





Maria Sibylla Merian

ARTIST | SCIENTIST | ADVENTURER



Sarah B. Pomeroy
and Jeyaraney Kathirithamby

The J. Paul Getty Museum • Los Angeles



*To my grandchildren, Nate, Joel, Jesse,
Talia, Simone, Dina, and Jacob; to
the memory of Alexandra Pomeroy;
and to the memory of Elicia Brown Pomeroy*
≈ SBP

To Jacob Arun
≈ JK



**Lobster Claw with Potter Wasp and
Southern Army Worm** from *The Insects
of Surinam* by Maria Sibylla Merian

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Introduction

“All this inspired me to undertake a long and costly journey, and to sail to Surinam in America.”

— Maria Sibylla Merian

It was a dangerous voyage—two months crossing the Atlantic Ocean in a wooden boat about the length of two school buses. Storms rocked the seas, and pirates plied the waters looking for ships carrying valuable cargo. Friends begged Maria Sibylla Merian not to go, but she refused to listen to them. She had made up her mind.

In June 1699 Maria Sibylla and her daughter Dorothea sailed from Holland to Surinam, in South America, to explore the jungles in search of exotic creatures no European had ever seen. They were the first people to journey to the Americas for purely scientific reasons, and they planned to study and paint pictures of every new animal and insect they found.

Maria Sibylla Merian was one of the earliest entomologists—scientists who study insects—and also one of the world’s first ecologists—scientists who study the relationships among living things in the environment. At the age of thirteen she began an important study of metamorphosis, the process by

which caterpillars change into moths and butterflies. She investigated the development of tadpoles into frogs and was the first to describe army ants, orb weaver spiders, and many other rain-forest creatures. She understood how living things interacted and was the first to draw a complex ecosystem on a single page. More than a dozen species of insects, animals, and plants have been named in her honor.

Not only a scientist, Maria Sibylla Merian was also a famous artist. She had a talent for making accurate illustrations of plants and animals that were also very beautiful. She pictured insects among the flowers and fruits they liked to eat, and she did so in artistic ways that were wonderful to see. Today, paintings, drawings, and hand-colored books by Maria Sibylla Merian can be found in museums and art collections all over the world.

Artist, scientist, adventurer: Maria Sibylla Merian, born in 1647, more than 350 years ago, was a woman far ahead of her time.

1719 edition of *The Insects of Surinam* by Maria Sibylla Merian, now in the collection of the Getty Research Institute in Los Angeles, California

Coral Bean Tree with Giant Silkworm from *The Insects of Surinam* by Maria Sibylla Merian





Chapter one

Growing Up with Art and Nature

“This inspired me to collect all the caterpillars I could find and to observe their metamorphoses.”

— Maria Sibylla Merian

Stories of faraway places, paintings of flowers, and a family of artists surrounded Maria Sibylla Merian as she grew up. Her extended family was huge, including half brothers, half sisters, and stepsisters, and her home in Frankfurt, Germany, was always filled with people. The painting studio was her favorite room in the house, cluttered with brushes, easels, dried flowers, and paints in many colors. It was a busy place, where students and apprentices came to study with her stepfather, Jacob Marrel. Jacob was a well-known painter of flowers woven into wreaths or arranged in vases. This type of painting is called still life, because it shows objects captured in a moment, as if frozen in time. As long as she didn't get in the way, young Maria Sibylla was allowed in the studio. She watched the artists at work and helped by cleaning brushes and mixing paints.

When Jacob realized that Maria Sibylla was good at drawing, he began to include her in the lessons he gave to his students. She learned to paint in her own home, which was lucky, because girls were not allowed to attend art school. And unlike Jacob's male students, Maria Sibylla could not become an apprentice in another artist's studio. But she could still hope to become a professional artist someday, and she learned all she could from her artistic family.

