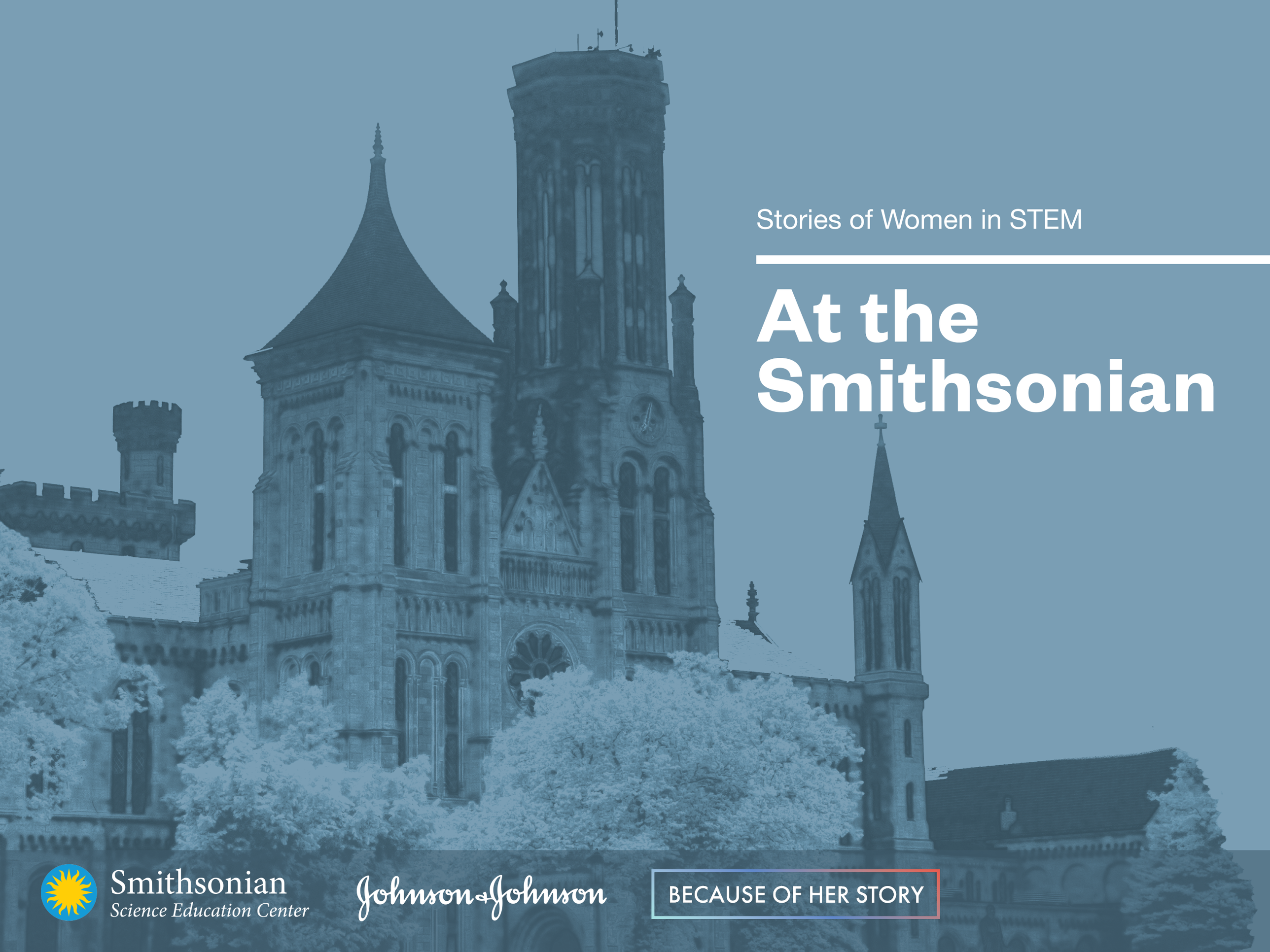

Stories of Women in STEM

At the Smithsonian

Smithsonian
Science Education Center

Johnson & Johnson

BECAUSE OF HER STORY

In America's most defining moments—times that shaped constitutional rights, yielded scientific breakthroughs, created the symbols of our nation—a diversity of women's stories has not been widely told. The Smithsonian American Women's History Initiative (AWHI) illuminates women's pivotal roles in building and sustaining our country and will expand what we know of our shared history. With a digital-first mission and focus, the initiative uses technology to amplify a diversity of women's voices—not in one gallery or museum, but throughout the Smithsonian's many museums, research centers, cultural heritage affiliates and wherever people are online—reaching millions of people in Washington, D.C., across the nation, and around the world.

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.

Cover and Design by Sofia Elian

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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 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 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.”

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.

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 role models I met along my journey, and hard work—they all helped me to achieve my goals.

The Smithsonian Institution is filled with amazing people working in STEM. In labs in our museums, women are working to explore specimens that have been preserved for years. In the lands and waters of our research centers, women are studying how ecosystems have changed over time. Behind the walls of galleries and zoo enclosures, women are studying ways to protect the art and animals you love. And in our education centers, women are writing eBooks to tell the stories of women in STEM.

There are so many amazing opportunities to explore STEM at the Smithsonian. This book tells some of those stories and introduces you to the women behind them. I hope you can “see” yourself in these women. Who knows? One day, you might “do” STEM, too.

