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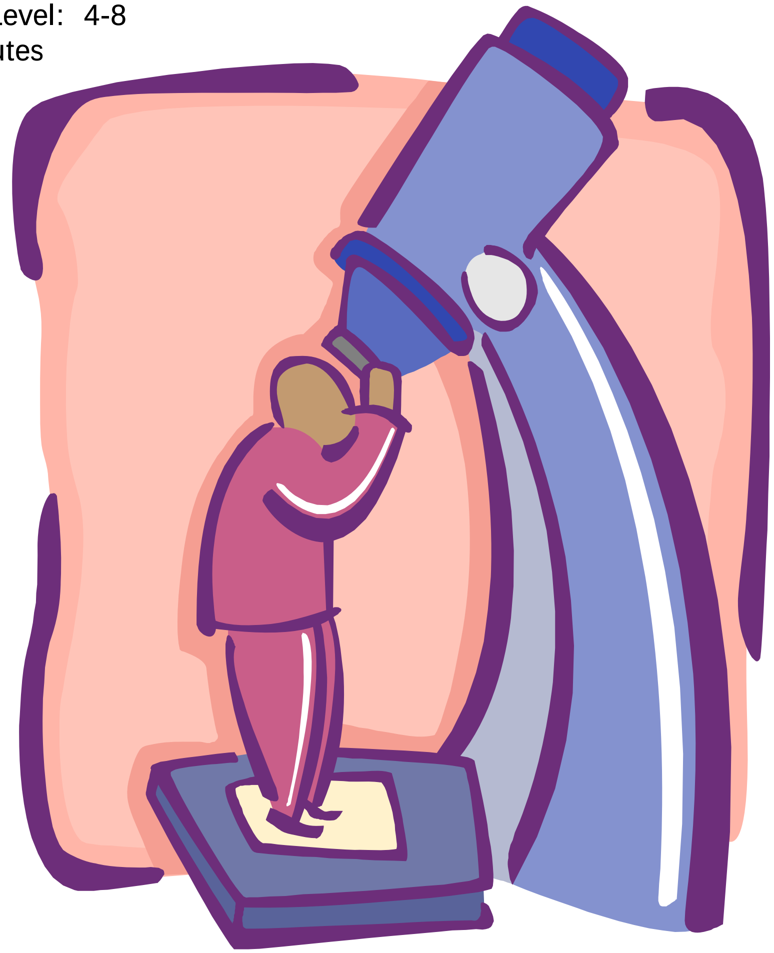
#10397
THE INCREDIBLE WORLD OF THE MICROSCOPE

RAINBOW EDUCATIONAL MEDIA, 2001
Grade Level: 4-8
25 Minutes



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INTRODUCTION

Filled with exciting close-up images, this video is designed to introduce students to the microscope and its incredible world. This remarkable instrument opens an entirely new world unseen by the eye alone and continues to be the single most important tool used in scientific study and medical research.

The video opens with a discussion of how magnification occurs, and includes a sequence on magnifiers. It is explained that overall magnification can be increased by placing one lens above another, and that is essentially how a microscope works.

Viewers are then introduced to the stereomicroscope and its various features and capabilities. The stereomicroscope can be easily identified by its binocular-style eyepieces.

Most of the video deals with the far more powerful standard light microscope and its features. Student light microscopes are about 10 times more powerful than stereomicroscopes, and can usually be identified by their single eyepiece lens.

Also included are sections on specimen slides and the gathering of pond water.

The video concludes with a brief history of the microscope leading up to the electron microscope.

After viewing this video, students should have a basic understanding of what a microscope is and how to use it. In addition, they should come away with an appreciation of the microscope's importance in science and medicine.

OBJECTIVES

After viewing this video, students should know:

- lenses magnify because of their curved edges
- overall magnification increases when one lens is placed above another
- microscopes work by combining lenses
- stereomicroscopes have twin eyepieces and can be used to examine both solid and transparent objects
- a standard light microscope is much more powerful than a stereomicroscope and is used to examine thin or transparent objects by illuminating them from below
- the lenses on a microscope are referred to as the eyepiece lens and the objective lens
- a variety of pond organisms can be examined under the microscope
- you can examine your own cheek cells and bacteria from your mouth, under the microscope
- Antony van Leeuwenhoek was probably the first person to observe bacteria
- Louis Pasteur was the first person to prove that bacteria caused disease
- electron microscopes use electrons to magnify instead of light

SUMMARY

The video opens with a discussion of how a magnifying glass enables us to see things much larger than they really are. Viewers are asked how is it that magnification occurs. A classroom demonstration shows that a glass globe filled with water causes the text of a book to appear magnified, due to the curvature of the globe. While ancient peoples may have used glass globes, or even crystal balls, to magnify objects, much more practical as a magnifier is a thick piece of glass with curved edges called a lens. Students learn that magnifiers come in a variety of styles and magnifications.

