

How Antony van Leeuwenhoek
Discovered an Invisible World

Lori Alexander

illustrated by Vivien Mildener

ALL *in* a DROP

*How Antony van Leeuwenhoek
Discovered an Invisible World*



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Illustrated by VIVIEN MILDENBERGER



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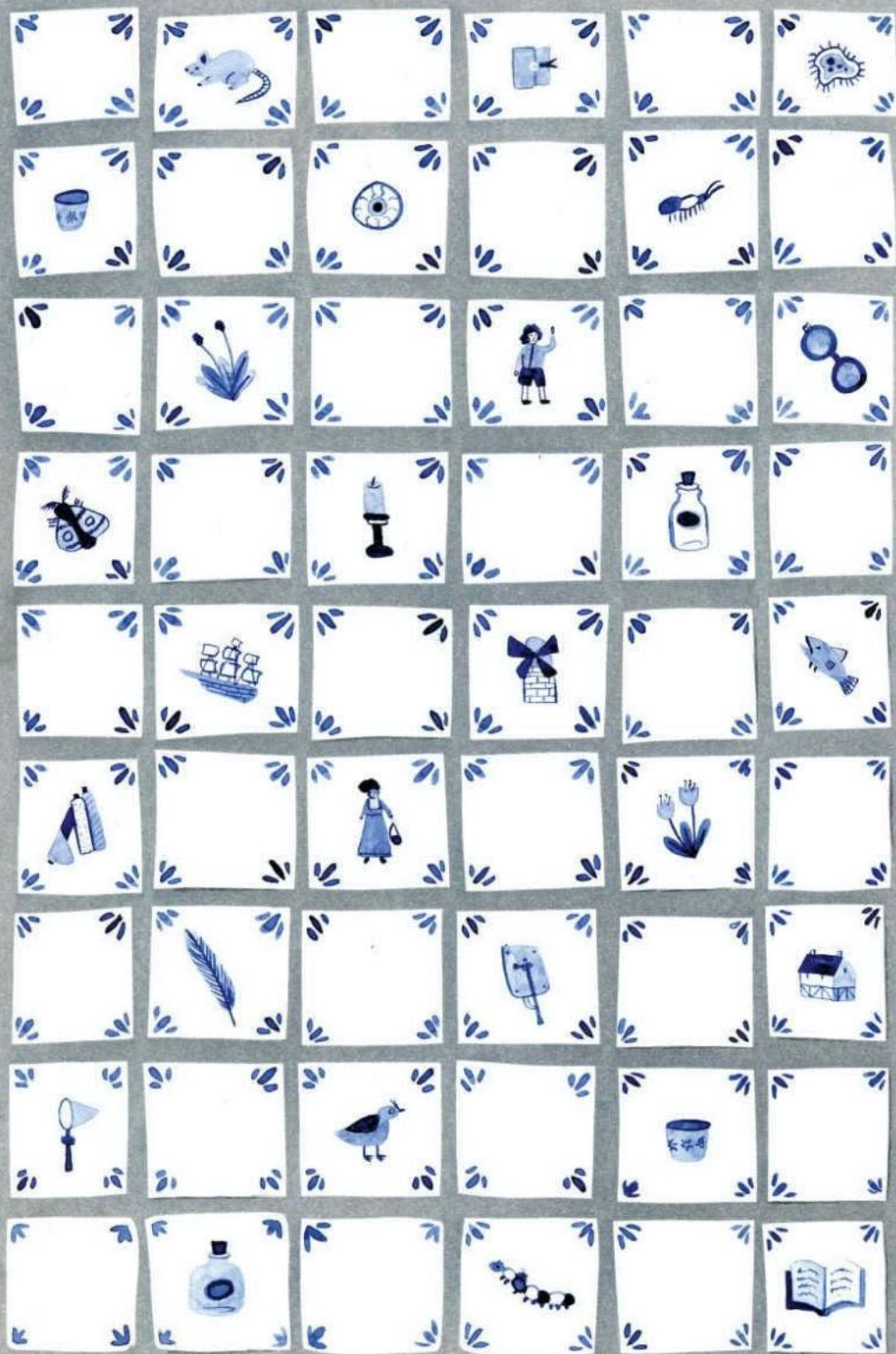
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To Nelson Alexander, who sees things not only for what they are but for what they might someday be—L.A.

To my dad, who taught me that the wonders of this world extend far beyond what the eye can see—V.M.



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L.A.

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Introduction

Just inside the window, in a bright patch of sunlight, sits a curious man. He lifts an oddly shaped metal bar to his eye. He squints through a tiny hole and doesn't move a muscle. What could he possibly see with a contraption like that?

His name is Antony van Leeuwenhoek (an-TONE-ee van LAY-ven-hook). He has never taken a science class. But he is about to make a discovery that will change the world.



“At such perfection in this tiny creature I did greatly marvel.”