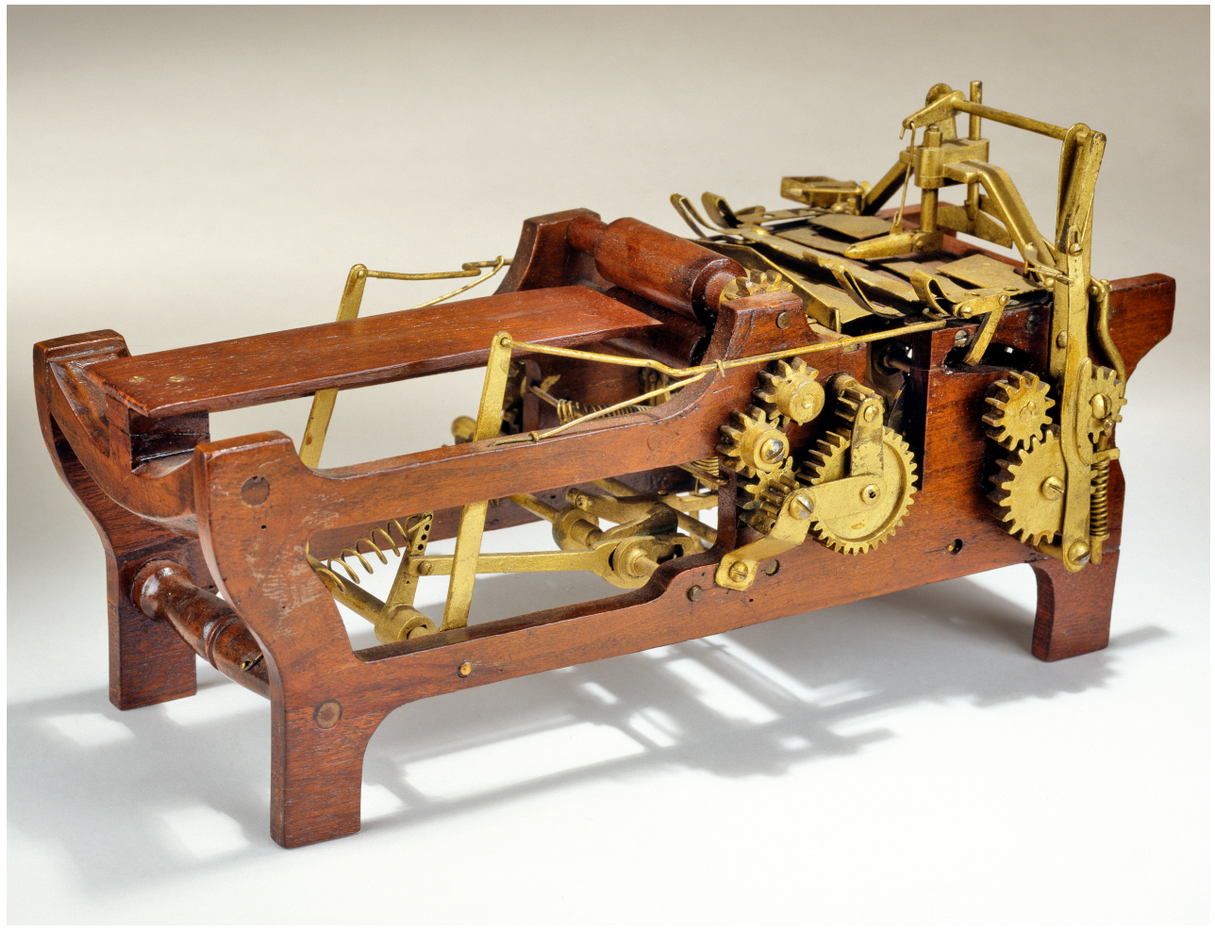
PAST

Inventor & Mechanical Engineer

Margaret Knight

The Paper Bag Pioneer

Margaret Knight



As you reach down into your brown paper lunch bag to pull out a delicious sandwich, you're probably more focused on the tasty flavors of your food than the ingenuity of the bag from which you're pulling it.

Can you imagine carrying all the goodies from your lunch bag in a big envelope instead of a bag? Your sandwich, chips and fruit would be bursting at the seams. What if you had to use a large piece of paper to wrap-up your groceries after checkout? Eggs, produce and snacks would spill out of the top and bottom, and you might even have to make extra trips to and from the store.

Thankfully, a brilliant inventor named Margaret Knight developed a machine to make the paper bags we so frequently use in our lives today. Knight's invention revolutionized how people carry goods, allowing us to bring items from place to place more efficiently and effectively.

Margaret Knight

The machine she created cut and glued paper bags so that they could stand tall, sitting on the flat bottom of the pouch. Before Knight's machine, people used bags that came down into a V shape at the bottom. This was because there wasn't an efficient or cheap way to create a flat-bottomed bag before Knight's machine.

While prototyping her machine, a man by the name of Charles Annan took notice of Knight's genius. Annan patented the invention as his own. Knight didn't know until she went to patent her invention. After battling it out in court, Knight was rightfully awarded her patent. Knight was one of the first women in the United States to receive a patent.

Knight's creative innovation didn't stop at her flat-bottomed paper bag machine. She was a lifelong inventor beginning from an early age!

Originally from Maine, Knight and her family moved to New Hampshire after her father died. She and her siblings had to work to help support the family. At 12 years old, Knight watched as one of her coworkers was severely injured by one of the machines in a textile factory. Textile mills were known for being unsafe environments for workers.

After witnessing the injury, Knight began working on an invention that would ultimately help make the American textile industry safer. She invented a shuttle stopper that kept shuttles from flying off the loom and injuring those around the machine. Shuttles are the part on looms that hold the thread used to weave the fabric.

Knight's inventions helped improve the lives of those around her. Her inventions have had a lasting impact on our world! What solutions do you have for everyday problems in your world?

AT THE SMITHSONIAN

The patent model for the paper bag machine is located at the National Museum of American History. Knight was granted the patent for her design in 1871 and her concept is still used for today's paper bag manufacturing.

Aerospace Engineer & Mathematician

Mary Golda Ross

The Interstellar Engineer

Mary Golda Ross

Not so long ago, there was a time in which exploring space was just an idea floating around our planet. It took years of imagining and experimentation to develop the rocket that would shoot us to space.

Lots of people were involved in the development of the math, science, and technology created to launch our space dreams. One of those people was Mary G. Ross, a Cherokee woman from Oklahoma.