Another classroom demonstration shows a student placing one magnifier above another to increase the overall magnification. It is explained that that is essentially how a microscope works, combining lenses to increase overall magnification.

The first microscope featured is the stereomicroscope, which usually has a maximum magnification of around 40. This type of microscope can examine both solid and transparent objects. The lenses on a stereomicroscope include two eyepiece lens and an objective lens, which is usually adjustable. A stereomicroscope is focused by turning its focus knob. The video then presents a variety of specimens that can be examined using this type of microscope.

Students then learn that as powerful as a stereomicroscope is, much more powerful is a standard light microscope. Most student standard light microscopes have a single eyepiece lens and several objective lenses located on a rotating turret. Multiple objectives provide a variety of magnifications and each magnification teaches us something new and different about a

specimen.

The narrator then discusses the basics of using a standard light microscope. Specimens must be very thin so that light will pass through them, and some are stained or treated in chemicals so that you can see them more easily. They should be placed on the microscope stage beneath the stage clips. They are illuminated from below using either an illuminator or a mirror. A large focus knob is used to bring a specimen into rough focus, while a small focus knob is used to bring a specimen into fine focus. Centering a specimen can be tricky because the specimen appears to move in the opposite direction you move it. Some microscopes have a mechanical stage which makes centering easy.

Students are cautioned that a microscope is a delicate instrument and should be handled with great care. They should never touch the glass in the lenses, and lenses should only be cleaned if they're dirty, using lens cleaner and lens tissue. A microscope should only be carried by its arm and base and, when not being used, it should be replaced in its storage case or protected with a dust cover.

It is discussed that while most student microscopes are set up for brightfield illumination, some might also have darkfield illumination. Both methods have useful applications.

The best thing about microscopes is what they can do, and at this point, the video features a variety of fascinating specimens set to fast-paced music.

A group of students are then seen collecting water samples at a pond. Back in the classroom they place a single drop under their microscope and are fascinated by the variety of microscopic organisms they encounter, including amoebas, Paramecium, Stentor, Vorticella, Dileptus, Daphnia, planaria and hydras.

The narrator observes that we have much in common with these strange organisms because we are all composed of cells. A student proves it by scraping the inside of his cheek to examine his own cheek cells. He then scrapes material from his teeth to observe bacteria. It is then mentioned that during the Middle Ages, millions of people died from bacteria-caused diseases, but because people could not see these organisms, they had no way of knowing they even existed, let alone were the cause of disease. It was the famous French scientist, Louis Pasteur who first proved the connection between some forms of bacteria and disease.

The video concludes with a discussion of the electron microscope, an instrument that uses electrons to magnify, rather than light. The electron microscope can magnify objects 100 times more than the most powerful light microscope and, with it, scientists are able to learn more about viruses and the diseases they cause.

REVIEW QUESTIONS

1. **Why do objects appear larger when placed behind a glass globe?**

   Because of the curved surfaces of the globe.

2. **In addition to glass globes, what other things might ancient peoples have used to magnify objects?**

   Crystal balls.

3. **What happens when you place one lens on top of another?**

   It increases the overall magnification..

4. **How do microscopes work?**

   By combining lenses.

5. **What is the name of the microscope that has binocular eyepieces and can illuminate specimens from above and below?**

   A stereomicroscope.

6. **What are the names of the two types of lenses found on microscopes?**

   Eyepiece and objective lenses.

7. **Why do standard light microscope specimens have to be very thin?**

   So that light will pass through them.

8. **How are specimens illuminated on a standard light microscope?**

From below with either an illuminator or a mirror.

9. **How is the large focus knob used?**

To bring a specimen into rough focus.

10. **How is the fine focus knob used?**

To bring a specimen into fine focus.

11. **Why is centering a specimen difficult with many microscopes?**

Specimens appear to move in the opposite direction they're moved on microscopes without a mechanical stage.

