EXPERIMENT MANUAL

KIDS FIRST BIOLOGY LAB

THAMES & KOSMOS

WARNING — Science Education Set. This set contains chemicals and/or parts that may be harmful if misused. Read cautions on individual containers and in manual carefully. Not to be used by children except under adult supervision.

WARNING!

WARNING! Parts in this kit have functional sharp points, corners, or edges. Do not injure yourself! Be careful when handling the dissecting needle, when cutting objects with the slicing tool (microtome) or other blades, and when working with the fragile glass slides.

WARNING! Not suitable for children under three years. There is a risk of choking due to small parts that can be swallowed or inhaled.
Keep away from young children!
Before starting, check the parts list to be sure that all the right pieces are contained in the box.
Keep the packaging and instructions, as they contain important information.

Rules for Safe Experimentation

- Prepare your materials and work area carefully before starting the experiments. Give yourself sufficient space and gather all of the things that you will need.
- Conduct your experiments and make your observations with the microscope slowly and deliberately, as described in the instructions.
- Read these instructions before use, follow them and keep them for reference.
- Do not use any equipment which has not been supplied with the set or recommended in the instructions for use. Do not use any power supply other than as indicated.
- Do not eat or drink in the experimental area.
- When foodstuffs are required by any experiment:
  Before starting an experiment, separate the amount of foodstuffs required for the experiment from the rest of the foodstuffs.
  Do not replace foodstuffs in original container. Dispose of immediately.
- Some of the recommended investigation objects might contain substances that are slightly toxic (e.g. ivy, tulip). Therefore:
  Do not allow chemicals to come into contact with the eyes or mouth.
  Do not apply any substances or solutions to the body.
  Wash hands after carrying out experiments.
- Keep young children and animals away from the experimental area.
- Store this experimental set out of reach of children under 8 years of age.

Dear Parents!

In this experiment kit, your child will discover the wonders of the microcosmos. Please stand by your child's side during the experiments and provide help and support when it is needed. The help of an adult is particularly necessary when using the slicing tool or dissecting needle.
When setting up the microscope, you should go through the steps for proper usage together with your child. Please also make sure that the batteries are properly inserted in the device. With some practice, your child will soon be conducting fun and successful microscopy experiments!

We wish you and your child a lot of fun and fascinating experimentation!

Battery Safety

Two AA batteries (1.5-volt, type AA / LR6 / penlight) are required. They are not included in the kit due to their limited storage life. Avoid short-circuiting the batteries. A short circuit can cause the wires to overheat and the batteries to explode. Different types of batteries (e.g., rechargeable and standard batteries), or new and used batteries should not be used together. Do not mix old and new batteries. Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries. Always insert batteries in the right polarity orientation, pressing them gently into the battery compartment. Do not recharge non-rechargeable batteries. They could explode! Rechargeable batteries should only be charged under adult supervision. Rechargeable batteries are to be removed from the toy before being charged. Remove exhausted batteries from the kit. Dispose of used batteries in accordance with environmental provisions. Make absolutely sure that metallic objects such as coins or key chains are not left in contact with battery terminals. Keep batteries away from fire. Do not bend, warp, or otherwise deform batteries. After experimenting, disconnect all circuits

Advice About Protecting the Environment

None of the electrical or electronic components in this kit should be disposed of in the regular household trash when you have finished using them; instead, they must be delivered to a collection location for the recycling of electrical and electronic equipment. The symbol on the product, instructions for use, or packaging indicates this. The materials are reusable in accordance with their designation. By reusing or recycling used devices, you are making an important contribution to the protection of the environment. Please consult your local authorities for the appropriate disposal location.

EXPERIMENT 1

An experiment to help you hit the ground running

Water drop as "magnifying glass"

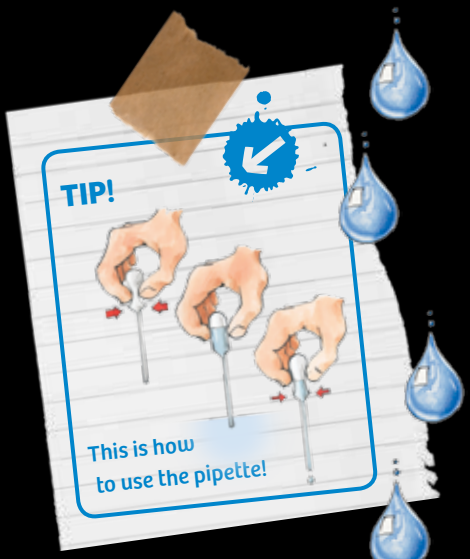
YOU WILL NEED

› **2 slides, pipette**
› *1 glass of tap water, 1 newspaper*

HERE'S HOW

1. Use the pipette to place a drop of water on the slide (see illustration) and carefully set the slide on the newspaper. Now look through the drop at the newspaper page.

2. Next, place another drop of water on the second slide and hold this second slide above the first one in such a way that you can look through both water drops to the newspaper beneath them. Can you find the optimal distance between the two slides that will make the writing appear even more enlarged than when you use just one?



EXPLANATION

You see the letters of the newspaper enlarged as if by a magnifying lens. Your microscope works by the same principle as this "two-drop microscope." Instead of the water drop lens, your microscope has plastic lenses installed in its optical tube, and the viewed object lies on a slide clamped in place beneath them.

TIP!
You can use a lamp or a mirror to illuminate the microscope. A replacement bulb is included.

Checklist: Find – Inspect – Check off

✔	No.	Description	Qty.	Item No.
❍	1	Microscope	1	708223
❍	2	Tweezers	1	700595
❍	3	Dissecting needle	1	000208
❍	4	Slicing tool (microtome)	1	000211
❍	5	Pipette	1	000210
❍	6	Sample container	1	000214
❍	7	Slides	4	062018
❍	8	Box of cover slips	1	062206
❍	9	Natural fiber specimens		
		(silk, cotton, wool)	1	708224
❍	10	Replacement bulb	1	000218

If you are missing any parts, please contact Thames & Kosmos customer service for a replacement.

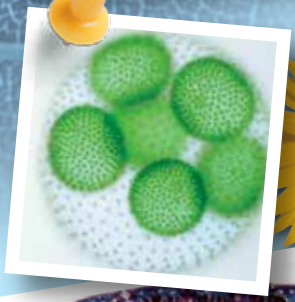
Any materials not included in the kit are indicated in *italic script* under the "You will need" heading.

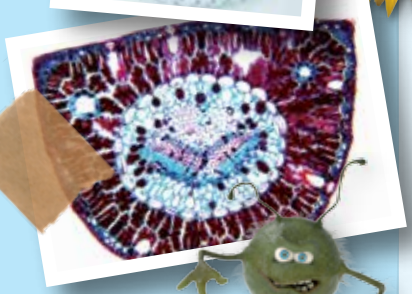
You will also need:
Two 1.5-volt batteries (AA/LR6/penlight), water glass, plate, teaspoon, blotting paper (or paper towels), white paper (letter size), newspaper, razor blade, fabric tape, permanent marker, cotton swabs, polystyrene foam pieces, string, small plastic bags, pocket knife, plastic bag with gravel or sand, wine cork, desk lamp.