Ross was a mathematician who worked for Lockheed Martin during a critical time in the development of aerospace projects such as the top secret Skunk Works project. The Skunk Works project was started to help the US create technology to protect the country, such as the development of spy planes and high-speed fighter jets.

Some of the work Ross contributed to is unknown because it's still top secret! However, one of her biggest achievements was her work to help create the P-38 Lightning.

Mary Golda Ross

The P-38 Lightning was a fighter plane developed for military combat. It was the first military plane to fly faster than 400 miles per hour, and it came very close to breaking the sound barrier! Breaking the sound barrier means moving at a speed faster than sound waves can travel. That's super fast!

Ross continued working in aerospace innovation throughout her life. She helped develop the Agena rocket, and she also worked on our understanding of interplanetary flight by developing space handbooks. Her work on interplanetary flight helped lay plans for any future trips to planets like Mars!

Ross's skills as a mathematician and engineer helped to develop this fighter plane during World War II. Before she started working at Lockheed Martin she was a statistician and a science and math teacher! There are lots of different jobs in STEM, and Ross tried a few before working for Lockheed Martin.

As a lifelong STEM advocate and mentor, Mary G. Ross encouraged young women to pursue careers in engineering, helping to develop lots of STEM stars around the US.

AT THE SMITHSONIAN

America Meredith's "Ad Astra per Astra," depicting Mary G. Ross, was purchased by the National Museum of the American Indian in 2012. Meredith and Ross are members of the Cherokee Nation of Oklahoma.

Inventor & Innovator

Madam C.J. Walker

The Hair Care Pioneer

Madam C.J. Walker

Sometimes getting creative to solve individual problems can actually help a lot of other people, too. What started out as a project to cure hair issues of her own turned into a long legacy of hair artistry and treatments. Madam C.J. Walker started a haircare line after inventing a home remedy for the hair loss she was experiencing.

Available hair products weren't developed for the different needs of non-white hair. The development of "Madam C.J. Walker's Wonderful Hair Grower" helped meet the needs of so many women and men around the US who experienced hair problems resulting from a lack of shampoo formulated for their hair.

Before selling her own products, Walker worked as a salesperson for Annie Turnbo Malone's "The Great Wonderful Hair Grower." Annie was like a mentor to Madam C.J. As a successful businesswoman and inventor, Annie inspired Madam C.J. to sell her products.

Once Madam C.J. Walker's hair line took off, she made sure that her profits didn't just go toward her own personal wants but also to philanthropic efforts. Philanthropic means to support opportunities for and the wellbeing of other people.

Madam C.J. Walker

Madam C.J. was born in Louisiana in 1867 as Sarah Breedlove. She was born into a family of sharecroppers. Her parents were enslaved. The were freed at the end of the Civil War. Like many other former enslaved persons, they struggled to make enough money to comfortably support their children.

When Madam C.J. was just seven years old, she became an orphan after losing both of her parents. Her sister, Louvinia, watched after her. Madam C.J. had to work from a young age because of her family's poverty. She performed difficult labor as a child up until she became a salesperson for Annie.

Madam C.J. worked hard to rise up to her status later in life as the first African-American female millionaire. With just $1.25, she started a very successful international line for African-American haircare, and she also started a cosmetology school to teach people how to cut and style African-American hair.

Despite being orphaned at a young age, facing racial oppression, and being born into poverty, Madam C.J. Walker beat the odds. Her home experimentation led to an improvement in the hair industry that helped many people. How can science be helpful to you and those around you?

AT THE SMITHSONIAN

A tin for Madam C.J. Walker's Hair and Scalp Preparation is on display at the National Museum of African American History and Culture.

Nuclear Physicist

Dr. Chien-Shiung Wu

The Phenomenal Physicist

Dr. Chien-Shiung Wu

Dr. Chien-Shiung Wu's journey to the Manhattan Project was set in motion in a little town outside of Shanghai in 1912. In the early 1900s, education for girls wasn't seen as important, and it wasn't always guaranteed. Dr. Wu's father believed in equal education for girls, and he started a school so that girls had the opportunity to pursue their dreams just like boys.

After she went through her elementary and secondary schooling, Dr. Wu went to Nanjing University in Shanghai to study physics. Physics is the study of how the Universe behaves. Physicists look at things like motion, among other topics, and how different materials move more in different settings and under different conditions.

Dr. Chien-Shiung Wu

As a research assistant, Dr. Wu's supervisor—Dr. Jing-Wei Gu, a female professor in a physics lab—inspired her to continue her physics education at a higher level. In 1940, Wu graduated from the University California, Berkeley with a PhD in physics. She struggled to find a research job after graduating, so she began teaching physics at Princeton University in 1944. In fact, she was the first female instructor hired to teach at Princeton!

A short time later, Dr. Wu began working on the Manhattan Project. The Manhattan Project was a government project that started during World War II to establish a better understanding of how to create and use nuclear weapons to protect the US. German scientists had been studying nuclear fission, so there was concern they might create an atomic bomb and nuclear weapons before the US and Allied Powers.

Nuclear fission is what happens when a big atom is split into two parts. This division creates a lot of energy that, when it's done in a safe and controlled way, can be used to power our homes through nuclear energy.

Dr. Wu's other work included research at the Department of Physics at Columbia University. After being asked by two theoretical physicists to disprove the law of parity, she experimented with a radioactive form of cobalt. Chien-Shiung was the first person to disprove the law of parity through experimentation. The two theoretical physicists, Dr. Tsung-Dao Lee and Dr. Chen-Ning Yang, received a Nobel Prize for their theory, but Dr. Wu didn't receive any credit or honor for her research. Without Dr. Wu's experimentation, Dr. Lee and Dr. Yang wouldn't have been able to prove their theory.