Maria Sibylla's father, Matthäus Merian the Elder, had been an artist and publisher. He had children from his first marriage before he married Maria Sibylla's mother, Johanna Sibylla Heim. Maria Sibylla's father died when she was only three years old. Her mother later married Jacob Marrel, who also had children from his first marriage. Maria Sibylla learned about art from her stepfather, her half

Iris with Dot Moth from *The Caterpillar Book*
by Maria Sibylla Merian





View of Frankfurt in a Floral Wreath by Jacob Marrel, 1650–51

Maria Sibylla's stepfather, Jacob Marrel, was a well-known artist, and he painted this wreath of flowers. In the center he shows a miniature view of the city where the family lived, along the Main River in Germany.



Floral Wreath with Lilies, Anemones, Peonies, and a Sunflower from *The Caterpillar Book* by Maria Sibylla Merian

Maria Sibylla learned to paint from her stepfather, and when she was grown-up, she often painted wreaths of flowers like the ones her stepfather made in his art studio.

Oil Painting Studio printed by Theodor Galle, about 1580, after a design by Jan van der Straet

Artists' studios were busy places. In this picture the master artist is standing on a platform painting a large canvas, while apprentices and assistants work all around him. On the left, one paints the portrait of a live model who sits in a chair nearby. Two apprentices are sketching. In the center, a young man is mixing colors, while in the background, on the right, two others are grinding pigments and mixing them with oil to make paint.



Portrait of the Family of Matthäus Merian the Elder by Matthäus Merian the Younger, 1642

This is a portrait of Maria Sibylla's father, the artist Matthäus Merian the Elder, surrounded by his first wife and their children. The painting shows that Maria Sibylla was born into a large family, including half siblings who were much older than she was. The figure on the left is Matthäus Merian the Younger, who was also an artist and points himself out as the one who painted this picture. Some of the family members are dressed up like ancient Romans, whom they admired. The child on the right is holding a plaster cast of the head of an enormous Roman statue. Artists used these casts as models for their paintings.

Roman Denarius with Sibylla, mint of Rome, 65 BCE

Maria's middle name, Sibylla, is derived from the name of an ancient Roman prophet, Sibyl of Cumae, who was said to tell the future. She is depicted on this Roman coin made about two thousand years ago. Roman history and mythology were popular in Europe during the seventeenth century.



brothers, and the many artists who visited or worked in Jacob's studio. Besides drawing, painting, and engraving, she learned to see like an artist, to develop her skills at observation, and to think like artists do about the world around them.

Like most artists of her time, Maria Sibylla probably began by copying drawings and paintings made by others. Since her stepfather's workshop specialized in flower paintings, she may have started with small sketches of individual flowers before she tried putting them together in larger compositions. Some of her later paintings feature single flowers, and some are like Jacob's, with vases filled with many flowers that would have bloomed at different times of the year.

Jacob painted his flowers with watercolors on vellum—a sheet of animal skin, scraped thin, soaked in lime, and stretched and dried. Vellum was expensive, and not a bit was wasted. In the studio Maria Sibylla learned how to prepare vellum with a thin coating of opaque white material that created a bright, smooth base for the watercolor paints that had been so carefully prepared.

Yellow for daffodils, pink for carnations, blue for irises . . . these colors did not come in trays or tubes as they do today. Artists like Maria Sibylla had to make their own paints using natural materials, including minerals, plants, and even shellfish and insects. These were ground into powders called pigments. Many came from





Vase with Flowers by Jacob Marrel, 1635
 Maria Sibylla's stepfather painted this arrangement of flowers. There are insects and animals in the painting too, but they lack detail and seem out of place on top of a wooden table.

Spring Flowers in a Chinese Vase from *The New Book of Flowers* by Maria Sibylla Merian

Maria Sibylla painted this still life. She included the stag beetle to “enliven” the painting, which was mainly focused on the flowers. In her later work, Maria Sibylla showed insects in their natural environments.