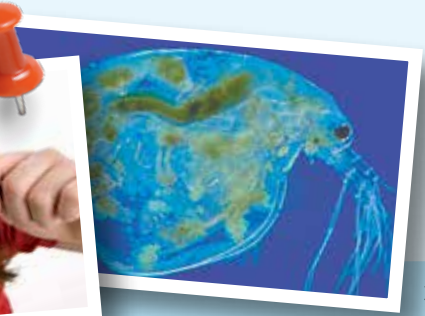
Also, for viewing under the microscope: Onion, elodea waterweed, pine needle, raw meat, hair and fabric samples, dust sample, honey (more precise descriptions accompany each experiment).

››› CONTENTS

TIP!
You will find additional information here: "Check It Out"
Page 4, 8, 9, 12, 13, 29, 32



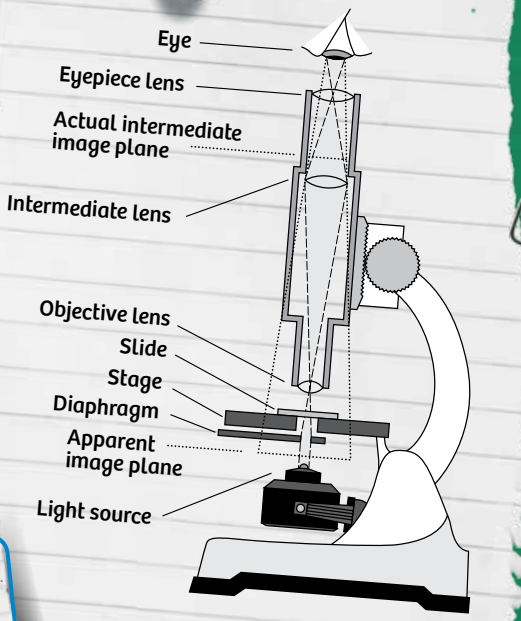




Your Microscope's Lenses

In your microscope, the role of the water drops from first experiment is assumed by convex plastic disks known as optical lenses, located in the eyepiece and lower down in the nosepiece. Lenses magnify the objects that you place on the stage for examination, so they are the most important components in your microscope. Handle them with care. If dust has collected on one of the lenses, wipe it off carefully with a soft, dry cloth.

CAUTION! Never touch the lenses with your fingers, and be careful not to let the lens in the eyepiece or nosepiece bump against other objects. Dirtied or scratched lenses will not produce a sharp image!



TIP!

Do not use a cleaning solution for cleaning your microscope, since it might damage some of the component parts. Ideally, hold onto the microscope by the stand or the base only.

Microscopy Basics

In this chapter, you will be getting to know the microscope and all of its accessories. The most important parts of the microscope will be explained, and the experiments will help you learn practical tips for using the microscope and exploring the world of cells.

EXPERIMENT 2

The first specimen: “natural fibers”

YOU WILL NEED

› Natural fiber prepared slide
› *2 1.5-volt batteries (AA/LR6/Penlight)*

HERE’S HOW

1. Before viewing your first specimen, you will first have to insert the batteries for the lamp. You will find the battery compartment on the underside of the base.
2. Turn the microscope’s illumination unit so that the mirror is pointing downward. The light will switch on automatically. The bulb’s light will shine through an opening in the stage, with the diaphragm letting more or less light through depending on its size. Always start by selecting the largest diaphragm setting.
3. Take the prepared slide and clamp it under the clips on the stage. The specimen should be positioned as precisely as possible over the center of the stage opening so it is well illuminated by the bulb.

Pay attention to the correct orientation of + and – !

NOTE! At the strongest magnification (500x – 750x), the objective is so long that you have to be careful not to let it hit the slide!

1: base, 2: battery compartment cover, 3: arm, 4: illumination unit (mirror and lamp), 5: stage with clamps and adjustment wheel, 6: nosepiece with three objective lenses, 7: fine adjustment, 8: eyepiece with turning function

TIP!
Use the adjustment wheel on the underside of the stage to select different degrees of illumination and different color filters, which will help you get the sharpest image of the object you are looking at. Experiment a little!

4. Rotate the nosepiece so that the objective lens with the lowest magnification (96x – 144x) is above the slide. Use the fine adjustment knob to lower the objective lens all the way down and then gradually up again until the image is sharp.
5. Keep rotating the nosepiece to the next two magnification levels, using the fine adjustment knob to sharpen the image each time.
6. Everything OK so far? Now for the final trick: Turn the silver sleeve around the eyepiece to enlarge the microscope image even more!

EXPLANATION !

When you look through the eyepiece, you will first just see a blurry image, or maybe nothing at all.

If you just see a blurry image, it is because the two lenses (in the eyepiece and the nosepiece) are not yet at the optimum distance from each other. To get a clear enlarged image, the distance between the lenses (just as with the "two-drop microscope" in the first experiment) will have to be adjusted. To do this, slowly (!) turn the fine adjustment knob while looking through the eyepiece, and you will get a clear image.

If you don't see anything at all, it's probably because the specimen is not positioned precisely beneath the objective lens. Carefully move the slide on the stage in order to bring the specimen into the correct position.

TIP!
Always start with the lowest magnification in order to get an overview of the object on the slide.

TIP!
Before turning the microscope upside-down, it's best to remove the eyepiece and set it aside so that it doesn't accidentally fall out and get damaged.

CHECK IT OUT

Introducing the Microscope Accessories

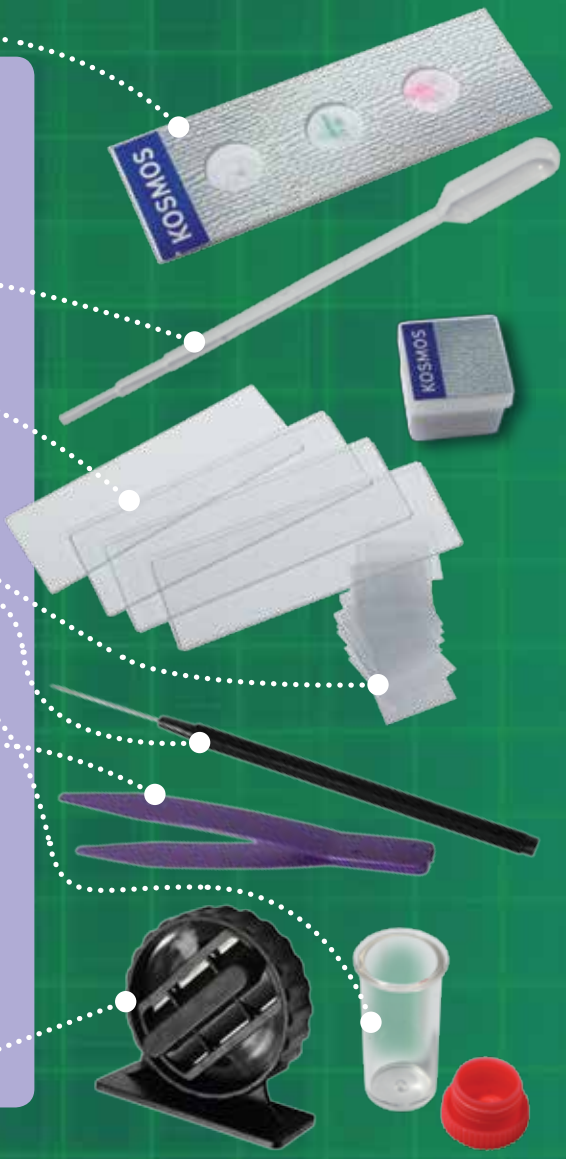
The prepared slide will be used right at the beginning and again later on in the detective chapter. Prepared slides are handy because they are ready-to-use and they can be quickly pulled out whenever you want to compare different kinds of samples.