Dr. Chien-Shiung Wu

Despite not being recognized in 1957 with Dr. Lee and Dr. Yang, Dr. Wu received other honors in her lifetime, including the Research Corporation Award, of which she was the first woman to achieve; the John Price Wetherill Medal from the Franklin Institute; and the National Academy of Sciences Cyrus B. Comstock Award, of which she was also the first woman to receive. In addition to many other awards and honors, Dr. Wu was named Scientist of the Year by Industrial Research Magazine, and she became the first woman to serve as president of the American Physical Society in 1976.

A good mentor and a motivation to explore and experiment helped motivate Dr. Chien-Shiung Wu toward her goals. What helps inspire you to achieve your goals?

AT THE SMITHSONIAN

A photo of Dr. Chien-Shiung Wu from 1958 resides in the Smithsonian Institution Archives.

PRESENT

Ornithologist, National Museum of Natural History

Dr. Carla Dove

The Bird Nerd

Dr. Carla Dove

Growing up in the Shenandoah Valley of Virginia, a young Carla Dove explored every inch of the wilderness around her. She would splash in the creeks and venture through the forest. Creatures of all sizes, shapes, and colors grabbed her attention. As she got older, she remained interested in the natural world, but a mentor helped her soar further into natural science. Dr. Dove took flight, diving head first into ornithology, the science of birds.

“I went to community college and I met a very good professor there who was interested in natural history and wildlife, and he just happened to be a birder and an ornithologist. So he turned me onto birds,” Carla said.

Dr. Carla Dove

Her college instructors influenced her to choose a career in ornithology. They helped her find a passion for birds that has lasted throughout her career. Carla has been working at the Smithsonian National Museum of Natural History for more than 30 years. She works in the Feather Identification Lab.

“A normal day for us, in the Feather Identification Lab, begins with picking up the mail,” Carla explained, “We will get our casework from all over the country and, sometimes, all over the world.”

The mail will contain a report and bird remains from the sender. This could be feathers or microscopic remains.

“Sometimes we receive whole feathers, sometimes it’s partial bird carcasses, and sometimes there’s tiny little bird fragments called ‘snarge,’ which is bird ick,” Carla said, “We can get a species identification using the DNA techniques, we can look at the microscopic structure of the feathers, and we can match whole feathers with museum specimens.”

Carla’s favorite part of her job is solving the mystery behind the remains and distinguishing the species.

“We’re really like detectives,” Carla exclaimed.

Ornithologists’ work is especially important today. Technology has changed the way our world works in many ways. Innovations in transportation technology are very helpful for humans, but sometimes they clash with wildlife —literally. Aircraft companies call The Feather Lab team when this happens.

Dr. Carla Dove

Shortly after an airplane took off in 2009, a bird strike forced the pilot to land on the Hudson River in New York. A bird strike occurs when birds and aircrafts collide in the sky. After the collision, the bird remains were sent to the Feather Identification Lab at the Smithsonian National Museum of Natural History.

Thanks to Carla and her team, we now know the birds that collided with Flight 1549 were Canadian Geese.

“By identifying the species of birds that are causing these problems, we’re actually helping to improve aviation safety,” Carla explained.

Biologists in the airfield use this information to make habitat modifications to help dissuade the birds from coming into that area.

Using her skills as a scientist, Dr. Dove spends her days in the lab with a team of other ornithologists doing what they love most. She and her team combine problem solving, science, and a love for nature to help make our airways safer.

Dr. Carla Dove

Has a southern accent

Loves to garden, cook and go fishing

Loves to travel

Enjoys spending time with her dog, Remy

Invertebrate Zoologist , National Museum of Natural

Linda Cole

The Sea Squirt Expert

Linda Cole

Many scientists have STEM interests from a young age, but that wasn't quite the case for Linda Cole. It wasn't until she was older that she realized her passion for science.

Linda always aspired to go to college, but she wasn't quite sure what she wanted to do once she got there. She started out studying business. It wasn't until she met her mentor that she was charmed by sea life such as tunicates. Tunicates, or sea squirts, are filter feeders in the ocean that stick to and grow on different objects like rocks.

Linda Cole

“We had a wonderful biology professor. There were 100 of us in the class, but there were 12 of us that she really inspired. She made science so fun,” Linda explained. It was through her mentor that Linda was able to achieve an internship at the Smithsonian.

“I was hooked! The passion just set in,” Linda said about the Invertebrate Zoology unit at the National Museum of Natural History.

After her internship, Linda applied to work as an invertebrate zoologist at the Smithsonian. Invertebrate zoologists study animals without a backbone, such as worms and sponges. After she started studying different invertebrates, Linda learned about tunicates, or sea squirts. Sea sponges and tunicates are similar, but tunicates are able to control their bodies a little more than sponges can. Both have openings called siphons.

Tunicates can open and close their siphons, but most sponges can’t. Those that can, cannot open or close their siphons as quickly as tunicates.

“Because they’re so important to the environment, it’s something that I was interested in,” she said, “They’re really beautiful. I’m happy I’ve been able to add to science with these animals.”

Before Linda began working on the tunicate collection at the Smithsonian, no one was specifically focused on this group of invertebrates. She worked hard to build-up the world’s understanding of this important group of sea creatures.

“I had colleagues all over the world. This became a passion of mine. I started looking under the microscope and became so fascinated with them,” Linda explained.