12. **How should a microscope be carried?**

By its arm and base.

13. **When not being used, where should a microscope be placed?**

In a storage case or protected with a dust cover.

14. **What is the name of the type of illumination where the background is bright?**

Brightfield.

15. **What is the name of the type of illumination where the background is dark?**

Darkfield.

16. **What are protozoa?**

Organisms consisting of a single cell.

17. **How does an amoeba move?**

By sending out streams of cytoplasm called pseudopods.

18. **What are the short, hairlike structures that surround many protozoa?**

Cilia.

19. **How are we similar to pond organisms?**

We all are made up of cells.

20. **Who was probably the first person to observe bacteria?**

Antony van Leeuwenhoek

21. **Who was the first person to prove the connection between bacteria and disease?**

Louis Pasteur.

22. **A light microscope uses light to magnify. What does an electron microscope use?**

Electrons.

DISCUSSION QUESTIONS

1. **The video mentions that ancient peoples used glass globes filled with water to magnify objects.**

   How do we know that today?

   By way of written documents left behind. It was Roman philosopher, Seneca, who observed in the first century A.D., that "letters, however small and indistinct, are seen enlarged and more clearly through a globe of glass filled with water."

   Could ancient peoples have used other objects as well?

   While there are no reports of it, they might have used crystal balls, and gemstones with curved surfaces.

   When were the first true lenses developed?

   Probably not until the 13th century and they were used then as spectacles, not as magnifiers. The first known lenses used specifically as magnifers did not occur until the 16th century.

2. **Students are seen using a variety of magnifiers in the video.**

   What determines the power of a lens?

   While not discussed in the video, it is the amount of curvature in the lens in relationship to its diameter. Greatly curved lenses with small diameters are the most powerful.

3. **The video discusses brightfield and darkfield illumination.**

   What might be the advantages of either type?

   Dark, less transparent, specimens are generally best observed against a bright background while light, more transparent specimens are generally best observed against a dark background. The fine hairlike cilia which cover most protozoa, for example, are best observed in darkfield. Colors are enhanced using darkfield.

4. **The video mentions how an animal cell shares similarities with the single cell of a protozoa.**

   How are these cells different?

   A protozoan cell is a complete life form capable of living independently of other cells. An animal cell is highly specialized and is dependent on other types of cells to live.

5. **The video features a powerful electron microscope.**

   Since electron microscopes are far more powerful than light microscopes, isn't it always better to use them to examine specimens?

   As powerful as electron microscopes are, they have their limitations. Because magnification occurs within a vacuum, living specimens cannot be examined. Further, specimens have to be coated in metal which masks a specimen's true colors. The coating also makes it impossible to examine the interior of specimens. For these and other reasons, the light microscope continues to be a very important research tool.

ACTIVITIES

These activities are designed to encourage students to learn more about some of the things covered in the video.

1. **The video mentions that glass globes filled with water were used by ancient peoples.**

   Activity: Have students research and report on the earliest types of magnifiers.

   Activity: Have students conduct their own magnification demonstrations using glass globes or bowls filled with water.

2. **A student is shown examining a variety of specimens with a stereomicroscope.**

   Activity: Have students gather specimens of their own that might be interesting to examine. They might have a contest to determine who brought in the most interesting specimen.

3. **A variety of pond organisms are featured in the video.**

   Activity: Have students research and report on any of these organisms, or any others they might be interested in.

   Activity: Have students draw and color a picture of a selected organism.

4. **Protozoa are easy to keep.**

   Activity: Have students keep a protozoa culture several weeks, adding spring water when necessary. Have them make periodic observations to

see what changes occur in the culture over time.

5. **Some bacteria are known to cause disease.**

   Activity: Have students research and report on a plague or disease caused by bacteria.

6. **The video features a boy examining his own cheek cells.**

   Activity: Have students scrape the inside of their cheeks with toothpicks in order to observe their own cheek cells through a microscope.

7. **Bacteria are featured in the video.**

   Activity: Have students produce their own culture rich in bacteria by adding dried egg yolk, rice grains, or the broth obtained from boiling wheat kernels to a sample of spring water. Have them make periodic observations to see what changes occur over time.

8. **Early microscopes are featured in the video.**

   Activity: Have students research and report on the invention and development of microscopes through the ages.