Chapter One:

A Golden Age



In a booming city laced with waterways and bustling with merchants who bellow, *Fresh fish! Furniture! Porcelain tiles! Tapestries!* lives a young boy named Antony.

From the trees that line the canals in his town of Delft, Netherlands, Antony

plucks a fistful of leaves. He feeds the tender greens to his pet silkworms. They munch and munch until the leaves disappear. Antony watches closely. Do the silkworms have tiny teeth? He watches one spin a cocoon. Where do those silky threads come from? There is so much his eyes cannot see. But now is not a time for watching and wondering. His father is calling.



Antony's father is a basket maker. The sturdy wicker baskets he sells are used to pack and protect dishes and other fragile exports that will leave Delft on nearby cargo ships. The large vessels travel both east and west to faraway ports in Africa, India, Japan, the Caribbean islands, and North America. They carry many items for sale and trade: spices, sugar, silks, coffee, tea, silver, ivory. It's the late 1630s, and the Netherlands owns the largest fleet of ships in the entire world. Indeed, it is a profitable time to be a merchant. So profitable, the Dutch (the people of the Netherlands) will later give this period a nickname: the Golden Age.

Antony's mother knows of something golden as well. Hers is in the form of a crisp, tasty beverage. Her father, Antony's grandfather, was a respected beer brewer. Mugs of ale keep the townspeople happy and healthy. When Delft's water supply is polluted by local industries, everyone, even the children, drinks the low-alcohol beer. Maybe Antony will learn to make bottles of brew and continue the family tradition. One thing is certain: he will learn a trade of some sort, just like his parents.



Antony sells his pet worms to a silk spinner in the market square. Their cocoons will be used to make delicate threads for yarn. The sale earns Antony a small profit. Already, he has a head for business.

Chapter Two:

Big Changes

Antony is still young when his father dies unexpectedly. Now his mother must care for Antony and his four sisters all by herself. Before long, she remarries. But her new husband's home is small and cramped. His mother has a solution: eight-year-old Antony is sent off to a boarding school, a place where he will live and study, in a neighboring city about fifteen miles from Delft.

Antony's schooling is basic. He learns some math. He learns to read and write in his country's language: Dutch. He does not study science or learn other languages, like English or Latin. He doesn't need them. He is not expected to become a philosopher or a great thinker. He will grow up to be an ordinary tradesperson, like his parents.



When he is fourteen years old and finished with his schooling, Antony moves in with his uncle, who is a lawyer and lives in the city of Benthuisen, about nine miles from Delft. His uncle makes a promise to Antony's mother: he will help Antony learn a trade. But Antony shows little interest in learning about the law and his uncle's government job. Still, his uncle makes good on the promise. Antony is sent to Amsterdam for training in a linen merchant's shop.



Antony is impressed by the city. Amsterdam is huge! There are 100,000 more people here than in his hometown. Immigrants come from France, Spain, and Portugal. In their countries, they were told which religion to practice. But in the

Netherlands people have more freedoms when it comes to religion and government. Anyone who works hard is welcome here. Antony watches the city construction: buildings grow taller, canals grow wider, houses spring up everywhere. He visits the bookstores, apothecaries, boot shops, bakeries, and stores filled with maps and nautical gadgets. He listens to the traveling musicians. Amid the commotion of the bustling city, Antony begins his training.



Antony spends the next six years working as an apprentice for a linen merchant. He learns how to assist customers as a sales clerk. He learns how to handle money as a cashier. He learns how to place orders and pay bills. Finally, Antony is ready to open his own shop. By this time, he has had enough of the big-city life. In 1654, at the age of twenty-two, he moves back to Delft. With some money left to him in his grandfather's will and a loan from the seller, Antony buys a house where he will live and set up his shop. He will not weave baskets. He will not brew beer. Antony has mastered the trade of draper.



Growing Up Quickly



In seventeenth-century Netherlands, and many other places around the world, most children were considered adults by the age of fourteen. Basic schooling might end as soon as their tenth birthday. A boy would typically learn his father's trade or be sent to live with a relative to become an apprentice in the trade of his uncle or cousin. Only the wealthiest families would send their male children to universities to continue their education. Those students would learn Latin and other foreign languages, philosophy, mathematics, physics, astronomy, and other advanced sciences. Graduates would become lawyers, physicians, engineers, or government officials. The education of a girl varied depending on her parents. Some wanted their daughters to have an advanced education including a foreign language. But most girls in the Netherlands received only the basics in spelling, reading, writing, and math (more education than girls received in any other part of the world). After that, they would remain home to learn the housekeeping and childrearing skills they would need for their likely career of wife and mother, although some women took part in the family business alongside their husband.

Chapter Three:

Seller of Cloth



A draper is a person who sells cloth. Antony fills his shop with woven wools, shimmery silks, crisp taffetas, and bleached linens. People need these fabrics for all sorts of things: dresses and suits, pillowcases and sheets, napkins, tablecloths, window curtains, and furniture upholstery. Buttons and ribbons fill the shelves

as well.