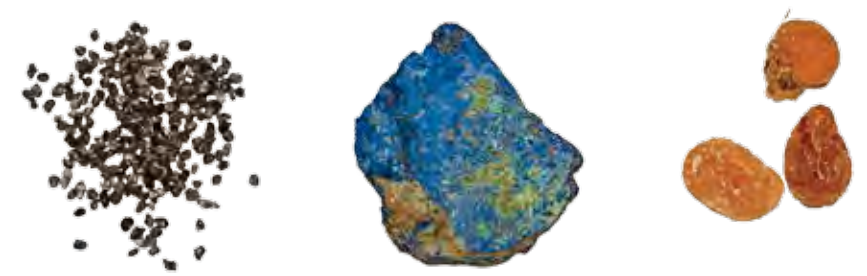
Self-Portrait by Jacob Marrel, 1635

After the death of Maria Sibylla's father, her mother married the artist Jacob Marrel. In this self-portrait he shows himself at the age of twenty-one, painting one of the floral still lifes for which he was best known.



Cochineal, Lapis Lazuli, and Gum Arabic

These are some of the natural materials Maria Sibylla used to make paints.



Study Book by Maria Sibylla Merian

When she was thirteen, Maria Sibylla began to record her observations about caterpillars and butterflies, and she painted pictures of them in full color. She later copied her notes into a study book she would keep nearly all her life. It eventually included 318 studies of different insects and hundreds of drawings of eggs, pupae, caterpillars, beetles, butterflies, moths, and other creatures. She wrote in German using black letter, or Gothic script, common throughout Europe in the seventeenth century but today read only by scholars.



faraway lands: orange-red cinnabar from Spain, blue lapis lazuli stone from Afghanistan. Carmine red came all the way from South America, where it was made from cochineal insects that live only on a particular type of cactus. To use these pigments, Maria Sibylla first had to mix them with a binder, something that made them stick to the vellum. Oils were used for oil paints, but to make watercolors, Maria Sibylla mixed the pigments with water and gum arabic, a sticky substance collected from the bark of acacia trees. It wasn't easy to get just the right mix of pigments to match the exact color of a particular flower, or to get just the right amount of binder to make the color easy to paint with and to dry—but not too fast. Maria Sibylla learned by doing.

There were not just flowers but also insects in some of Jacob's paintings, and in the studio there were dead, dried specimens stuck on pins for the artists to use as models. As Maria Sibylla later recalled, “I was always encouraged to embellish my flower painting with caterpillars, summer birds [butterflies] and such little animals in the same manner in which landscape painters do in pictures, to enliven the one through the other, so to speak.” But Maria Sibylla didn't want to use dead bugs as models; she wanted to paint insects while they were alive, to capture their true colors and show how they behaved in their natural environments. She was curious about their lives—where they came from and how they grew. She especially loved to watch wiggling silkworms and the changes they went through from egg to larva to cocoon to moth. “Then I noticed that much more beautiful butterflies and moths emerged from other caterpillars,” she wrote. “This inspired me to collect all the caterpillars I could find and to observe their metamorphoses.” Metamorphosis is a Greek word meaning “transformation.” The word could apply to Maria Sibylla herself, as she went through many changes during the course of her adventurous life.

The first transformation took place at age thirteen, when she made a surprising decision. “I set aside my social life. I devoted all my time to these observations [of insects] and to improving my abilities in the art of painting, so that I could both draw individual specimens and paint them as they were in nature. I collected all the insects I could find around Frankfurt . . . and painted them very precisely on vellum.”



Wreath of White Mulberry with Silkworm Metamorphosis from *The Caterpillar Book* by Maria Sibylla Merian

On this decorative page Maria Sibylla depicted the silkworm in different stages of development on a wreath made with its favorite food—mulberry leaves.

Maria Sibylla collected caterpillars and insects from gardens within walking distance of her home. She found specimens in trees along the river and took rides in a horse-drawn carriage to the countryside just beyond the city. To her mother's dismay, she began raising caterpillars at home, keeping them alive in wooden boxes and giving them lettuce leaves to eat. She watched each one change from a caterpillar to a moth or butterfly. Like a modern scientist, she took notes, recording her observations with words, drawings, and paintings. Careful note-taking was a habit she would keep throughout her life.