9. **Hydras featured in the video are multicellular organisms named after a character from Greek mythology.**

   Activity: Have students research this character to see why its name was lent to the mentioned organism.

GLOSSARY

algae: plantlike protists that rely on photosynthesis

amoeba: a single-celled pond organism which moves by sending out streams of cytoplasm

antenna: one of the sensory organs on top of an insect or a crustacean

antlion: an insect larva with sickle-like jaws that preys on ants

bacteria: the smallest and simplest single-celled organisms; some cause disease

brightfield: a type of illumination marked by a bright background

brine shrimp: a small, saltwater organism

camouflage: a protective coloring that acts like a disguise in nature

cell: the basic unit of which all living things are composed

cilia: the hairlike structures found on the surface of some protists used for propulsion and food gathering

coverslip: a thin piece of glass used to cover a specimen on a glass slide

cranefly: a fly that resembles a large mosquito

crystal: any of the shaped pieces into which some substances are formed when they become solids

Daphnia: a micro crustacean with large antennae related to shrimp, crabs, and lobsters

darkfield: a type of illumination marked by a dark background

diameter: the widest part of a circle

Dileptus: a protozoan with a long trunk which it waves through the water

egg sac: an enclosure within an organism that holds eggs

electron microscope: a microscope that uses electrons to magnify

embryo: an animal in the first stages of its growth before it is born

eyepiece lens: one of the lenses of a microscope over which you place your eye

fetus: the unborn young of some animals

fossil: the remains of plants or animals that lived long ago

fungus: one of a group of plants that has no leaves, flowers, or green color

globe: anything shaped like a ball

hydra: a multicellular pond organism with tentacles

illuminator: a device that gives off light

larva: the wormlike stage of many insects

Leeuwenhoek, Antony van: the Dutch microscope maker who was probably the first person to observe bacteria and many other microscopic organisms

lens: a thick piece of glass with curved edges which can be used to make small things look larger

light microscope: an instrument that uses light to magnify

magnification: the power of a lens

magnifier: a curved piece of thick glass which is used to make small things look larger

mechanical stage: a microscope stage that is maneuvered by means of knobs

microscope: an instrument consisting of one or more lenses which is used to make small things look larger

Middle Ages: the period in European history from about 500 - 1450 A.D.

mineral: an inorganic substance obtained from the ground

mold: a fuzzy growth that is caused by a fungus

objective lens: one of the lenses of a microscope that is positioned directly above a specimen

Paramecium: single-celled organism that resembles a slipper

Pasteur, Louis: French scientist was the first person to prove a connection between some forms of bacteria and disease

planaria: a very small flatworm

pollen: the yellow powder that is found in flowers

power: the amount a lens can magnify

protozoa: microscopic, single-celled organisms

scale: any of the small, thin sections that make up a butterfly's wing

slide: a rectangular piece of glass upon which a specimen is placed

specimen: a sample used for examination

stain: to color

Stentor: a large protozoan with a large mouth lined with long cilia

stereomicroscope: a microscope with binocular eyepieces that is used to examine both solid and transparent objects

symmetry: the condition of having matched parts or shapes on either side of an object

text: the printed words on a page

turret: a rotating device used to hold lenses

vacuum: an enclosed space from which most of the air has been taken

virus: submicroscopic matter capable of causing disease

Vorticella: a bell-shaped protozoan with a coiled stalk

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WEBSITES

The following list includes some of the best websites devoted to microscopes, and pond organisms

Micscape
(http://www.microscopy-uk.org.uk)
This acclaimed site, devoted to the miniature world, includes a handy pull-down menu that leads to a variety of interesting topics, including articles and images on algae, protozoa, crystals, bat droppings, snow -- just about anything that can be placed under a microscope and examined.

Light Microscopy Forum
(http://www.microimaging.ca)
This site features images and articles on microscopes, pond organisms and polarized light.

Protist Image Data
(http://megasun.bch.umontreal.ca/protists/protists.html)
This award-winning site provides pictures and information on selected algae and protozoa. While the text is advanced, the picture gallery features top quality images. Each featured species has articles on appearance, reproduction, classification and much more.

Steve Durr's Homepage
(http://www.durr.demon.co.uk)
This site is put together by the photographer of the Institute of Neurology in London. Steve's goal is to make a permanent record of the interesting plant and animal life found in freshwater in and around London. Steve's images are outstanding and so is his text.

