

# Through a Microscope

A Reading A-Z Level Q Leveled Book  
Word Count: 940

## Connections

### Writing

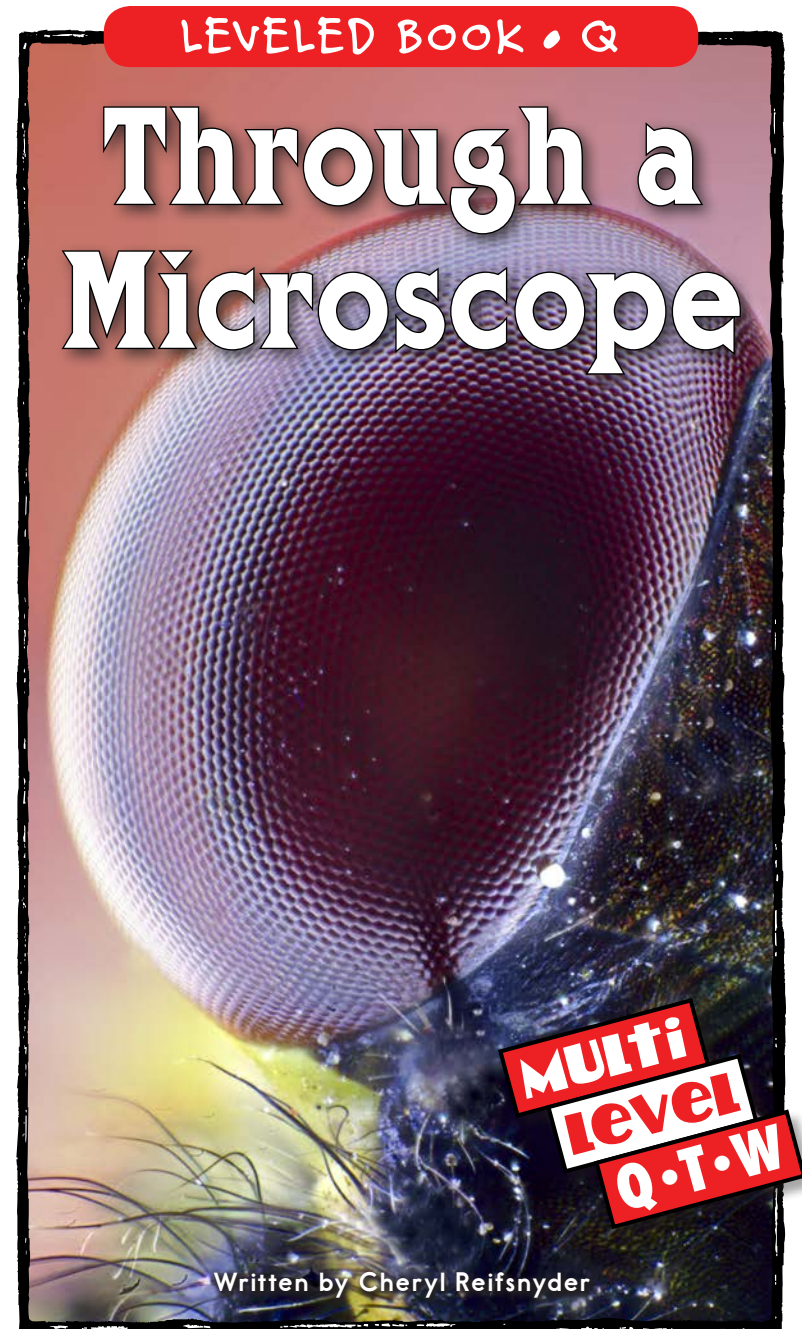
View an object through a microscope. Draw a picture and write a descriptive paragraph of what you see. Invite a partner to guess what you are describing.

### History

Research the life of Antonie van Leeuwenhoek. Write a short biography about his major accomplishments and influence on the world.