She continued to study silkworms, which she considered “the most useful and noble of all worms and caterpillars” because the fibers of their cocoons could be made into silk cloth. She would not have found silkworms outside but at a silk manufacturer's workshop. The ancient Chinese had been the first to spin silk thread from the fibers of the silkworm cocoon, and the fabrics they wove were the envy of the world. The women of ancient Rome loved silks for their lightness and the way they absorbed colorful dyes. But for a long time no one knew how to make silk outside of China, and the Chinese emperors threatened death to anyone who would



The Reeling of Silk printed by Karel van Mallery, about 1595, after a design by Jan van der Straet

Silk manufacture was women's work. In this engraving the woman holding a child is supervising the workshop. The women pictured in the background are gathering cocoons to be brought indoors. Inside, other women unwind the silk fibers from the cocoons and wind them onto reels so that they can be spun into thread.

Metamorphosis of the Silkworm

Maria Sibylla's first illustration in her first scientific book was the life cycle of the silkworm, which she based on the earliest observations in her study book. The life cycle begins with the eggs (lower right corner), which hatch into caterpillars (technically called larvae) after ten days. The bodies of caterpillars are segmented and often covered with hairs. As a caterpillar eats, it grows and periodically sheds its outer skin—which is actually an external skeleton called a cuticle—in a process called molting. Maria Sibylla wrote, “The size of the larvae increases every day, especially when they have enough food. They reach their full size in several weeks to two months. The larvae shed their skins completely three or four times, just as a person pulls off a shirt over his head.” The silkworm caterpillar sheds its cuticle five times. The large caterpillar in the lower middle of the picture is sitting on a mulberry leaf, and it is in the process of shedding its wrinkled cuticle. A cuticle that has already been shed is to the left of the mulberry leaf.

In the next stage of metamorphosis, the caterpillar uses its silk glands to produce a fluid that it forces through its mouth. This fluid hardens in the air to create the silk thread that it wraps or spins around its body to form a protective cocoon. Inside the cocoon, the caterpillar changes into a pupa. Maria Sibylla shows a yellow cocoon in the middle of the painting. Just above it is a cocoon showing the pupa inside, and a whole pupa is visible on the far right. While the insect is a pupa, chemical reactions cause many of the larval tissues to break down, and the pupa fills with what appears to be a white, milky sap. Then flat, round sheets of cells called imaginal discs begin to form structures such as adult wings, legs, and antennae. This process takes five to seven days. Finally the



Metamorphosis of the Silkworm from *The Caterpillar Book* by Maria Sibylla Merian

adult moth emerges, leaving the cocoon empty.

At the top are two adult moths. The male on the left is secreting semen. The female, which is much bigger, is laying eggs. Maria Sibylla showed the reproductive process because it was the least understood part of the insect life cycle at that time. Insect eggs are tiny and hard to see

without a magnifying glass, and some people didn't know they existed, thinking that worms, caterpillars, and flies simply emerged from rotten food or dirt. Maria Sibylla's careful observation of insect reproduction and her detailed diagram of metamorphosis helped to disprove these mistaken beliefs.

reveal the secret. Eventually travelers smuggled silkworms out of China, and Europeans began cultivating them, together with the mulberry trees on which they fed. By Maria Sibylla's day, silk was made in Frankfurt in family workshops not unlike the Marrel art studio.

But Maria Sibylla wasn't interested in silkworms just for their cocoons. She was fascinated by the changes that occurred throughout their life cycle. She described their appearance and behavior in her notes and drew pictures of the eggs that developed into caterpillars that spun cocoons, out of which flew moths that laid eggs that developed into caterpillars . . . it was all amazing to her. She wrote, "The metamorphosis of caterpillars has happened so many times one is full of praise at God's mysterious powers and the wonderful attention he pays to such insignificant little creatures."