Antony wants to sell quality fabric, so he inspects the cloth closely. Are the fibers straight and strong? He holds up a swatch. His eyesight is good, but he still can't count the tiny threads. How will he know if his fabric is the best? Like other cloth merchants, Antony must use a lens—a piece of glass cut in a special way—to see up close.

He places the circle over the fabric. What does Antony see? Rows and columns of fuzzy fibers. They look more like fat ropes than fine threads.

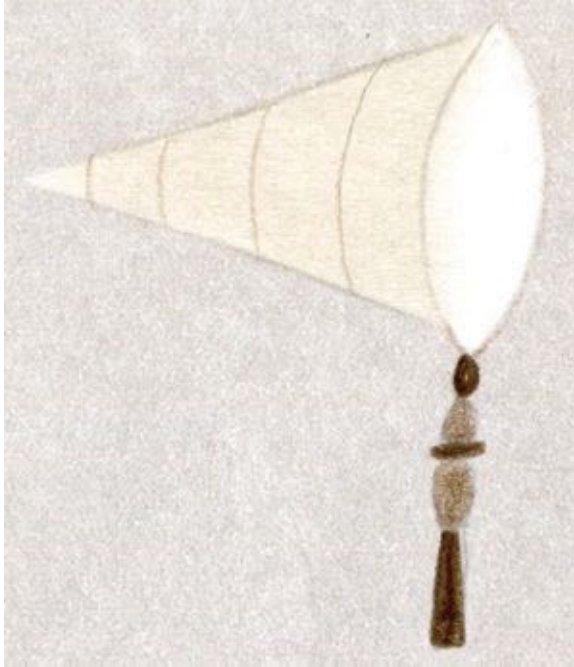
Verbazend! Amazing!

With his magnifying glass, Antony is able to study his fabric's fibers. He is able to measure thread count—the number of horizontal and vertical threads in a small sample of fabric—to determine the quality of the cloth. The higher the thread count number, the better and softer the fabric. Now Antony can be sure he is selling top-quality cloth.



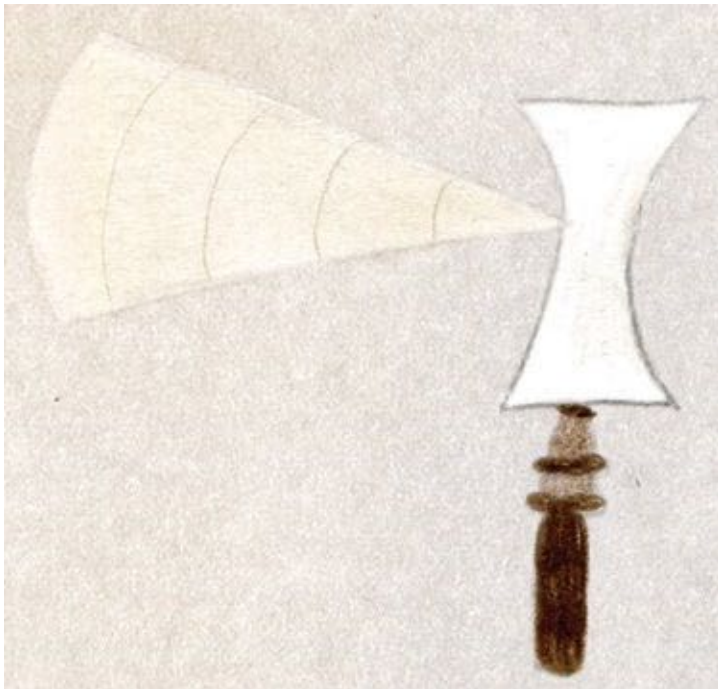
Focus on Lenses

*A **lens*** is a clear piece of curved glass or plastic that bends light. The shape of the lens will determine how the light is bent. There are two basic types of lenses:*



Convex

A **convex** lens bulges outward—it is fat in the middle and thin around the edges, like a lentil. These types of lenses focus light into a point, like in a magnifying glass.



Concave

A **concave** lens curves inward—it is thin in the middle and fat around the edges, like a bowl. These types of lenses spread light out, like in a flashlight.

Back in Antony's time, lenses were fairly new. The most common type were lenses placed into metal frames. These became eyeglasses and were used to help people with poor eyesight. In the 1590s, combinations of lenses were placed into metal or wooden tubes to create early telescopes and microscopes. Telescopes helped to view distant objects up close. Microscopes helped to make small objects look larger. Neither tool was very powerful at first, magnifying objects only three to nine times their original size. Lenses would improve over time as more people began to experiment with their form and function.

* The word lens comes from the Latin for "lentil," or lens. This is because a convex lens has the same shape as a single lentil bean.