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## Glossary

<b>compound</b> ( <i>adj.</i> )	made up of two or more elements or parts (p. 6)
<b>crystals</b> ( <i>n.</i> )	solid substances in which the atoms are arranged in regular, tight patterns (p. 12)
<b>detail</b> ( <i>n.</i> )	a small part of something; a specific piece of information (p. 7)
<b>electrons</b> ( <i>n.</i> )	particles in atoms that orbit the nucleus and have negative electrical charges (p. 14)
<b>fabric</b> ( <i>n.</i> )	cloth, usually made by weaving (p. 8)
<b>germs</b> ( <i>n.</i> )	tiny living things that can cause disease or sickness (p. 11)
<b>invisible</b> ( <i>adj.</i> )	unable to be seen (p. 9)
<b>lenses</b> ( <i>n.</i> )	curved pieces of glass or plastic that focus light to give a magnified or clearer view of something (p. 5)
<b>magnified</b> ( <i>v.</i> )	caused something to appear larger than it is (p. 6)
<b>magnifying glass</b> ( <i>n.</i> )	a piece of glass, usually circular with a handle, used to make things look larger (p. 5)
<b>microscope</b> ( <i>n.</i> )	a device used to view tiny objects (p. 4)
<b>reliable</b> ( <i>adj.</i> )	able to produce a consistent result; dependable (p. 11)

# Through a Microscope



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### Focus Question

How do microscopes help people learn about the world?

## Words to Know

compound	invisible
crystals	lenses
detail	magnified
electrons	magnifying glass
fabric	microscope
germs	reliable

Front cover: A magnified image shows the detailed surface of a damselfly's eye.

Title page: A magnified view of a butterfly wing shows yellow and black scales and dark-brown veins.

Page 3: A magnified view of a raised number on a credit card reveals tiny imperfections.

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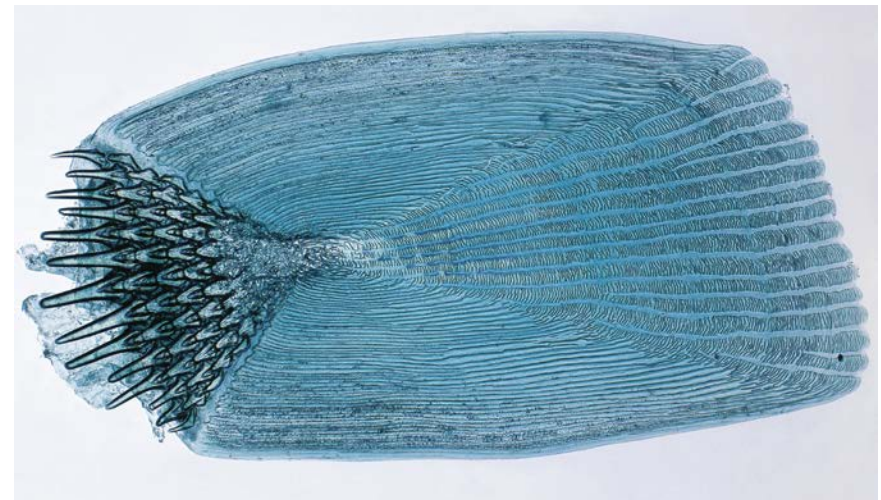
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### Correlation

LEVEL Q	
Fountas & Pinnell	N
Reading Recovery	30
DRA	30



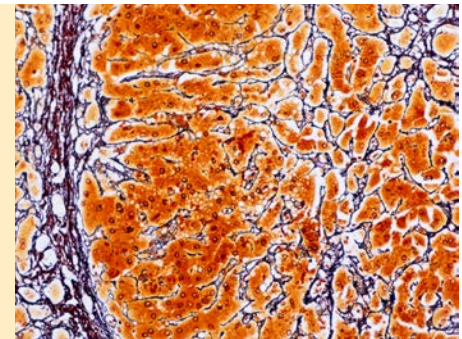
A microscopic view of a fish scale reveals details that are impossible to see with the naked eye.

## Conclusion

As microscopes have become more powerful, we have learned many new things about our world. Microscopes have led to discoveries in nearly every area of science.

## Stains and Dyes

Many cells and other small objects are transparent, or see-through. This makes them difficult to see under a microscope. Stains and dyes have been used since the 1800s to make objects stand out more against their backgrounds. This makes the objects easier to see with a microscope.



Stains reveal that healthy cells (orange) are being replaced by damaged cells (purple) in this microscopic view of a diseased human liver.