The pipette is used whenever you want to drip small amounts of water onto a slide.

On the slide, you will be placing all the specimens that you want to study under the microscope. When you do this, you will cover the specimen with a cover slip in order to get the best image and protect the specimens from getting dirty.

Use the sharp dissecting needle (be careful!) when you want to place or move a specimen on the slide. The tweezers and sample container will come in handy when you're searching for new specimens.

The objects that you view under the microscope will have to be very thin in order for enough light to be able to shine through them. Some specimens will have to first be cut into very thin slices so you can study them under the microscope in cross section. You can use the slicing tool for this, or a razor with fabric tape over the part you hold.

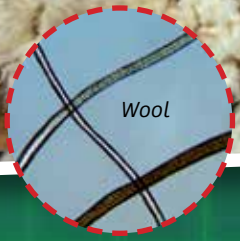


NATURAL FIBERS

The prepared slide contains the three natural fibers cotton, wool, and silk. They are all artificially colored. You will be able to see the characteristic qualities of the various fibers under the microscope. Cotton fibers are flattened and often twisted. They have thick edges (cell walls). The wool (sheep's hair) is thick and round, hollow, and with scaly cell walls. Silk, by contrast, is a lot thinner with no hollow interior, with a smooth and even surface that makes it look similar to an artificial fiber (such as polyester or nylon).

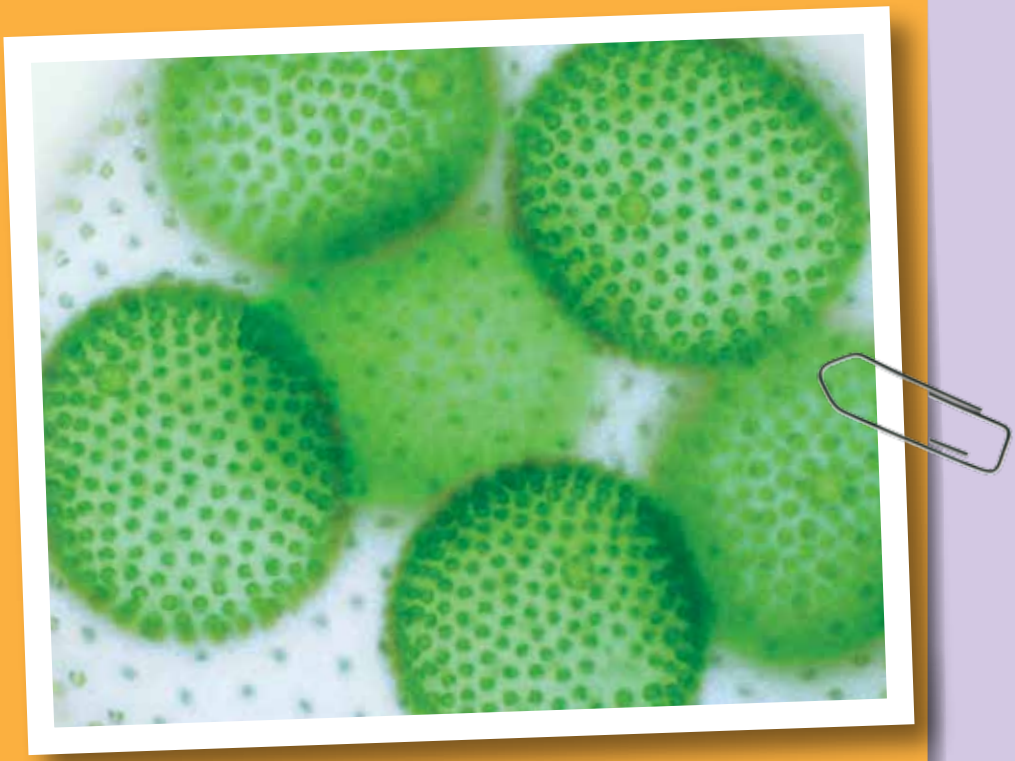
TIP!

You can use the mirror for illumination instead of the light bulb. With the proper adjustment, you can use it to guide the light from your desk lamp or the sun through the hole in the microscope stage.



Plant Cells

What do all living things have in common? They breathe, they feed themselves, they grow, they reproduce, and they consist of tiny building blocks called cells. Most plant or animal cells are incredibly small. To study them, you need a microscope. That's the only way that you can see and study all their tiny structures.



EXPERIMENT 3

Onion skin cells under the microscope

YOU WILL NEED

› **1 Slide, 1 cover slip, pipette, tweezers**
› *Blotting paper (or paper towel), water, razor blade, fabric tape, half an onion*

HERE'S HOW

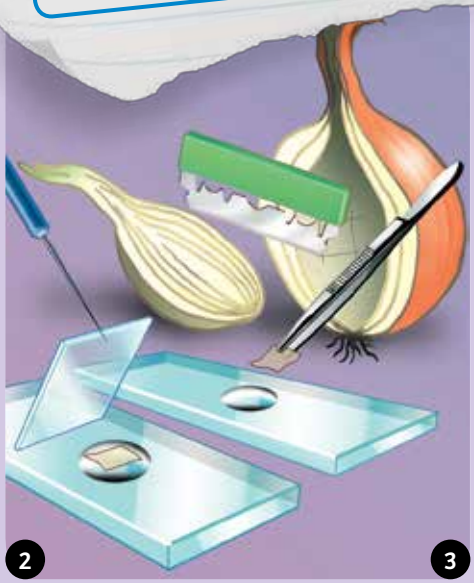
1. **Get all the materials ready and prepare the slide: Suction up a little water with the pipette and place a drop on the center of the slide.**

CAUTION! Razor blades are very sharp, so the first thing you have to do is to cover one of the two edges of the blade with fabric tape. That will make the blade a lot safer to handle. Have an adult help you cut and apply the tape.