NanoWorld
(http://www.uq.oz.au/nanoworld/images_1.html)
This site features a wide variety of fascinating specimens photographed with an electron microscope.

Society of Protozoologists
(http://www.uga.edu/~protozoa)
Maintained by America's leading protozoology organization, this site features images and articles on a wide variety of protists.

CellsAlive
http://www.cellsalive.com
This site features a rich assortment of photographs, artwork and articles dealing with cells, including protists and bacteria.

Molecular Expressions
(http://micro.magnet.fsu.edu/micro/gallery.html)
This outstanding site features an expansive photo gallery with hundreds of images, and articles on microscopes and microscopy. One of the highlights is a section featuring antique microscopes.

Project Micro
(http://www.msa.microscopy.com/ProjectMicro/PMHomePage.html)
Sponsored by the Microscopy Society of America, this site offers suggestions on how to incorporate microscopy into the classroom and makes recommendations for books, videos and CD-ROMs related to microscopy.

Note: Some servers have difficulty reaching every site address. If you encounter troubles, try reaching the site by entering its name in a search engine.

SCRIPT

You are looking at the incredible world of the microscope.

We're all familiar with a magnifying glass. It enables us to see things much larger than they really are. Have you ever wondered how it is that magnification occurs?

These students are about to find out by placing a book behind a glass globe filled with water. The book's text appears larger because of the curved surfaces of the globe. Ancient peoples used globes filled with water as the first magnifiers.

They may have also used crystal balls as well.

Much more practical as a magnifier is a thick piece of glass with curved edges, called a lens. It is meant for examining just about anything in which you have an interest.

Magnifiers come in a variety of styles. Some have a handle. These are very easy to use, but they usually have less magnification. This one has a magnification of three. It's power is three. It is meant to be placed a comfortable distance from your eye, and adjusted until the specimen comes into focus.

Other magnifiers are meant to be placed very close to your eye. These usually have a smaller diameter and a greater magnification.

Some magnifiers are meant to be placed directly on top of an object.

Others are part of containers.

And still others offer a choice of lenses and magnifications.

Regardless of the type of magnifier you use, observations should be made in bright light for better visibility, using an illuminator, when necessary, for dark objects.

Here's a trick. Place a second magnifier above the first and it will increase the overall magnification. In this example, the first lens magnifies the object three times. The second lens magnifies that image another three times. The overall magnification becomes nine.

That is essentially how a microscope works. Combining lenses to increase magnification far beyond that of a single lens.

A microscope you might already be familiar with is a stereomicrosope.

Objects are placed on a platform called a stage.

Solid objects are illuminated by a light from above.

While thin or transparent objects can be illuminated from below.

The lenses on a microscope are referred to as the eyepiece lens, there are two on a stereomicroscope, and an objective lens, which often has changeable magnifications.

The microscope is focused by turning the focus knob.

Stereomicroscopes usually have a maximum magnification of around 40. At this power, you will see that a smooth sheet of paper isn't so smooth at all, and neither is the surface of an egg. That a common mineral can resemble the surface of Mars. That a fungus can

can resemble the surface of Mars. That a fungus can resemble a bird's nest, and mold a forest. You'll marvel at the pattern of ridges in your finger tips, and discover that a picture is nothing but a sequence of dots. You'll find the hidden statue of Lincoln on the back of a penny, and explore the tiniest details in a minuscule fossil. The veins of a tiny leaf. Pollen grains in a flower. The sharp points at the end of a wheat plant. Nature's symmetry in a beautiful shell. The tiny scales in a butterfly's wing. The camouflaged eggs of an insect. The bizarre face of a walking stick. It's strange mouth. And you'll marvel at a dish full of tiny brine shrimp.

As powerful as a stereomicroscope is, much more powerful is a standard light microscope.

Most student light microscopes usually have a single eyepiece lens.

The objective lens is usually located on a rotating turret with several other lenses.

Multiple objectives provide a variety of magnifications.

This objective will magnify an object four times. Its power is four.

This objective will magnify an object ten times. Its power is 10.

Finally, this objective will magnify an object 40 times. Its power is 40.

The eyepiece of a typical student microscope usually has a magnification of 10.

When you combine a 10-power eyepiece with a four-power objective, the overall power or magnification

becomes 40.

This is a brine shrimp magnified 40 times. At this power, you can get an overall view of an object.