Still, why would Maria Sibylla go to such trouble to observe metamorphosis firsthand, instead of reading about it in a book? Why would she want to collect worms she had to feed every day, whose boxes she had to keep clean? Because at the time, no book existed that explained insect metamorphosis correctly. Some people still believed in Aristotle's theory of "spontaneous generation," which held that living things could spring from nonliving matter. They didn't know that all insects laid eggs and thought some just "spontaneously" grew out of mud and garbage. It would take collecting the insects, raising them to adulthood, and observing their reproduction to begin to comprehend the whole process of metamorphosis. And that is exactly what Maria Sibylla started doing when she was thirteen years old.



Women's Work

In households where there was a family business to run, everybody worked, almost all the time. Men, women, children, and servants all had jobs to do and helped in whatever way they could to support the family. Still, in addition to the family business, some tasks were considered "women's work" that men were never expected to do. These included cooking, washing clothes, cleaning, sewing, and caring for children. Maria Sibylla probably had to do some of these chores at home.



A Woman Cleaning from *Five Feminine Occupations* by Geertruydt Roghman, 1640–57



The Lacemaker by Nicolaes Maes, about 1656



Portrait of Sara Marrel by Johann Andreas Graff, 1658

Maria Sibylla's stepsister Sara Marrel is shown doing embroidery in the family's workroom. She is bent over her sewing, following a design in a pattern book that lies open on the table. This picture shows some details of Maria Sibylla's home, such as the drawing instruments on the table, the artist's easel in the corner, and the clothing worn by girls in her family. Sara is dressed for work, wearing a pinafore to protect her dress and a kerchief to cover her hair. This sketch was made by one of Jacob Marrel's apprentices, Johann Andreas Graff.

Embroidered Sampler, 1691

This piece of embroidery is typical of those made by girls and women in seventeenth-century Germany. Called a sampler, it was used for trying out different kinds of decorative sewing stitches and designs. This one shows the alphabet, flowers, and fruit trees. The year 1691 can be read both right-side up and upside down.



Maria Sibylla began her study of metamorphosis in 1660, nine years before the first accurate descriptions were published in books. In 1669 Jan Swammerdam published *The Natural History of Insects* in Holland, and in Italy the same year Marcello Malpighi published *On the Silkworm*. Swammerdam and Malpighi are sometimes given credit for "discovering" metamorphosis. Though Maria Sibylla started recording her observations earlier, she would not publish her findings until 1679.

Maria Sibylla would have liked to spend all of her time studying and drawing insects and the fruits, flowers, and leaves they ate, but she had many other responsibilities in her family's busy home. Girls growing up in the seventeenth century were taught the skills they would need to raise a family and run a household. Maria Sibylla learned from her mother, whom she loved very much and stayed close to all her life. She learned to cook and to sew, as women had to make and repair their family's clothes. The girls in Maria Sibylla's house were taught the special sewing skill of embroidery, also called "needle-painting." It involved sewing colored thread onto cloth using different types of stitches to create patterns and pictures. Embroidery decorated fine table linens and clothing for men and women. Some of Maria Sibylla's early paintings of flowers were meant to be used as patterns for embroidery.

At the same time she was doing her chores and learning to be an artist, Maria Sibylla was learning to read and write, possibly from her mother or at one of the "dame schools" where educated older women taught young girls. Most girls learned at least well enough to read the Bible. Maria Sibylla also studied French and Latin

Frankfurt

Maria Sibylla's father, Matthäus Merian the Elder, engraved this view of Frankfurt, Germany—the city where he lived and where Maria Sibylla grew up. Notice the windmill, used for pumping water and grinding grain for bread. The many boats in the Main River show that Frankfurt was a busy port and center of trade. The only buildings in the picture with names written on them are churches. Religion was a big part of life in Frankfurt, and the city was home to people of many faiths, including Jews, Muslims, and Christians of different denominations.