2. **Now use the razor blade to cut a small square section out of the skin of the onion. Remove the square with the tweezers and place it in the water droplet you placed on the slide.**

3. **Carefully position a cover slip over the water droplet. If there is too much water under the cover slip, just blot up the extra water with blotting paper or a paper towel.**

TIP!
Some specimens are easier to see if you dye them. It's easy to do — try it with a drop of red or blue ink. Let the ink get pulled under the cover slip (as described in the tip on page 13), wait a few minutes, and then add clean water and let it get pulled under the cover slip. Then you can study the prepared specimen.

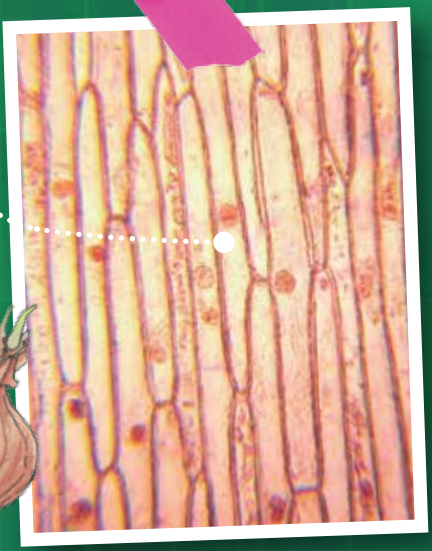


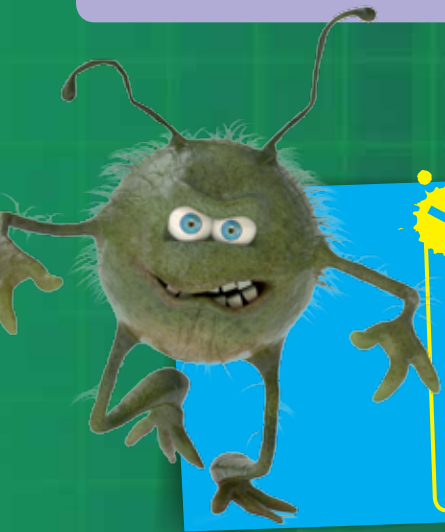
EXPLANATION

You will see the elongated onion skin cells, each one with a round cell nucleus. In red onions, the walls and contents of the cell are colored reddish-purple by a natural pigment. With white or yellow onions, the translucent cell walls and contents appear colorless to slightly yellow under the microscope.

Onion Skin and Chloroplasts

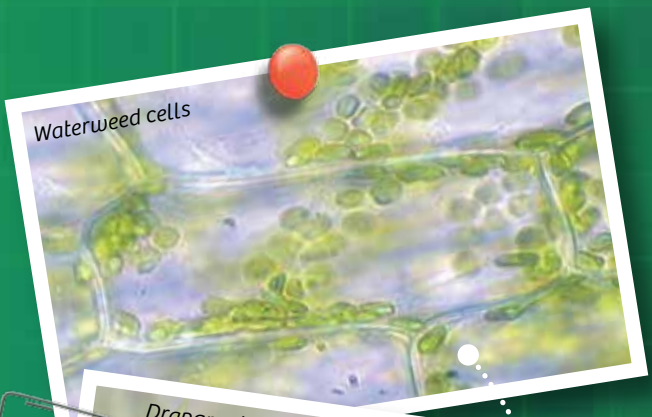
An onion is composed of many layers, with each individual layer covered by a very thin skin. This skin has a silvery sheen and consists of just a single layer of cells. You can easily view this "prototypical" plant cell under the microscope — a typical cell with a large round cell nucleus. The living portion of the elongated cells is surrounded by a protective cell wall. The cytoplasm (the substance filling the cells) of a white onion is colorless. If you take a red onion, you can see the deep purple cytoplasm inside the cells.





DID YOU KNOW ?

A bacterial cell is just one thousandth of a millimeter in size. That means that about 70 bacterial cells placed side by side will be about as thick as a hair! At the other extreme, the egg cell of an ostrich is a veritable giant, measuring 15 cm in length. Giant cells like that are the exception however.


Waterweed cells


Draparnaldia algae

TIP!

Bubbles of air in the microscope slide can interfere with your viewing. Almost all specimens should lie in water in order to yield a really good image. You can easily get rid of air bubbles by placing a drop of water along one edge of the cover slip with the pipette, and then holding a piece of blotting paper or paper towel along the opposite edge. That will pull the drop of water under the cover slip and the bubbles will disappear. Repeat if necessary...

The green color of plant cells comes from tiny leaf-green structures that biologists call **chloroplasts.** You can very easily study the way these green granules look and move in the elodea "waterweed," a common aquarium plant. Its leaves consist of just two layers of cells, so they can be viewed directly under the microscope without any preparation. If you happen to know someone who owns an aquarium, just ask for a little branch of **waterweed.** Or you can ask for one in an aquarium or pet supply store. Either elodea or egeria, another closely related waterweed species, would work.

EXPERIMENT 4

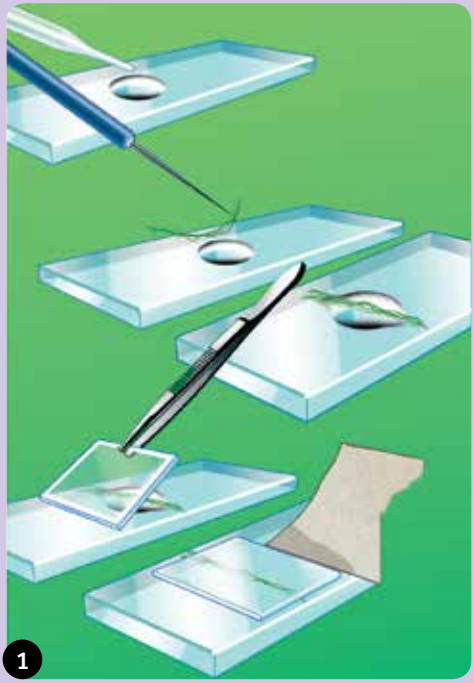
Waterweed chloroplasts

YOU WILL NEED

› **1 Slide, 1 cover slip, pipette, tweezers**
› *1 Piece of blotting paper (or paper towel), 1 waterweed leaf, water*

HERE'S HOW

1. **Prepare the slide as already described in the onion skin experiment (Experiment 3).**
2. **Use the tweezers to place the leaf in the water droplet, and cover everything with a cover slip.**


1

TIP!

Most leaves consist of several layers of cells. That is why you first have to cut these specimens in order to get layer thin enough for the light of the microscope to penetrate. Before practicing your cutting technique in the next chapter, try finding other types of plants with similarly simple tissue structures. Moss leaves are ideal for this. Or try "peeling off" thin layers from the surface of other plant leaves, such as cabbage or lettuce leaves (close to the stalk), or from the stems of cut flowers (e.g., tulips, gerber daisies), or the skin of a tomato.

