

Invisible Worlds

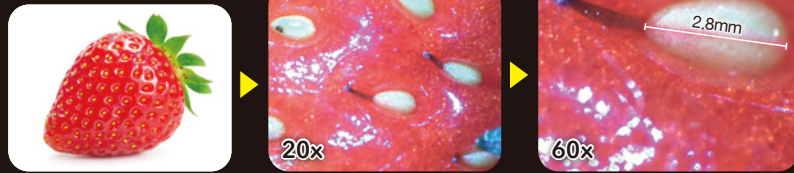
Your point of view makes all the difference!

When you observe a familiar object in an unusual way, it may look completely different. For example, a microscope is laboratory equipment for observing objects with a magnified view. This column will share lots of different ways to make observations.

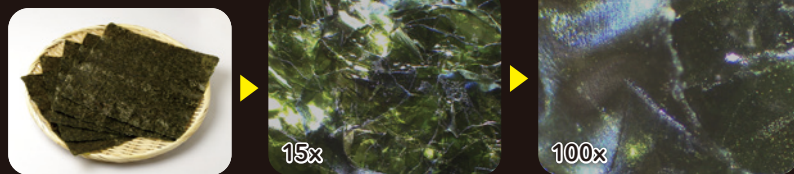
Ultra close-up

A microscope is a tool with lenses that let you magnify and observe objects. There are various types. An optical microscope uses light. An electron microscope uses electron beams, which are flows of tiny electrically charged particles called electrons.

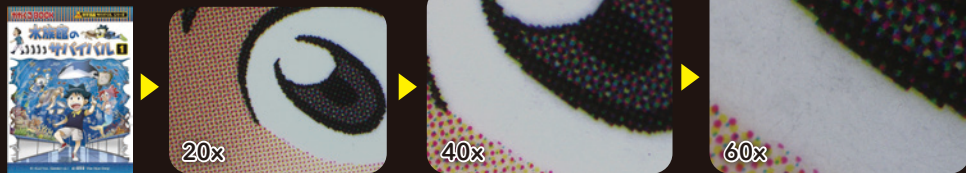
① Strawberry



② Dried seaweed



③ Geo's eye



So my iris isn't all black?

What's this?
Q



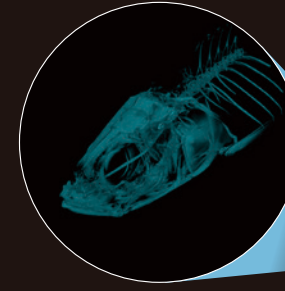
What's the third one? Can you tell?



X-ray vision

X-rays are light the human eye can't see. They can pass through objects that block visible light. The kids used an X-ray CT system in their showdown with the Baron.

This instrument lets you examine the inside of an object without breaking it, so it has many uses. Examples include X-rays and CT scans at hospitals, luggage screening at airports, and detecting defective products at factories.



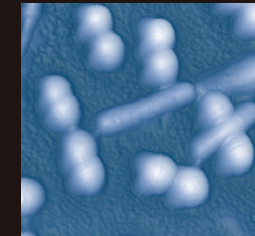
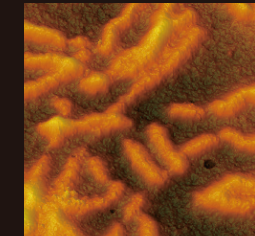
◀ A CT image of a small fish taken from above and to the side. You can see details like the skeleton.



▶ An image of a pumpkin. The white oval shapes in the middle are seeds.

Probing the surface

A scanning probe microscope lets you observe an object's surface by tracing a small needle along it. You can see the object's three-dimensional shape and even observe its properties. This instrument is used for viewing subjects like the surface of a metal, organic cells, or DNA. The left photo is of chromosomes. These are genes in your cells that contain information about your body. The photo on the right shows lactic acid bacteria.



This device was invented in the 1980s.



The Micro World

Distances can be measured in more than just meters, kilometers, centimeters, or millimeters. The table on the right shows units of measurement from smallest to longest. If you convert 1ym to meters, it would be 0.000000000000000000000001m. That's 24 zeros in total! How many of these units do you already know?

Unit	Meters	Fraction of a meter
ym (yoktometer)	10^{-24}	1 septillionth
zm (zeptometer)	10^{-21}	1 sextillionth
am (attometer)	10^{-18}	1 quintillionth
fm (femtometer)	10^{-15}	1 quadrillionth
pm (picometer)	10^{-12}	1 trillionth
nm (nanometer)	0.000000001	1 billionth
μ (micrometer)	0.000001	1 millionth
mm (millimeter)	0.001	1 thousandth