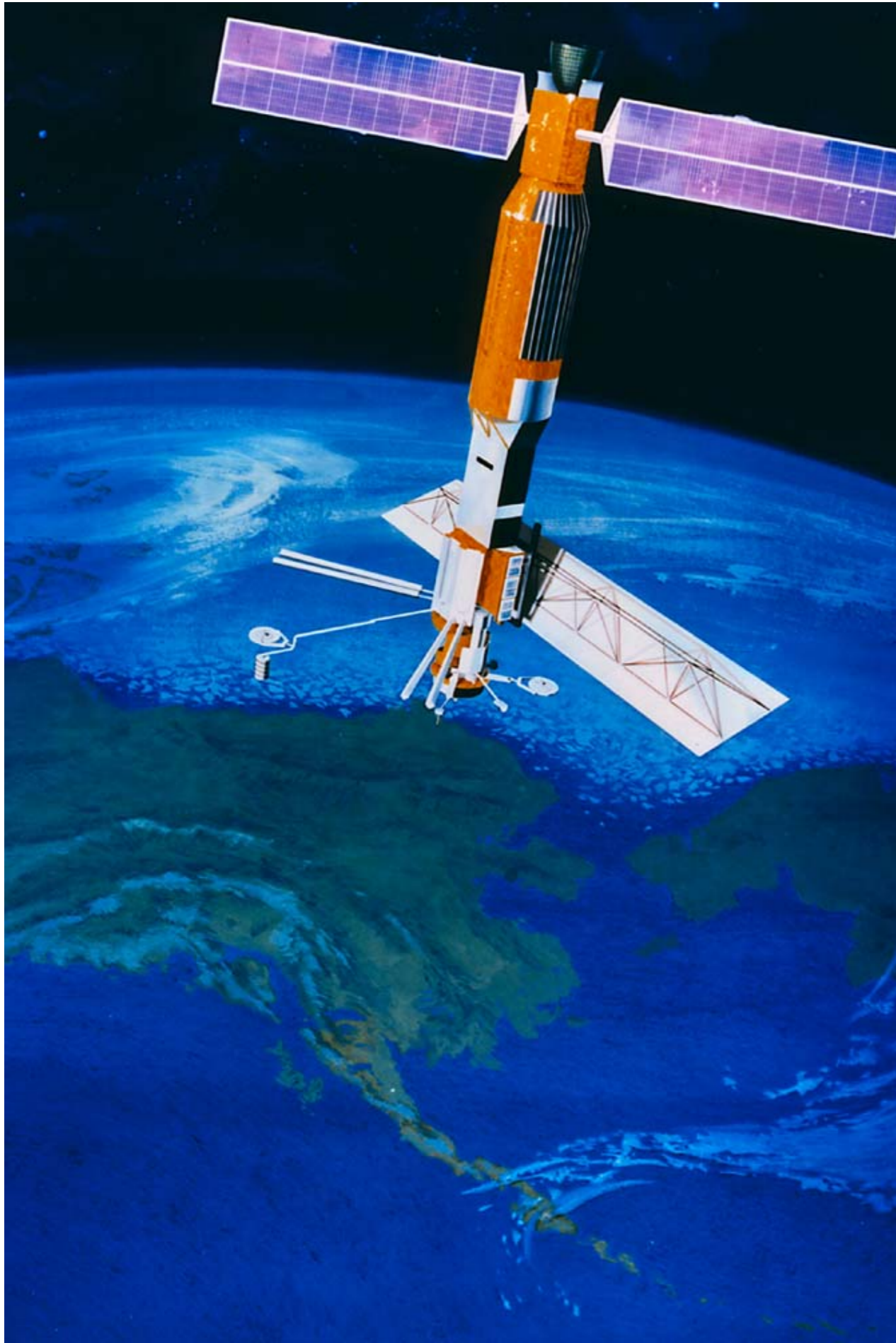
Gladys’ work in the Aeronautics and Geodesy Division of the Naval Surface Weapons Center Dahlgren Laboratory was classified as top secret. Although she didn’t have a computer science background, she was trained to program and code mathematical equations for computers. Unlike modern-day coding, computer programs back then were created and stored on punch cards. Each punch card described one instruction in the program. The cards needed to be verified and then organized. The cards were then sent to a large-scale mainframe computer for computations.

“It is awesome how GPS technology has changed the thinking and the capabilities of the world, especially on travel”

The United States had started using satellites to understand Earth and the solar system. Gladys worked with data from satellites. She used her math and programming skills to develop models that processed this information. She was a project manager of Seasat. Seasat was the first satellite designed for remote sensing of the Earth’s oceans.

“My job was to analyze this data, especially the orbits and figuring out the shape of the Earth,” she said. “This was difficult because [Earth] is not perfectly round, and it is covered with a lot of water.”