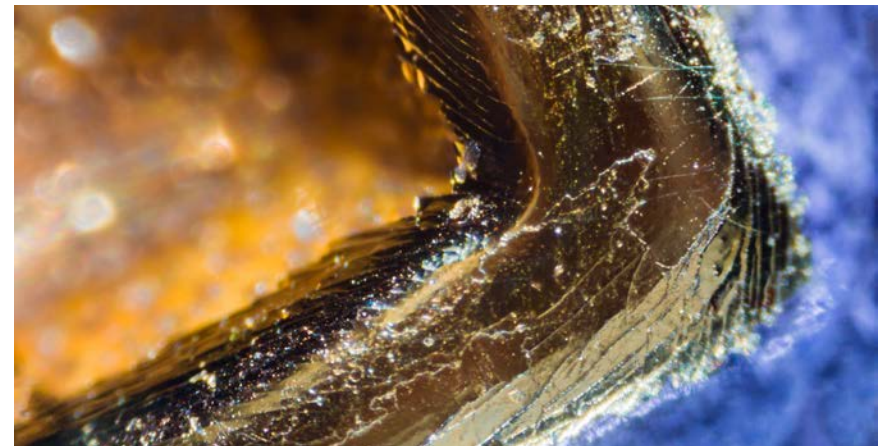


A tiny dust mite feeds on flakes of human skin.

### Magnified One Million Times (1,000,000x)

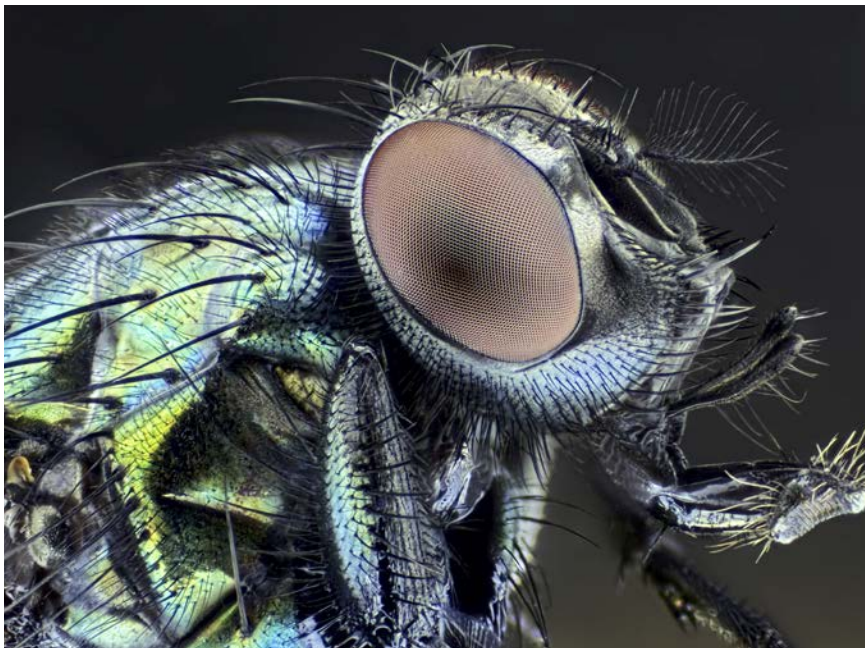
Because of the way light works, there is a limit to how much a compound microscope can magnify objects. During the past century, though, scientists have created microscopes that don't use light.

One such microscope uses energy called **electrons**. Electron microscopes provide the greatest magnification of any type of microscope. They magnify things up to one million times (1,000,000x)!



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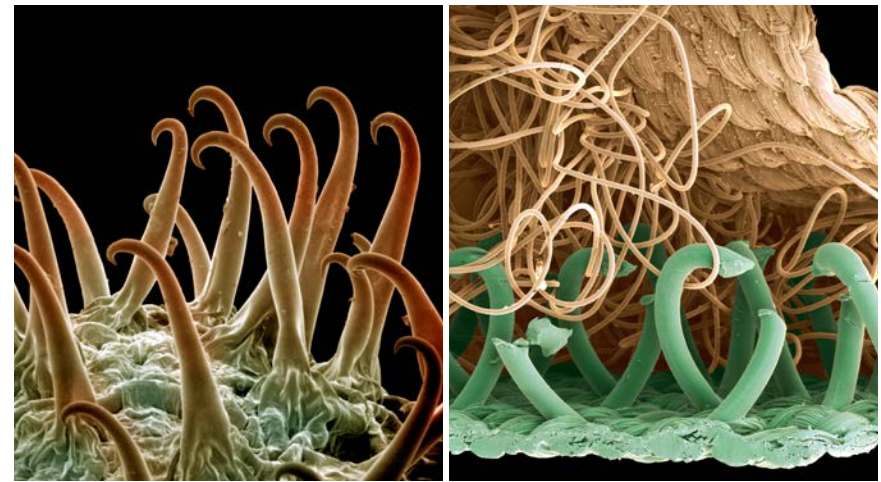
A green blowfly's body would look very different if you could make yourself really small.