When you combine a 10 power-eyepiece with a 10-power objective, the overall magnification becomes 100.

This is the brine shrimp magnified 100 times. Now we can see details we weren't able to see before. These are its eggs.

When you combine a 10-power eyepiece with a 40-power objective, the overall magnification becomes 400.

These are the brine shrimp's eggs magnified 400 times.

Each magnification teaches us something new and different about a specimen.

The microscopic world is waiting for you to explore.

Your class may have a selection of specimen slides.

These are things that have been professionally prepared for study.

Specimens are very thin so that light will pass through them.

And some are stained, or treated in chemicals, so that you can see them more easily.

Glass slides should be handled carefully, by the edges. Select one you wish to examine and place it on the microscope stage beneath the stage clips.

The specimen is illuminated from below, by either an illuminator, or a mirror. The mirror should be angled toward a source of bright light, such as a lamp, or a window, or, as in this case, an illuminator. Mirrors should never be angled directly at the sun.

Many illuminators have a knob that controls the brightness.

Your eye should be placed directly above the eyepiece and a little away from it. You should keep both eyes open, so they don't get tired.

The large focus knob is used to bring a specimen into rough focus.

The small focus knob is used to bring a specimen into fine focus.

You may also have to re-center the specimen, which can be tricky because the specimen appears to move in the opposite direction you move it.

Recentering is easy if your microscope has a mechanical stage.

The microscope is a delicate instrument and should be handled with great care. You should never touch the glass in the lenses. Finger marks can damage a lens.

Lenses should only be cleaned if they're dirty, using lens cleaner and lens tissue, rubbing with a gentle, circular motion.

A microscope should only be carried by its arm and base.

And when not being used, a microscope should be replaced in its storage case, or protected with a dust cover.

Most student microscopes are set up for brightfield illumination. This is the head of a cranefly shown in brightfield. The background is bright. That's why they call it brightfield.

Your microscope might also have darkfield illumination. Here the specimen is set against a dark background. Both methods of illumination have useful applications.

The best thing about microscopes is what they can do.

They open an entirely new world unseen by the eye alone.

This is an ordinary ant magnified 40 times.

This is the larva of an antlion. It uses it's fierce looking jaws to snap off the heads of ants.

This is the larva of a moth.

This is a fruit fly, commonly known as a gnat.

This is the head of a common housefly.

The multi-faceted eye of a cranefly.

The mouthparts of a grasshopper.

The clubbed antenna of a beetle. Compare it to the feathery antennae of a moth.

This is the rear leg of a honeybee, showing its pollen basket.

And this the elegant wing of a cicada.

This is a chicken embryo at 33 hours.

The fetus of a cat.

The head of a newborn mouse.

And this is its heart.

This is a cross section of a pine stem.

And this a tiny water organism called a daphnia.

These are salt crystals magnified 100 times.

Many household chemicals are crystals, and after they're dissolved, some form beautiful patterns as they reform.

These students are about to discover that some of the best specimens can be found at a local pond.

Back in the classroom, an eye dropper is used to deposit a drop of water onto a glass slide. The slide is then covered with a coverslip. It is then placed on a microscope stage beneath two clips.

That single drop of water is teeming with life. These are protozoa, organisms consisting of a single cell.

This one is called an amoeba. It moves by sending out pseudopods, or false feet, consisting of cell material.

These belong to a group called Paramecium. They're feeding on pond debris. In darkfield, you can see their bodies take on the color of the green algae they are eating. Paramecia move by beating their cilia, which are hairlike strands visible here along their outer edges.

This one is called Stentor. If you look closely, you can see the cilia that line the outside of its large mouth. The cilia are used in swimming and food gathering.

This vorticella uses its cilia to create water currents that pull in food. Larger organisms like these green algae get caught in the current as well, but are not consumed.

This dileptus feeds by waving it trunk back and forth through the water, hoping to draw in organisms.

The daphnia is a common multicellular organism you find in pond water. It moves by flicking its large antennae.

The planaria is a common flatworm you might run across.

The hydra has tentacles lined with sharp barbs that attach themselves to prey. Once caught, the victim is then stuffed into the hydra's mouth located at the base of its tentacles.

The organisms you see in a drop of pond water may look strange, but they share much in common with you and me.

Here's how you can prove it. Scrape the inside of your cheek with a toothpick. Dab this on a glass slide and cover it with a coverslip. Then place this under your microscope.