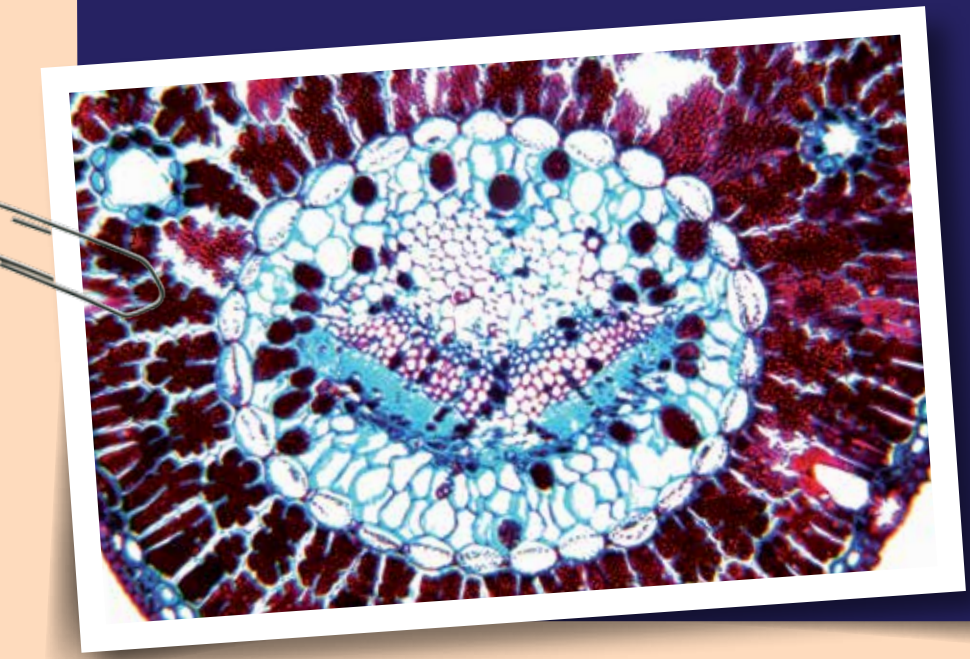
EXPLANATION !

The individual chloroplasts are easy to spot inside the cells. They are constantly in motion under the bright light of the lamp. The green chlorophyll plant pigment is important for manufacturing sugar and starch, which it does with the help of sunlight.

Cells in Cross Section

Every organ in our body has its own particular task: The heart pumps blood through the veins, the stomach absorbs food and starts the process of digestion, the bones support the body and the brain controls it all. With plants, by contrast, you will find many different structures depending on where the plant grows.

The corresponding tasks in plant bodies are handled by specialized cell tissues. In leaves, stalks, and roots, you will discover a lively division of labor. It is especially easy to see the various cell tissue types in a cross section of a pine needle (or other conifer needle).



EXPERIMENT 5

Pine needles, sliced thin

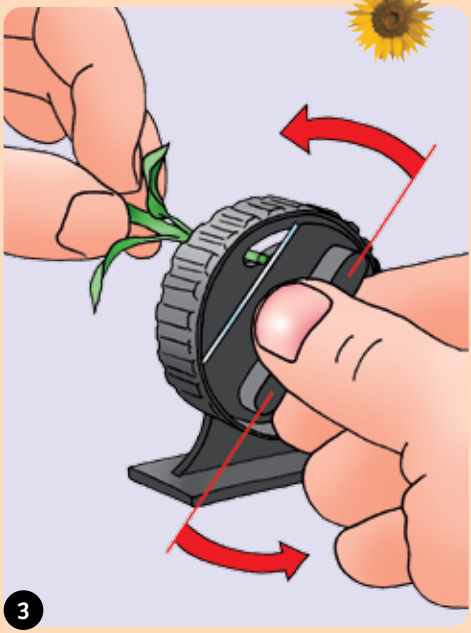
YOU WILL NEED

› 1 Slide, 1 cover slip, pipette, slicing tool, tweezers, dissecting needle
› *Water, pine needle*

HERE'S HOW

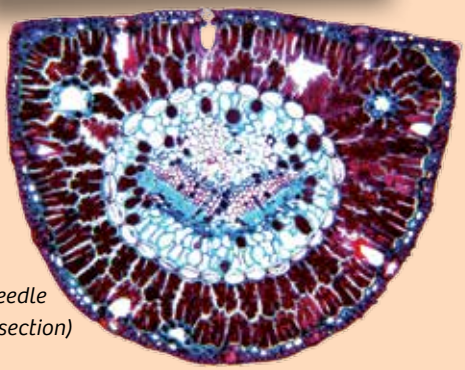
1. Prepare a slide and take the slicing tool out of the box. You will see a silver razor blade inside the slicing tool.

CAUTION!
The razor blade is very sharp — so you will have to stay sharp too! The dissecting needle is also sharp. Be careful using both tools!



3

TIP!
You will always need a sharp razor blade to cut your specimens. The blade that comes with the kit will become dull over time. Be absolutely sure to have an adult help you change the blade. Making thin slices is an art unto itself and it requires time and practice. It's always best to prepare several slices at one time. That increases your chances of getting a slice of just the right thickness.

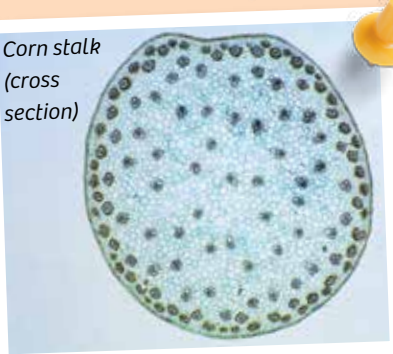


Pine needle (cross section)

2. Set the slicing tool on its base and turn the handle until you can no longer see the silver blade through the oblong openings. Insert the pine needle through one of the slicing tool openings.
3. Now, slowly turn the handle until the pine needle has been completely cut through.
4. Turn the blade back again and make another slice. Repeat these steps at least ten times, slicing off very thin slices each time (sort of like cutting thin salami slices).
5. Carefully take the thinnest slices with the tweezers or the dissecting needle from the rear side of the slicing tool and place them in the water droplet on the slide.

DID YOU KNOW? ?

You can tell right off the bat if a slice is too thick by the fact that the cover slip will not lie flat on the slide. You can only tell by looking through the microscope if a slice really is thin enough.



Corn stalk (cross section)

Ivy shoot (cross section)

EXPLANATION !

You can see a variety of tissue types in the slices even without using a dye. The supportive wall tissue provides a stable structure for leaves and stalks. Inside the walls, there are tube-like passageways for water and nutrients, typically also surrounded by supportive tissue. At the very edge, you can easily see the outer cuticle covering composed of lots of small cells.

Animal Cells and "Guinea Pigs"

Right at the beginning of the manual, we said that all living things are composed of cells, and that there are smaller cells and larger ones. The question remains whether large living things have bigger cells than little ones. Or is it just that their bodies are composed of more cells? If you can find an adult willing to serve as a "guinea pig," you will be able to answer these questions easily enough. Let's assume you are about 4 feet (1.3 meters) tall and your adult "guinea pig" is 6 feet (1.8 meters) tall. In that case, the guinea pig's cells would have to be at least about one and a half times the size of yours — assuming a larger body means larger cells!