### Barely Visible

A human hair is one of the smallest things the human eye can see. Imagine, though, if you could shrink yourself until that hair looked as thick as your arm. What would you see?

The hairs on a fly's legs would look like huge spikes. The fly would look like a monster with giant eyes!

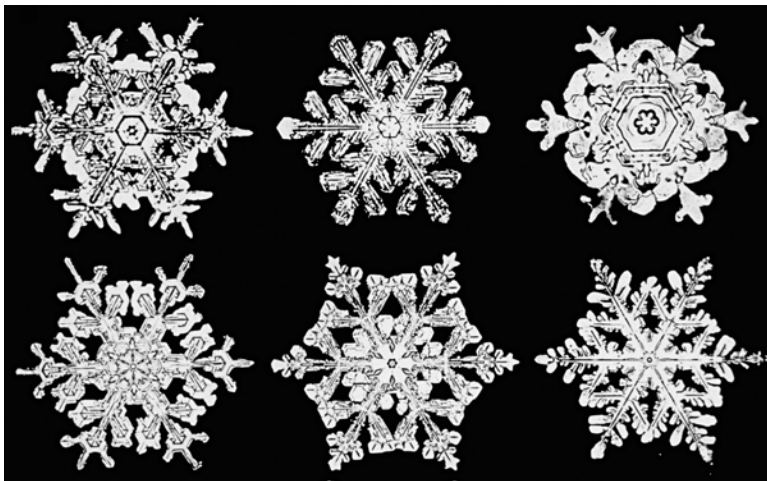
That's the close-up view a **microscope** allows.



Scientists copied the shape of natural hooks on cockleburs (left) to make the fastener Velcro (right).

Seeing the world's tiny details can help people understand how things work. Take burrs, for example. A man named George de Mestral saw that burrs stuck to his clothing after he walked in a field. He took a closer look at the burrs under a microscope. He saw that they had tiny hooks that caught on the loops in the fabric of his pants.

De Mestral worked to copy the design of the burrs using fabric. The result was Velcro. Velcro is made up of two pieces of fabric. One piece is covered in thousands of tiny hooks. The other is covered in thousands of tiny loops. The hooks and loops let the two pieces of fabric "zip" together.



These photographs taken by "Snowflake" Bentley in 1902 reveal how each snowflake is a different, beautiful shape.

The early compound microscope also led to the discovery that no two snowflakes are alike. Wilson Bentley was known as "Snowflake" Bentley for his work with snowflakes. He used a camera to take pictures with his microscope. In the late 1800s and early 1900s, he took photographs of more than five thousand snowflakes.

Microscopes showed that some things in nature form special shapes called **crystals**. Salt crystals are cubes, like building blocks. Table sugar forms crystals that are slanted at each end and longer than salt crystals.



Sugar crystals form regular rectangular shapes.

## The First Simple Microscopes

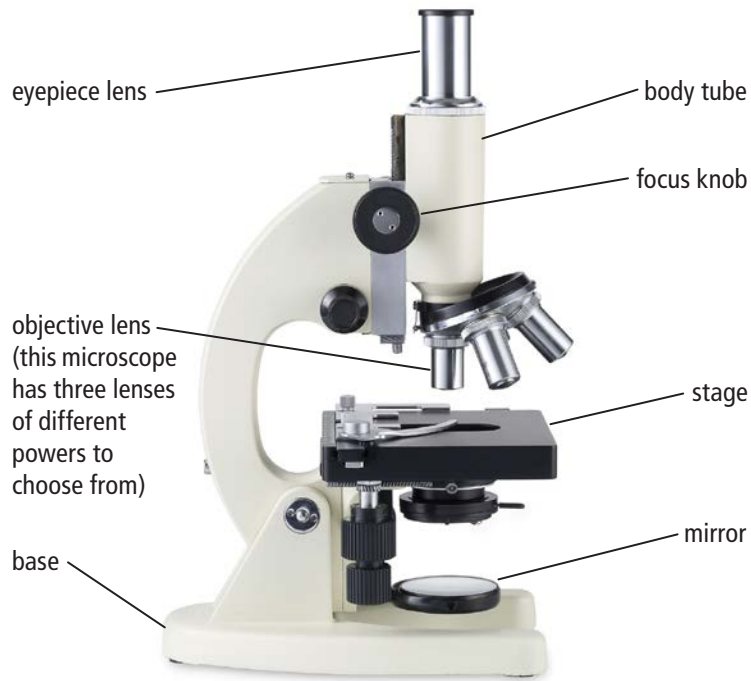
For thousands of years, people have wanted to take a closer look at their world. The ancient Greeks used glass balls filled with water to make objects look larger. The Romans discovered that glass that was thick in the middle and thin on the edges made things look bigger. This was the first **magnifying glass**. People learned how to make better glass **lenses** in Europe in the 1600s. With that discovery, the microscope was invented.