The Merian family followed a Protestant Christian faith founded by John Calvin. Protestants “protested” certain practices of the Roman Catholic Church and broke away from it to worship separately. This historical period is called the Reformation, because old ideas about religion were being reformed, and new ways of thinking were emerging—in religion, in art, and also in science.

The City of Frankfurt by Matthäus Merian the Elder, before 1619



(the language used by scholars), probably from her parents, her half brothers, or tutors. This was unusual training for a girl at the time.

Maria Sibylla's stepfather had many books in his library, and her father, Matthäus Merian, had been a printer, publisher, and artist. Maria Sibylla had probably seen many of the beautifully illustrated books that came from the Merian publishing house. Some were nearly a foot tall and filled with pictures of distant places. One series of volumes gave views of towns and cities throughout Germany and Switzerland. They showed natural landscapes as well as buildings and streets. But even more fascinating was *Historia Americae*, later called *Grand Voyages*, which depicted stories of exploration. In the centuries after Columbus first sailed to the Americas, Europeans were fascinated by the “New World,” where there were people, plants, and animals they had never seen before. Some of these were pictured in *Grand Voyages*. And perhaps, from these pictures of unfamiliar cities and a distant continent, and from the exotic colors arriving at the Marrel studio from all over the globe, the seed of an idea was planted in Maria Sibylla's mind. Maybe she even dared to dream of a life of travel and adventure.

The books from Matthäus Merian's workshop were famous throughout Europe. Maria Sibylla's two older half brothers, Matthäus the Younger and Caspar, carried on the Merian publishing business after their father died. Maria Sibylla may have visited their printing shop. Perhaps she helped them sort the metal letters that would be formed into words on a tray, spread with ink, and loaded into the printing press. She probably watched as they used sharp implements to cut designs onto



Intaglio Printmaking from *Encyclopaedia* by Denis Diderot and Jean le Rond d'Alembert, 1769

Employing the intaglio method, artists used a sharp tool to engrave a design onto a copper plate. The surface was covered in ink, and then it was wiped off so that the ink remained only in the engraved grooves. Then the plate was put into a rolling press, like this one, which pressed the inked plate against paper or vellum, leaving an imprint of the design. Notice the newly printed illustrations hanging up to dry in this printing workshop.

Columbus and His Brother Bartholomew Are Captured and Returned to Spain from *Grand Voyages*, engraved by Theodor de Bry, 1594, published by Matthäus Merian the Elder, 1634

Books from the Merian publishing house were popular with people interested in travel and adventure. In this scene from *Grand Voyages*, Christopher Columbus and his brother Bartholomew are depicted on the Caribbean island of Hispaniola (now Haiti and the Dominican Republic).



copper plates to make engravings for book illustrations. The copper plates were also spread with ink and put into the press, which imprinted the words and pictures onto vellum or paper. Then the sheets were hung to dry before they were purchased by readers who would take them to a bookbinder to be stitched between leather covers. The motto of the Merian publishing house was *Pietas contenta lucratur*, a Latin phrase meaning “industrious piety pays,” a philosophy that would guide Maria Sibylla throughout her life.

Maria Sibylla's family were Calvinists, followers of John Calvin, a Protestant teacher who encouraged men and women to live simply, work hard, and prosper—as Matthäus had done with his publishing business. Instead of depicting Catholic saints and Bible stories, Protestant artists preferred to create pictures of flowers, landscapes, and ordinary people going about their everyday chores. Protestantism fostered both a questioning attitude and a confidence in human ability to solve problems. These strands of thought were part of Maria Sibylla's education.

Just before Maria Sibylla set aside her social life to study and draw caterpillars, one of her stepfather's apprentices, Johann Andreas Graff, went off to Italy to study art. Another apprentice, Abraham Mignon, remained in Frankfurt. Whenever Maria Sibylla's stepfather went on a long journey, as he often did as part of his business as an art dealer, Mignon continued her art lessons and helped her improve her ability to paint butterflies and flowers with beauty and skill.

With her art and her study of insects, her reading and her household chores, Maria Sibylla's early years were busy and full.