Scientists working with satellites realized that if they could find the right satellite orbits, they could use them to provide an accurate location on the planet. The astronomical group relied on this accurate data to project the location needed for military operations.



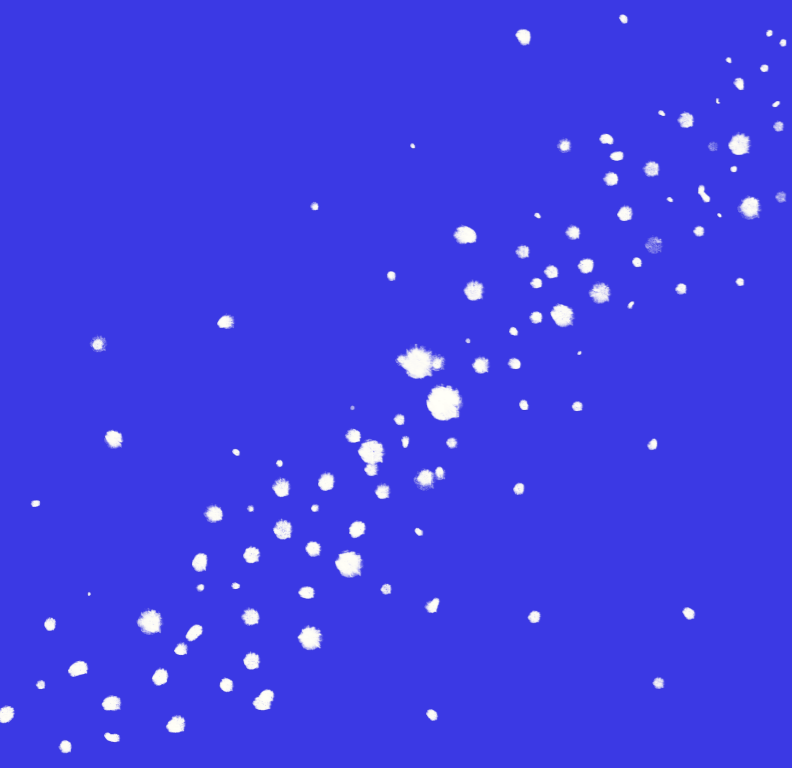
Gladys West

Gladys also analyzed the effects of tides in the orbit of satellites. This work gives you a more correct position. “If the tides are smaller or bigger than you thought, it affects the accuracy of the position if [it’s] not included in the analysis,” she said.

Gladys’ data was used to develop a navigation system for the military. It also built the foundation for the global positioning system, GPS.

Gladys knew she wanted to have an impact on society. She didn’t know her discoveries would be used around the world. “It is awesome how GPS technology has changed the thinking and the capabilities of the world, especially on travel,” she said. “We are adapting to using the GPS in our cars, but I still secretly use a map as a backup.”

Gladys encourages students to participate in STEM events offered by schools and to always believe in themselves.



Antonia Novello



Antonia Novello

Dr. Antonia Novello did not let difficulties stop her from helping others.

As a baby, Antonia was diagnosed with congenital megacolon. This is a problem with the nerve cells of the intestine. Antonia needed surgery to cure her. The earliest she could have surgery was at eight years old. But her surgery was delayed by the death of her father and problems with access to health care. Antonia received treatments that helped her pain until she was 18 years old. Then she had surgery.

Her challenges helped her decide to become a doctor. She did not want other people to suffer with long-term medical problems.

Antonia Novello

Antonia went to medical school at the University of Puerto Rico. She studied to become a pediatrician, a doctor who cares for children. Then she specialized in kidney health.

Antonia worked as a doctor for two years. Then she shifted her focus to public health. Public health officials help to prevent disease. They also study many ways to improve quality of life for communities.

In 1979, Antonia joined the U.S. Public Health Service Commissioned Corps. There she worked for the National Institutes of Health at the Institute for Arthritis, Metabolism, and Digestive Disease. Congress made Antonia a congressional fellow. She advised legislators on bills about health issues. She worked on bills for organ transplants and warning labels on tobacco products.

Antonia made history in 1990. She was made the U.S. Surgeon General. She was the first woman and the first Latina in this role. She worked for better health care for women, children, and people of color. She also led anti-smoking campaigns and improved AIDS education.

Antonia was Surgeon General for three years. She then worked for the United Nations Children's Fund (UNICEF). With UNICEF, she continued to her work on women and children's health care.

Antonia retired in 2014 but still works to improve community health. She returned to Puerto Rico in 2017 to help after Hurricane Maria. She is also helping with COVID-19 vaccination efforts in Puerto Rico.

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Robin in a lab- Robin Kumoluyi

Petri dish- AndreasReh/E+/Getty Images Plus

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Gladys West- Gladys West

Space station- NASA

Antonia Novello- Antonia Novello

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