Linda Cole

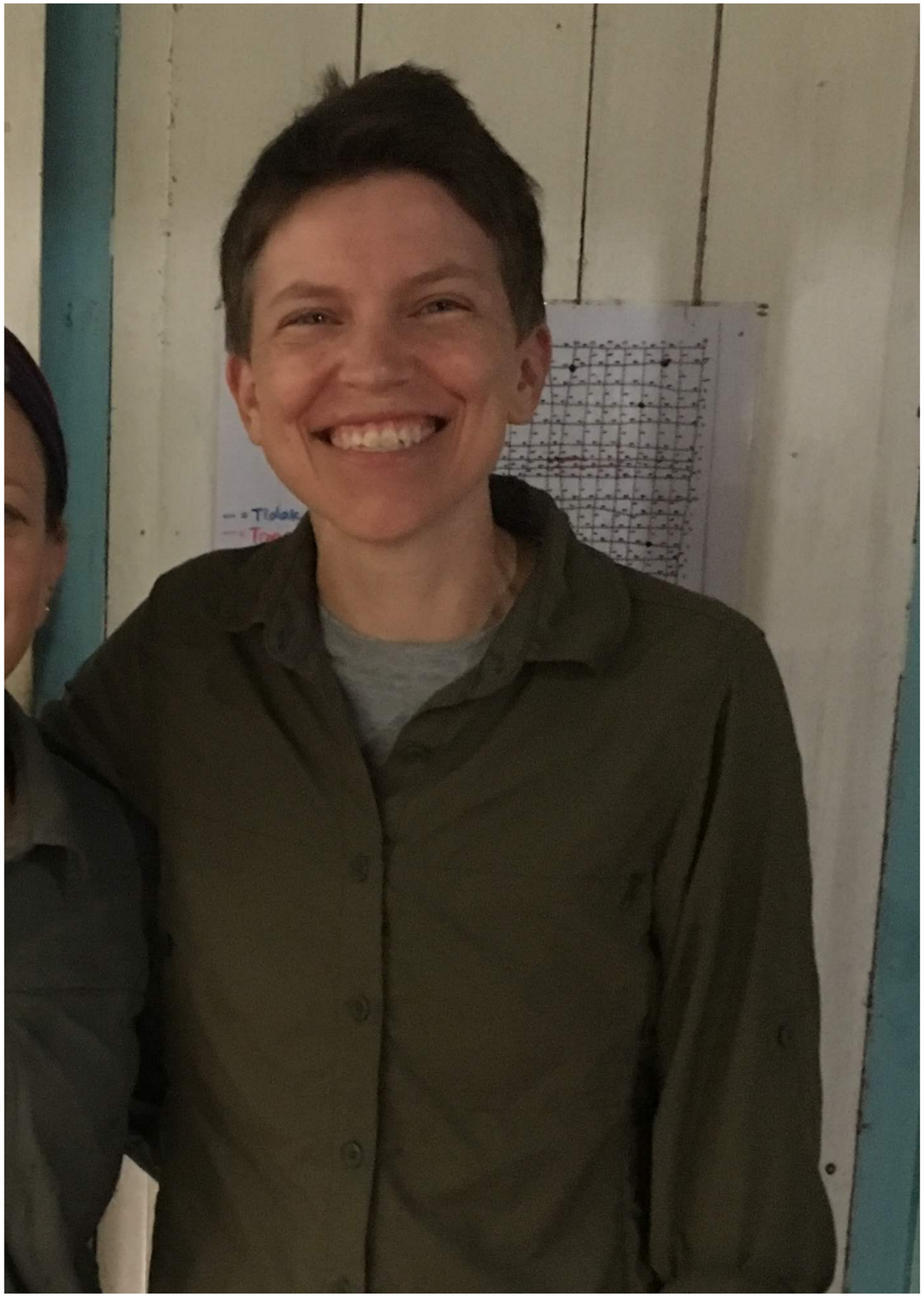
- Average height
- Loves comic books and history
- Scientist
- Loves watching movies and dancing

Curator of Primates, National Zoo and Conservation Biology Institute

Dr. Meredith Bastian

The Clever Curator

Dr. Meredith Bastian



Dr. Meredith Bastian wanted to work with great apes since she was three years old. She wanted to work with wild apes, but now she works with both wild and zoo-housed apes and other non-human primates as the Curator of Primates at the Smithsonian's National Zoo and Conservation Biology Institute. Her job is kind of like that of a museum curator but with animals instead of historical artifacts.

"So just like you think of museums that have objects, we have living objects," Meredith explained.

Her research on wild primates has taken her to jungles around the world. She researches and studies wild orangutans, and then she heads back to her office at the Smithsonian National Zoological Park to help care for and study the zoo-housed primates.

Dr. Meredith Bastian

Meredith's love for science started early and was solidified when she did a project in second grade.

"I was doing a project about gorillas, so I came to my home zoo, the National Zoo. I interviewed the Curator of Primates at the time. Something just clicked," said Meredith.

Even outside of her interest in primates, she always loved science and hands-on activities. Meredith remembers reading an entire book on DNA in elementary school. Even though she didn't quite understand it all, it was all very exciting to learn about. Meredith has always loved and succeeded in science, even though some people around her weren't the most supportive of girls taking interest in STEM.

"Science has nothing to do with gender. Both my mother and father were scientists," explained Meredith.

Her parents were big supporters of her STEM interests from the beginning. Meredith would curl up with the books that her parents kept as references for their own scientific work.

As she got older and became more independent, Meredith realized that there was something about her that made her do things like note-taking a little differently than you and I might. When she was in graduate school, Meredith was diagnosed with Obsessive Compulsive Disorder (OCD). OCD is a condition in which individuals might be more sensitive to certain things, like disorganization, and then they have an overwhelming amount of thoughts about it until the thing is fixed.

For Meredith, it's especially important that her notes and workspace are well-organized.

Dr. Meredith Bastian

“Everything has to be extremely organized. I’ve had roommates that are the complete opposite, but it doesn’t bother me,” she said, “It’s that I need my own space to be a certain way.”

Even though she might do things a little differently than others, Meredith hasn’t allowed her OCD to hold her back, even as a child.

“It’s something that I will always deal with, but it shouldn’t be something that stops you from doing anything,” said Meredith.

Regardless of whatever obstacles you might face, Meredith encourages everyone to experiment with their interests.

Dr. Meredith Bastian

Introverted

Loves cats and the forest

Loves virtual reality

Intelligent, organized and driven

Paintings Conservator, Smithsonian American Art Museum

Amber Kerr

The Barrister of Brushwork

Amber Kerr

As a young girl, Amber Kerr enjoyed the arts. She always thought she would pursue an artistic career. While in her later twenties, she was attending college to become an art therapist. But that changed when a teacher told her about the importance of art conservators.