EXPERIMENT 6

Human cell size comparison

YOU WILL NEED

› **2 Slides, 2 cover slips, pipette**
› *Water, 2 clean cotton swabs, 1 permanent marker (for marking the slides)*

HERE'S HOW

1. Use the pipette to place a drop of water on the center of the first slide.
2. Now, applying a little bit of pressure, wipe the inside of your cheek with a cotton swab.
3. Dip the swab in the water drop on the slide.
4. Prepare a second slide and ask your "guinea pig" to provide a tissue sample using the second cotton swab.
5. Cover both samples with cover slips and compare the cell sizes of the two specimens under the microscope.

EXPLANATION !

When you rub the inside of your cheek with the cotton swab, it releases cells from the mucous membrane. These cells are then transferred to the slide, where you can observe them under the microscope. And what did you find? Are the "guinea pig's" cells larger than your own cheek cells, or is there no difference?

EXPERIMENT 7

Different cell jobs, different cell shapes

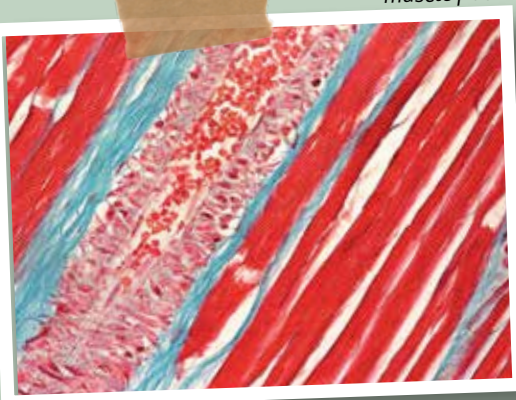
YOU WILL NEED

› 2 Slides, 2 cover slips, dissecting needle, tweezers, pipette
› *Water, 1 small piece of raw meat with fat!*

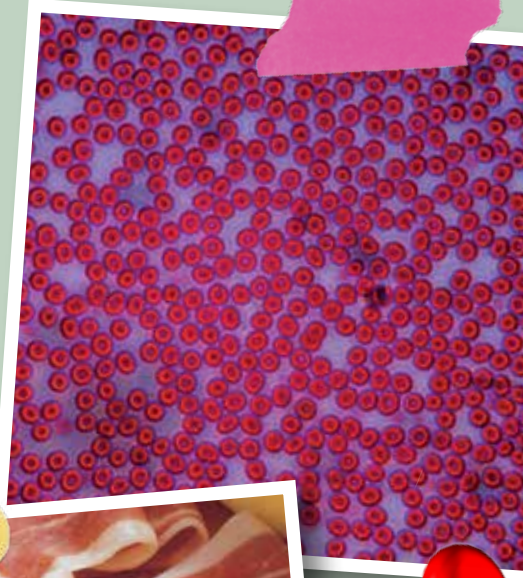
HERE'S HOW

1. Prepare two slides by placing a drop of water in the center of each one with the pipette.
2. Have an adult help you cut off a lentil-sized piece of meat and an equal-sized piece of fat.
3. Carefully maneuver these two samples into the water droplets on the slides with the help of the dissecting needle and the tweezers. Remove any thick, non-transparent pieces from the slide.
4. Cover both specimens with a cover slip and observe them in turn under the microscope.

muscle fibers



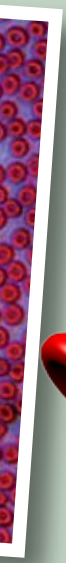
Red blood cells



DID YOU KNOW ?

All plant and animal cells have a cell nucleus that contains the genetic information (DNA). Unlike animal cells, however, plant cells have a solid cell wall for support. In simple terms, you might say that animal cells don't need this kind of support because that job is handled by the skeleton or shell. Animal cells come in various shapes and colors, depending on the job they perform in the body.

Fat cells in the skin



EXPLANATION !

The colorless fat cells are large round or oval shapes packed together in groups. They are almost completely filled with a droplet of oil — making them pure energy stores. It's a completely different story with the muscle cells from the meat. They are striped, elongated structures that are hardly recognizable as cells. When you raise your arm, each one of these individual muscle cells will shorten, an action that draws on the energy stored in the droplets of oil inside the fat cells!

There are dozens of different types of cell in our bodies, such as skin, bone, blood, and nerve cells. Each one of these cell types has its own special work to do, and each looks different from the others!

DNA sample

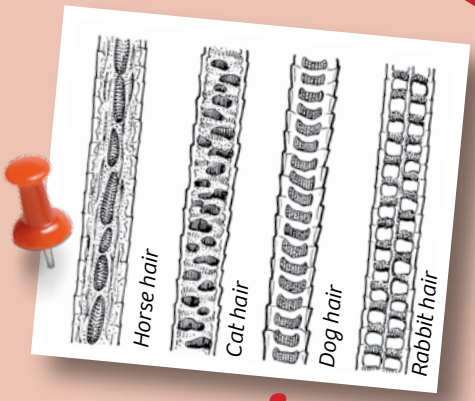
Detectives on the Trail

The refrigerator door is ajar... all the gummy bears have been stolen off the birthday cake... the lemonade has been drunk up and somebody has taken bites out of the hot dogs... a hyena must have broken into the kitchen last night!

Who was the hungry culprit? The first thing to do is to collect any possible pieces of evidence, such as hair or clothing fibers, from around the scene of the crime and save them in a special sample container. Then you will need samples from all the suspects for comparison: Collect a hair or a thread from the pajamas of each of the suspected perpetrators and pack each one into a separate bag labeled with his or her name.

EXPERIMENT 8

Refrigerator detectives: Who was the perpetrator?



YOU WILL NEED

› **Slides, cover slips, pipette, sample container, tweezers, "natural fibers" prepared slide**
› *Water, various hair and fiber samples (from around the house), small plastic bags (resealable), 1 permanent marker (for identifying the bags and slides)*

HERE'S HOW

1. **Prepare several slides by placing a drop of water onto the center of each one with the pipette.**
2. **Set the hairs or fibers in the water droplets, place a cover slip on top of each, and study the samples using the smallest objective lens. Then try the lens with medium magnification, followed by the one with the greatest magnification, which will let you see the fiber structures most clearly.**

EXPLANATION !

Each fiber reveals its own unique details under the microscope. Hairs from fabric fibers are easy to tell apart. With a little practice, you will be able to see the difference between cotton fibers and silk, or between the hairs of various living things. The prepared slide will give you some idea how your crime scene samples will look under the microscope.


Human hairs

On a "carpet safari" in your house dust

YOU WILL NEED

› **1 Slide, 1 cover slip, pipette, tweezers**
› *Water, 1 sheet of white letter-size paper, "sample" from the vacuum cleaner bag, desk lamp, kitchen sieve*

HERE'S HOW

1. Place a dust sample in a fine-meshed kitchen sieve and shake the sieve gently over the sheet of paper. Little dust particles and a few mites will fall onto the sheet when you do that.