At first, the microscope was just a sort of fancy magnifying glass. Most magnifying glasses only make things look about five to ten times larger in size. That was the power of the first simple microscopes.



This simple microscope from 1780 could be folded up in its case and carried in a pocket.

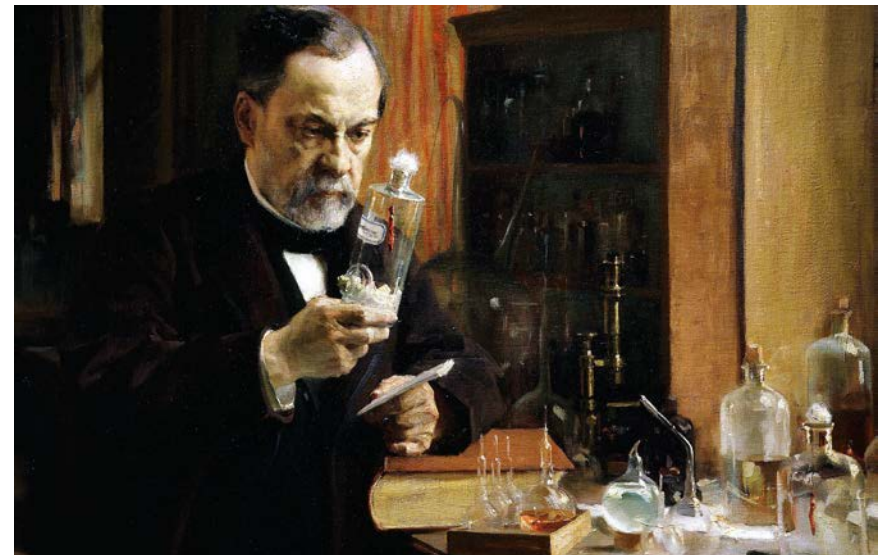
## Parts of a Modern Compound Microscope



### Compound Microscopes

Early microscope users found that they could put two magnifying glasses in a row. The second lens **magnified** the image from the first lens. This made the image look even bigger. With the two lenses working together in a single microscope, the **compound** microscope was born.

Today, compound microscopes can make objects look up to fifteen hundred times (1,500x) bigger!



Louis Pasteur (1822–1895) was a French chemist who found that heating milk could kill tiny life forms in it that could make people sick. Most milk today is “pasteurized” to make it safe to drink.

In the early 1800s, a scientist named Joseph Jackson Lister invented a new type of lens. This lens got rid of the stretching and color changes. It made microscopes more powerful and **reliable**.

As a result, microscopes allowed new discoveries in science and medicine. In the mid-1800s, Louis Pasteur (pass-TUR) discovered that tiny life forms in the air could cause milk to spoil. The improved microscope allowed doctors to see **germs** in the bodies of sick people. This discovery completely changed medicine.





Early microscopes could stretch images the same way they get stretched by a funhouse mirror.

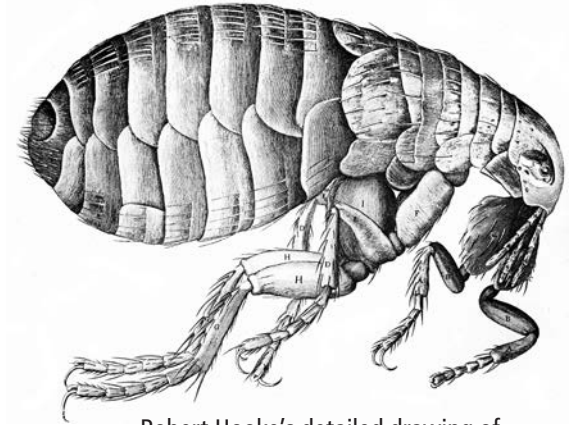
### **Magnified Two Hundred to Fifteen Hundred Times (200–1,500x)**

Early compound microscopes had some problems. The lenses could make things look blurry and stretched. They also changed the colors around the edges of what was being seen. It was difficult to tell what was real and what was caused by the lens.