“When I was young, I thought I was going to go into art therapy for children,” explained Amber, “It wasn’t until I was in school and taking classes for art therapy that one of my professors introduced me to the field of conservation.”

Now she spends her days using her scientific knowledge to help protect art.

Within the perimeter of the floor-to-ceiling glass walls of the Lunder Conservation Center, easels hold classic art and tiered carts sit beside them. These carts are a treasure trove of cleaning supplies and utensils.

Tweezers, paintbrushes, and cleaning solvents sit on each shelf of the cart.

Amber Kerr

Just like an artist uses tools to create their paintings, Amber uses tools to protect and conserve these paintings. Her creativity is combined with critical thinking and scientific knowledge to clean the aging parts of these paintings.

Conservation is more than just keeping the art pretty. By preserving the quality of artists' works, Amber is ensuring they will continue to be enjoyed and understood for generations to come.

Art is such an important part of a place's culture. Through the protection of art, Amber is also protecting the culture of so many spaces and times. Think about this: what kind of art do you enjoy? Why do you like it so much?

For many people, seeing themselves in artwork is an opportunity to feel a part of a much bigger community.

Take for example Alma Thomas. Alma's paintings are so much more than pigments on a canvas. Her work and success continue to represent hope for a lot of individuals.

"She actually was a middle school teacher for 30 years in the district in public schools. She taught art. She didn't become a painter full time until, I think, her late 60s, early 70s," explained Amber, "She also taught at Howard University, and she often taught in her own home how to draw."

When Amber and others within the lab began to examine Alma's works closer, they noticed something different from other abstractions, or a type of painting that uses lots of colors and shapes without any connection to reality.

"We were seeing a lot of pencil lines. It turns out that Alma had a severe case of arthritis, and so she couldn't paint very well with the painting straight in front of her. So she would lay her paintings flat on the table," said Amber.

This is unusual for this painting style because it's difficult to understand how something looks straight on if it's laid out flat instead of having it on an easel.

"What she did is she actually drew out her abstractions and painted them," said Amber.

Amber Kerr

Amber and others were able to use infrared light to see through the paint and take note of Alma's pencil technique. Using infrared light is like using an X-ray machine to see the bones in your body.

Alma's penciling technique is a way some artists might overcome a physical disability to be able to create their art. Amber is using her skills as a conservator to protect Alma's work so that it can be used as an example of how art can be done by anyone, regardless of ability.

Amber isn't the only person combining art and science to help better our communities. There are lots of opportunities to combine the arts and sciences in the STEM field. Creativity and critical thinking don't have to be separate! Can you think of other ways these two areas might be combined in a useful way?

Amber Kerr

- Loves animals
- Likes to cook
- Loves to travel
- Enjoys hiking, sailing, and sea kayaking

Photo Conservator, Museum Conservation Institute

Shannon Brogdon-Grantham

The Picture Protector

Shannon Brogdon-Grantham

Flipping through photo albums as a child, Shannon Brogdon-Grantham discovered the stories of relatives from the past she never got to meet. It's this activity that inspired her to go after a career as a photo conservator at the Smithsonian's Museum Conservation Institute.

"We always had the family photo albums out at the holidays to look through them. I really got to know a lot of my relatives through photography," Shannon said, "I always thought it was really cool that you could see someone from the past and be connected with them."

She began college with thinking about a job in forensic medicine, which is the usage of medical knowledge to figure out how a person might've been hurt during a crime, but she realized her heart was set on a different calling. She switched majors and began to study art history. That's when she learned about the field of photographic conservation.

Shannon Brogdon-Grantham

Even though most people might think of photographs in a photo album, pictures are very important for lots of other reasons.

Just like artwork and fossils are clues into the past experiences of people and animals, photographs help tell the stories of people from years ago. By protecting and conserving photos, Shannon can help provide people with important information about the lives of people from different times and places.

Shannon loved science from a young age. She especially loved dissecting an owl pellet, or poop, during class in fourth grade. It was a little gross, but to her, it was mostly exciting.