2. House mites don't like air that is too warm or dry. As soon as you warm the sheet with the desk lamp, they will escape from the dust and gather themselves into little heaps.

3. Use the tweezers to transfer the escapees to a drop of water on the slide, and then cover them with a cover slip and study them under the microscope.

House dust mite

DID YOU KNOW ?

Whether you look in the carpet, on upholstered chairs or sofas, or in the bed, you will find them everywhere that dust accumulates — tiny creatures known as dust mites. They are essentially harmless little animals that feed primarily on flakes of dead skin. They really only become a problem for those of us who suffer from dust mite allergies. If you are allergic, dust mite excrement can trigger a sneezing attack or even breathing problems.

DID YOU KNOW?

There are researchers who claim that the number of microorganisms living on and inside our body is greater than the number of all our body's cells. But don't worry! Most of these living things are not harmful to us, and in any case our body possesses a lot of defense mechanisms against any microorganisms that might cause diseases.

EXPLANATION !

The number of legs that a dust mite has — you can see eight of them under the microscope — is an indication of the close relationship between mites and spiders. Along with scorpions, spiders, and ticks, mites belong to a family known as arachnids. True insects, by contrast, have just six legs.

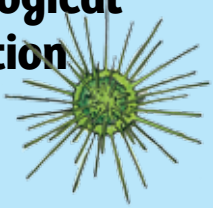
Gateway to the Microcosm

Set off on a search for more of the tiny fellow inhabitants of our planet! Use your pipette to take water samples. Your sample container will be just the thing to carry them! The preferred hunting grounds for microorganisms are algae-filled pools, the edges of ponds, rain barrels, puddles, and plant pot saucers. It's also worth using the dissecting needle to scrape off some rocks that have been lying around in water for a while and collect the scrapings with a little water in the sample container.

Water flea (Daphnia)

EXPERIMENT 10

"Fishing in the dark" with your biological collecting station

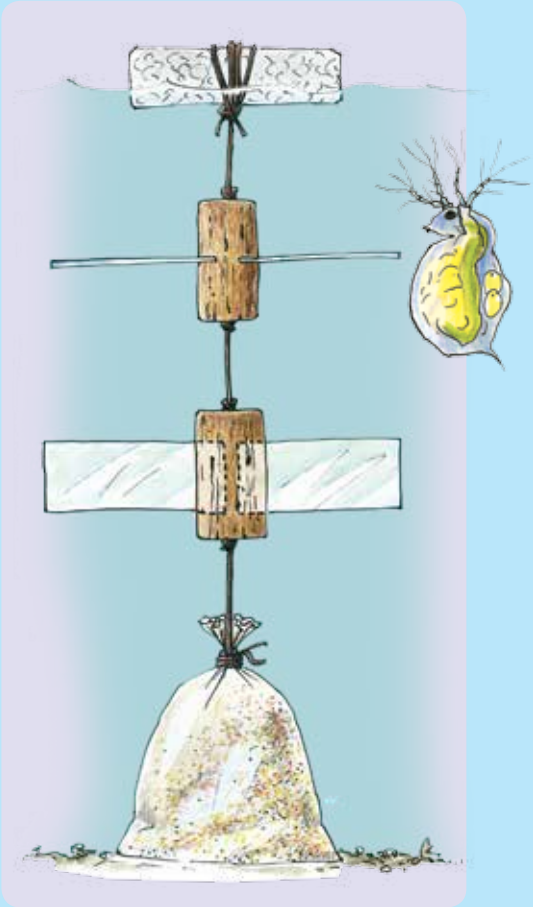


YOU WILL NEED

› 4 slides, cover slips
› *2 corks (from wine bottles), pocket knife, string, 1 plastic bag filled with rocks or sand, 1 piece of polystyrene foam, 1 permanent marker for marking your slides*

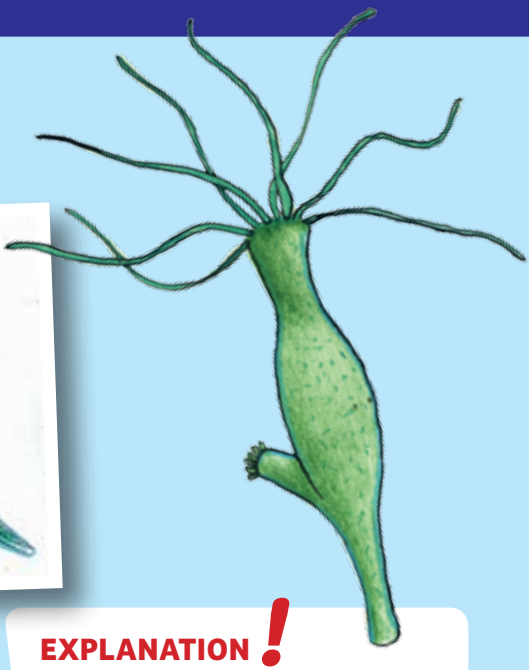
HERE'S HOW

1. Have an adult help you bore a hole through the length of each cork and thread the string through the holes. Secure the string with a knot at the top and a knot below.
2. In the top cork, make two horizontal slits for the slides and make two vertical slits in the bottom cork, and clamp the slides in the corks.
3. Tie a piece of polystyrene foam to the top end of the string to serve as a float, and tie the sand-filled bag to the bottom end to serve as an anchor or sinker.
4. Mark the slides with a symbol or H1/H2 (horizontal) and V1/V2 (vertical), and take the collecting station to a pond.
5. After about a week or two, bring your pond specimen collection station home in a bucket of pond water. Before you look at your "prey" under the microscope, wipe one side of each slide clean with a cloth.
6. The other side of the slide should not be soaking wet when you view it under the microscope. Let it dry a little before viewing. Put one or more cover slips on the slide, position it on the microscope stage, and begin your observations.



Note: When constructing the collecting station, particularly when boring the holes for the string and making the slits for the slides, it is absolutely essential to have an adult help you.


Diatoms

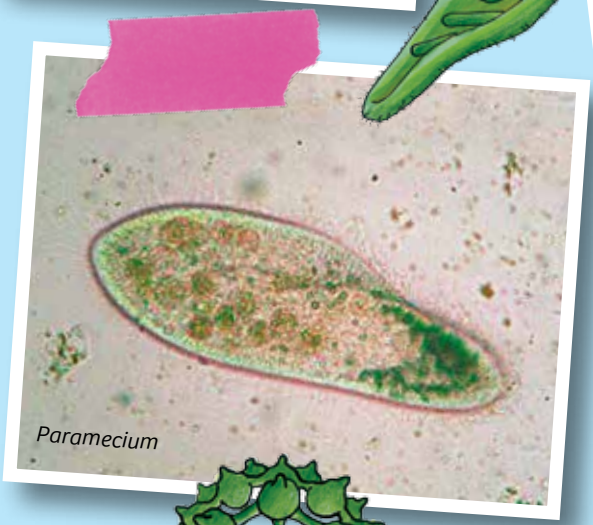



Volvox algae

EXPLANATION !