### **Magnified Twenty to Thirty Times (20–30x)**

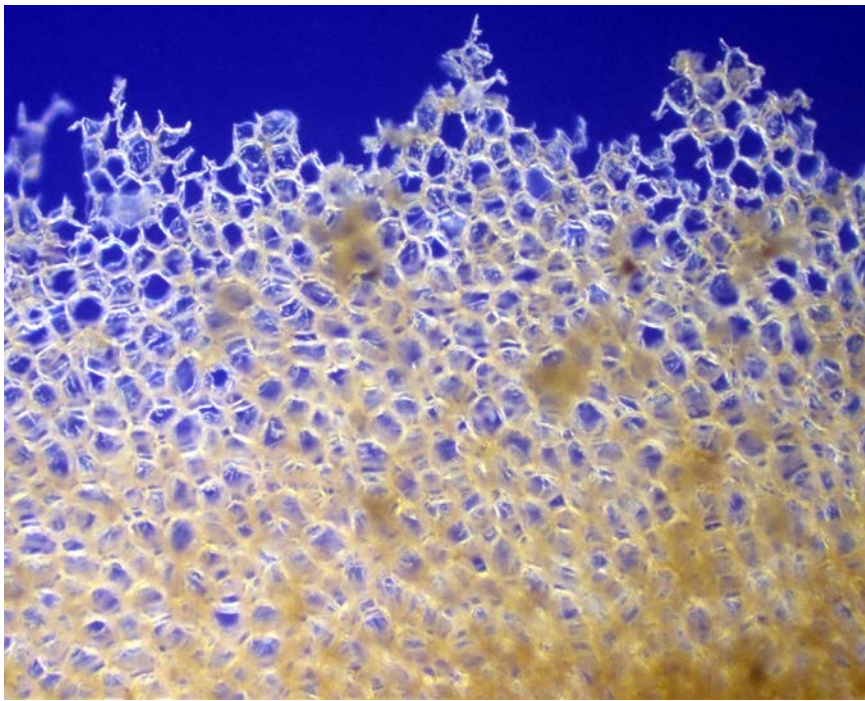
One of the early microscope users was Robert Hooke. Hooke was one of the first people to take careful notes on what he saw through a microscope. He published his notes in a book filled with drawings.

Hooke's book had close-up views of a louse and a flea. He drew the eyes of a fly in greater **detail** than anyone had ever seen before.



Robert Hooke's detailed drawing of a flea appeared in his 1665 book.

Hooke also sketched parts of plants and seeds. When he looked at a piece of cork under a microscope, he discovered that it was made of tiny chambers. He called those chambers "cells." Over time, the word *cell* came to be used for the tiny building blocks of all living things.



This magnified view of a thin slice of cork shows that it is made up of many tiny "cells."

### Magnified Fifty to Two Hundred Times (50–200x)

Historians believe that Hooke's book inspired another early microscope user, Antonie van Leeuwenhoek (LEY-vun-hook). Van Leeuwenhoek was a cloth merchant, not a trained scientist. However, he used magnifying glasses to take a close look at the **fabric** he bought and sold. After he saw Hooke's drawings, Van Leeuwenhoek started making lenses of his own.



Looking through a microscope can reveal the tiny living things in pond water (left) and the colorful variety of items that make up beach sand (right).

Van Leeuwenhoek discovered a way to create better lenses. He learned to make microscopes that magnified objects more than two hundred times (200x). Using his microscopes, Van Leeuwenhoek discovered tiny life forms living in lake water. These life forms are too small to see with the naked eye. Before Van Leeuwenhoek's time, no one knew there were such tiny living things. Microscopes showed that tiny life forms live everywhere.

When things are magnified two hundred times (200x), a person can see many things that are **invisible** to the naked eye. Even something as simple as sand looks different under a microscope. At normal size, sand looks ordinary and plain. Under magnification, it's clear that beach sand contains tiny shells, rocks, and coral.