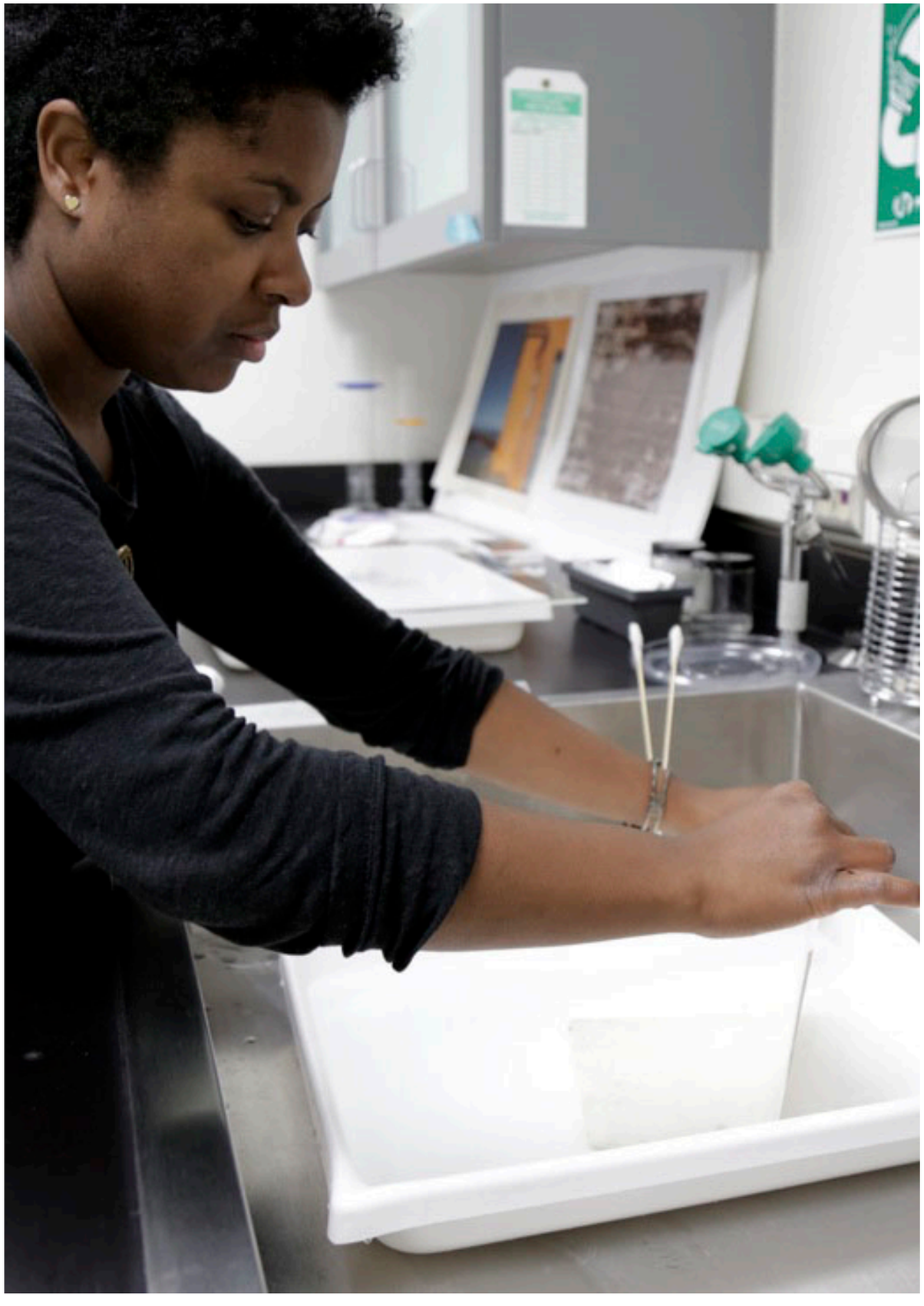
“As disgusting as that is, it was really cool, and I was hooked ever since then with science,” she explained, “I went to a specialty high school that was health sciences and engineering. So, that’s when my interest in medicine took hold.”

Shannon was interested in medicine because she wanted to help people. As a photo conservator she’s still helping people.

“I’m one of the few people that gets to connect the past and the present and the future through preservation,” Shannon said.

Even though she’s not curing colds, Shannon is still helping to protect people by making sure their stories can be shared for years to come. She’s protecting people’s cultural heritage by preserving their photos. In addition to protecting photos, Shannon also works to protect mixed media objects that incorporate photos, such as quilts made with photographic images.

Shannon Brogdon-Grantham



Quilts can be made to help keep people warm at night, but they’re also made for lots of other reasons, like artistic expression. By understanding how certain quilts are made, Shannon has helped to make sure that these quilts can be preserved for generations to come.

Shannon comes from a family of educators, and she’s been able to combine education, science, history and art in her career as a photo conservator. Her work is important when it comes to inspiring and teaching people about the diverse experiences of our world.

Shannon Brogdon-Grantham

Creative

Loves theatre

Swimmer

Loves science

Conservation Scientist, Freer Gallery of Art and the Arthur M. Sackler Gallery

Jennifer Giaccai

The Collections Chemist

Jennifer Giaccai

From a young age, Jennifer was influenced to pursue some kind of STEM career. Her father brought a computer into their home before it was common to have them around the house.

“My dad was a mathematician who then moved over into computer science. He would teach us computer programming things,” Jennifer explained.

Even though she doesn’t work primarily with computers now, Jennifer attributes her interest and fearlessness of STEM with early access to computers and computer programming.

“Anyone can tell you I’m not a good computer programmer now, but I’m not afraid of it. I think being introduced to math and computers at a young enough age made me not afraid of them,” she said.

Now she spends her days studying the chemical properties of objects and artifacts at the Freer Gallery of Art and the Arthur M. Sackler Gallery. It’s important to understand all the different properties of an object at its present state, but it’s especially important to take a closer look at all of the different properties that were used in the past to help conserve and create the object.

Jennifer Giaccai

Using science, conservation scientists like Jennifer can help unravel the mystery of how objects of the past have been preserved over time. Through this study, she can help document the history of preservation and creation that might not otherwise be available. This history is important.

Sometimes knowing the different scientific details can actually help historians tell a more complete story. For example, looking at different pigments of color and how they're used in paintings can help historians identify things like time period, cultural influence, and how different materials were and are used based on accessibility and region.

There are pigments, or paint colors, that are more available and affordable in certain times and places. Chemists can study the compounds in these pigments to better understand where the materials most likely came from.

"It gives you an insight into how the artists were working and what they were thinking at the time," Jennifer said.

Jennifer has always loved studying the chemical makeup of different things.

Even though a computer was her first STEM influence, chemistry was love at first sight for her.

"I knew after taking chemistry in high school that I wanted to go and pursue chemistry more. When I was studying chemistry in college, I could never find one branch of chemistry that I wanted to focus on and let everything else go."

That's when Jennifer started to explore her career options in the field of chemistry. "There were two that I had come across. One was food chemistry. There are people who work at Kraft and General Mills, and all of the big food production places. I just thought that sounded fascinating."

Food chemistry was, and continues to be, an area of chemistry that Jennifer really enjoys. However, Jennifer decided to focus on the chemistry of art. Even though she's not developing recipes for creating silky chocolate bars, Jennifer loves going to work each day and protecting and studying the makeup of objects in the galleries.

For Jennifer, an early interest in STEM helped launch her lifelong chemistry career. Exploring all different areas within a field can be a great way to find what you love the most.