In pond water, you can find a multitude of living organisms — both plants and animals. In the summer, lots of organisms will have settled on the slides within one to two weeks. A lot of tiny water organisms will not swim around freely in the water. They are sedentary, meaning that they grow on a fixed surface. Every animal or plant species has its own preferences in this regard. Some look for sunny, horizontal spots, while others prefer to settle on vertical surfaces.

On the surface of the water, you will often find flower pollen, such as pine pollen, which is spread by the wind. In the water itself there are all sorts of algae, single-celled organisms, and a lot of other aquatic organisms that can simply be collected with the pipette and transferred to a slide for viewing.

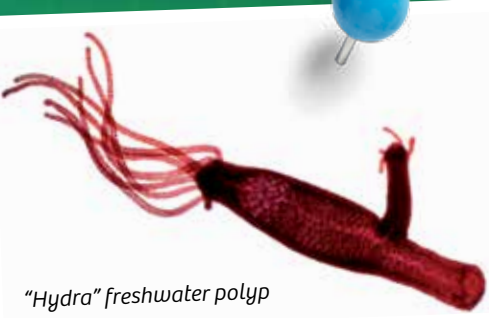

Paramecium

CHECK IT OUT

The World of Microbes in Our Water Systems

The creatures living in puddles and ponds live in all kinds of ways and in all kinds of places. Algae usually float freely in the water in order to get as close as possible to the light. Water fleas paddle themselves around and use their legs to filter out algae and microorganisms. Some animals can be seen with the naked eye, while others are only visible under the microscope.

A fearsome pond predator you might find is a freshwater polyp called a hydra. It has tentacles that it uses to fish for food, and it also possesses tiny, poison-tipped harpoons with which it shoots its prey upon contact, wounding or killing it. While some polyps are visible with the naked eye — some are up to 2.5 cm long — their prey can only be seen under the microscope.



"Hydra" freshwater polyp

TIP!

First study the water samples with your naked eye. A lot of specimens, such as water fleas and some diatoms, can easily be seen without magnification. If your water sample is very cloudy, just let it sit for a while. Fine sand or silt particles will settle to the bottom of the sample vessel. Then you will be able to see the freely swimming creatures quite easily, and you can suction them up with the pipette and place them on your slide for observation.

EXPERIMENT 11

Hunting for pollen in a honey sample

YOU WILL NEED

› **2 slides, 2 cover slips, pipette**
› *1 water glass, 1 teaspoon, 1 flat saucer, natural honey (ordinary quality from the supermarket), 1 permanent marker (for marking the slides), 1 piece of blotting paper (or paper towel), water*

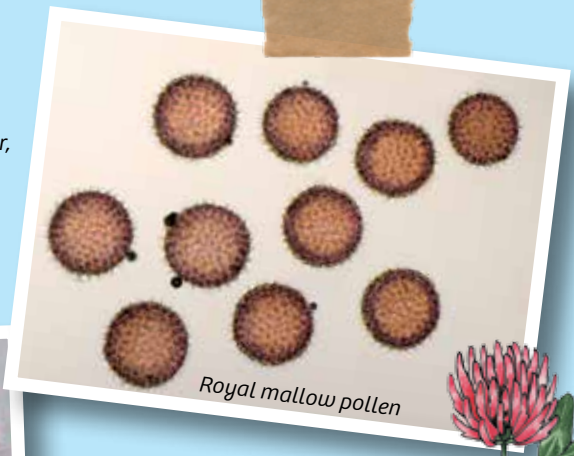
HERE'S HOW

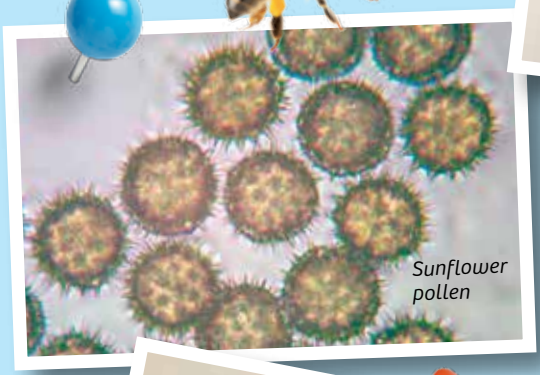
1. Get everything ready — slides, cover slips, and all the other items. Label the slides with the type of honey (wildflower, etc.) or the brand name.
2. Dissolve about half a teaspoon of honey in some water in a water glass. Then set the spoon on the saucer.
3. Now use the pipette to suction up a little of the solution (one sample from the bottom of the glass, and one from higher up) and drip the two samples onto the two slides.
4. Place a cover slip on each slide, carefully blot up any extra liquid, and study the samples under different levels of magnification using the microscope's different color filters.
5. After completing your observations, pour the remaining honey-water mixture down the kitchen sink drain and rinse it down with water. Clean the pipette, slides, cover slips, water glass, and spoon right away with some dishwashing liquid, and place everything on a kitchen towel to dry.


Honeycomb


Pine pollen

Different kinds of pollen can have really different shapes: 1 acacia, 2 cuckooflower, 2 maple tree, 4 oak tree, 5 dead nettle, 6 beech tree, 7 chrysanthemum, 8 fir tree, 9 grass, 10 spruce, 11 dandelion, 12 hazel, 13 sunflower, 14 cow parsley, 15 pine tree, 16 buttercup, 17 heather, 18 apple tree.


Royal mallow pollen


Sunflower pollen


Marigold pollen

EXPLANATION !

One type of honey is often mixed together with other types, resulting in a mixture of different kinds of pollen from the various field, forest, and meadow plants that the bees feed on. Pure types of honey are more expensive to produce and therefore cost more. In your honey sample, you will see various pollen shapes and structures, and you might even be able to check whether the honey really does come from the source stated on the label. A lot of pollen grains have a characteristic appearance, making them easy to identify under the microscope.

CHECK IT OUT

Pollen Grains: The Calling Cards of Flowers

As they fly around from flower to flower, honeybees collect the precious nectar from which they eventually make honey. At the same time, they also collect **flower pollen** to feed the bee larvae in the hive. Have you ever watched a bee that just visited a flower? As it emerges from the flower, it will often appear covered with yellow powder from head to foot. You shouldn't be surprised, then, if a few of those pollen grains end up in the honey.

Pollen grains are interesting objects to study under a microscope. You will be able to discover lots of different shapes and surface structures among them. The round, prickly pollen of a sunflower, for example, looks completely different from the air-bladder-equipped pollen grains of a pine tree or spruce. There are scientists who specialize in pollen, using a microscope to study the pollen composition of all sorts of samples — among other things, to determine the country from which a honey sample came.

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