As you can see, the inside of your mouth is made up of cells. A cell is the basic unit of which all living things are composed.

Your entire body is made up of cells. Billions of cells that are not that much different from the ones in a drop of water, and the microscope proves it.

Now try this. Scrape a little material from your teeth using a clean toothpick. Dab this onto a glass slide.

Add a coverslip, and place this under your microscope set to the highest power.

You should be able to observe plenty of bacteria. They're the tiny specks jittering about between the cells. Bacteria are among the world's smallest organisms. These bacteria are relatively harmless. Some, however, are deadly.

During the Middle Ages, millions of people died from bacteria-caused diseases.

Because they could not see these organisms, people had no way of knowing bacteria even existed, let alone were the cause of disease.

Even when the first microscopes were developed in the fifteen and sixteen hundreds, they were not very powerful and were not capable of seeing anything as small as bacteria.

Then, later in the 1600s, a Dutch microscope maker by the name of Antony van Leeuwenhoek, developed a powerful type of microscope which he used to observe a variety of everyday specimens. These included insects, protozoa, and these, bacteria. He called them "little animals", but he didn't know what they were.

It wasn't until the late 1800s that the famous French scientist, Louis Pasteur, first proved a connection between some forms of bacteria and disease.

Since then, cures to hundreds of diseases have been found.

Today, the microscope continues to be the principle tool used in medical research. When cures to today's diseases are found, it is certain the microscope will have played an important role; both the traditional light microscope, and the electron microscope -- an

instrument that uses electrons to magnify, rather than light.

Here, a tiny fruit fly is being prepared for study.

It is placed on a small mount with a sticky surface.

This is placed within a glass chamber, which is then covered with an airtight lid.

Air is removed from the chamber to create a vacuum.

Electricity is used to coat the fly with a thin layer of gold.

The chamber glows purple during the coating process.

The fly is then removed and taken to another room.

Here the microscope chamber is opened and the fly is placed inside on the microscope stage.

The chamber is closed and a pump is started to remove all air from the microscope, creating a vacuum condition.

Dr. Steve Barlow explains the difference in microscope types.

Dr. Barlow

A lot of people wonder what's the difference between a light microscope and an electron microscope. A light microscope, as the name suggests, uses light to illuminate your sample, whereas the electron microscope uses electrons. A light microscope can magnify about a thousand times normal size. The scanning electron microscope can magnify about a hundred thousand times normal size, or about a hundred times more than a light microscope. This more powerful microscope allows us to see more detail in our samples.

The microscope stage is moved by control knobs on the outside of the chamber. Another knob controls the magnification. And another, the focus. The image is displayed on a monitor, and while the picture is only in one color, it is nothing short of awesome in its detail. Here, we're zooming in on a sensing hair on the fly's head.

Now, we're zooming in on the fly's eye and we can see it is made up of thousands of smaller eyes, and dotted with sensing hairs.

And finally, we zoom in on one of the fly's legs and discover claw-like feet that enable it to cling tightly to just about any surface.

These are viruses. They're responsible for some of today's deadliest diseases. Smaller than bacteria, they cannot be seen with a light microscope. And that's one of the reasons why electron microscopes are so important, to help us learn more about viruses and the diseases they cause.

In this program we have seen how a curved piece of thick glass called a magnifier can be used to magnify a variety of objects and enables us to observe the world in a way we couldn't otherwise do.

When one lens is combined with another, it increases the overall magnification.

That's why stereomicroscopes are more powerful than magnifiers and enable us to see objects in even greater detail.

With stereomicroscopes, objects can be illuminated from above, or below.

Standard light microscopes are even more powerful than stereomicroscopes and enable us to see incredible detail in even minute objects.

Standard student microscopes usually have a single eyepiece lens and a rotating turret that holds at least three objective lenses.

Specimens for a light microscope have to be very thin so that light will pass through them.

Specimens are illuminated from below with an illuminator, or a mirror.

The microscope is focused using either the coarse focusing knob, or the fine focusing knob.

Most student microscopes are set up for brightfield illumination.

But some may also have darkfield illumination. Both methods have useful applications.

The microscope has contributed to the cures of countless diseases and is today an important research tool, both the light microscope, as well as the electron microscope.

The microscope is also a passport. Not to exotic foreign countries, but to an incredible miniature world.