Art Conservator, Museum Conservation Institute

Dawn Rogala

The Artwork Advocate

Dawn Rogala

When it comes to protecting artwork, Dawn Rogala is an expert on what to protect and how to protect it! Specifically, she helps conserve paintings through her work at the Smithsonian's Museum Conservation Institute.

To Dawn, artworks are clues about the past cultures and experiences of people around the world. Paintings, sculptures, and other cultural heritage items tell us about the places where they were created and the people who created them.

Dawn Rogala

“Art is an important part of life; it’s the evidence of mankind’s experience on this planet. I work to preserve that evidence for the benefit of future generations,” explained Dawn, “It’s a really nice way to learn about history, and about life, and to use that knowledge to help others have the same experience.”

There’s a lot of researching and science that goes into Dawn’s work. She has to have a strong understanding of chemistry to know how to clean and preserve artwork. Depending on the project, she might even need to know some biology.

For example, some works of art might be made with elements from nature or commercial materials made for other industries, and this can change how the artwork reacts to the materials she uses for cleaning and conservation. Dawn is always learning about different sciences so she can be better at her job.

“An art conservator needs a strong background in science to understand all the different materials they may encounter during their work. Conservators also need to learn art history to understand what may have influenced the artwork and the artist and studio art to build the careful hand skills needed to perform conservation work,” said Dawn.

Dawn had lots of different jobs before becoming an art conservator. She did graphic design. She also travelled around the country photographing circuses! As she learned more and more about different things, she looked for a way to combine her interests into a new career. That’s when she began working toward her career as a conservator.

“I realized that I could combine my love of art with a career that would be mentally stimulating. As a conservator, every day there’s something new for me to learn and to think

Dawn Rogala

about. I'm always problem solving, and I get to combine that with preserving important works of art," she said.

Dawn loves her job because she's always being challenged to learn more. When she's not being challenged in the office, she's chasing new adventures—like fire spinning and book writing! She continues to try new things because, in her eyes, that's what life is all about.

"The most important piece of advice I can give you is that it's okay to like more than one thing at a time. There are lots of things you need to learn in school, but that doesn't mean that you have to pick the thing you like best and forget about all the other things that you like," she said, "The most interesting careers are interdisciplinary—jobs that mix together a bunch of different types of knowledge. It can be hard to learn lots of different things, but it makes the world—and your life—a lot more interesting."

Dawn Rogala

Intelligent

Dedicated to learning new things

Loves to travel

Loves art & trying new things

Phytoplankton Analyst, Smithsonian Environmental Research Center

Dr. Brenda María Soler Figueroa

The Aquatic Explorer

Dr. Brenda María Soler Figueroa

During a scuba diving trip with her aunt in ninth grade, Brenda Soler fell in love with the vibrant wildlife roaming the sea. Swimming around the deep blue ocean sparked a passion for marine life that's turned into a career.

"I remember [tour guides] were throwing bread into the water. All the fish were swimming around me and I remember thinking 'Oh, this is cool.' That's when I decided I wanted to be an oceanographer," said Brenda.

Now Brenda works at the Smithsonian Environmental Research Center studying phytoplankton. Phytoplankton are at the base of the aquatic food webs. Without them, many organisms wouldn't have the nutrients they need to survive, so preservation of this marine flora, or plant-like organism, is very important to the survival of many other sea critters.

Dr. Brenda María Soler Figueroa

Brenda studies how phytoplankton species transported by water from different parts of the world, like if a ship with tanks full of water sailed from one waterway to another, can threaten local phytoplankton, other marine life, and the aquatic ecosystems in general. She and her colleagues work to reduce these potentially invasive species.

“There are regulations to control the amount of those organisms,” said Brenda, “and ships are now required to have treatment systems to reduce their number.”

Brenda and other scientists count the number of live phytoplankton in the water to make sure that the treatment systems inside the ships are in accordance with the regulations.

“We test whether or not those systems are working properly,” explained Brenda, “What I’m doing, it matters because I’m protecting our oceans and, in the end, our planet.”

Being near the ocean and getting to travel are fun perks of the job, but for Brenda, being able to help protect the marine ecosystem is especially rewarding.

When she isn’t protecting the oceans, Brenda works to protect and preserve the music and dance native to Puerto Rico, her home country.

“Besides doing science, I really like to promote my culture,” explained Brenda.

Since moving to the Washington, DC, area three years ago, Brenda has continued to participate in Bomba groups. Bomba comes from African slavery in Puerto Rico. “Bomba is folk music from Puerto Rico. It’s part of our African heritage,” said Brenda.

She’s the musical director and lead drummer of her Bomba group, which also happens to be an all-female group.

Dr. Brenda María Soler Figueroa

“Our main goal is to support and protect traditional Puerto Rican music through women’s empowerment,” explained Brenda.

Whether she’s dancing with her Bomba group after work or studying water properties in the lab or in the field, Brenda is working to protect important parts of our world. How can you help protect what’s important to you?

Dr. Brenda María Soler Figueroa

Extrovert

Caribeña

Bomba drummer and dancer

Loves kayaking, cooking, and reading

FUTURE

You

From Mary Ross to Linda Cole, women have contributed inventions and scientific breakthroughs throughout American history. They've overcome obstacles to pursue their dreams in STEM. Margaret Knight started inventing at the age of twelve! No barrier is too big. Just like the women in this book, you too can be an inventor, engineer or mathematician.

Your Name:

Add a photo of yourself here!

Some of the scientists featured in this book provided their own identity maps. An identity map is a graphic tool that can help people to understand the things that shape them as an individual.

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Credits

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Margaret Knight - National Museum of American History, Smithsonian Institution

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Dawn Rogala- Images courtesy of Dawn Rogala, Museum Conservation Institute

Mary Golda Ross - National Museum of the American Indian, Smithsonian Institution; United States Mint, United States Department of the Treasury

Mary C.J. Walker - Scurlock Studio/National Museum of American History, Smithsonian Institution; National Museum of African American History and Culture, Smithsonian Institution

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