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.

Franckh-Kosmos Verlags-GmbH & Co. KG, Pfizerstr. 5-7, 70184 Stuttgart, Germany | +49 (0) 711 2191-0 | www.kosmos.de
Thames & Kosmos, 89 Ship St., Providence, RI, 02903, USA | 1-800-587-2872 | www.thamesandkosmos.com
Thames & Kosmos UK LP, 20 Stone Street, Cranbrook, Kent, TN17 3HE, UK | 01580 713000 | www.thamesandkosmos.co.uk

KIT CONTENTS

What's inside your experiment kit:

Good to know!

If you are missing any parts, please contact Thames & Kosmos customer service (see back cover).

The parts not included in the kit are marked in *italics* in the YOU WILL NEED lists.

Checklist:

✓	No.	Description	Quantity	Part No.
○	1	Microscope	1	722510
○	2	Tweezers	1	722499
○	3	Dissecting needle	1	722500
○	4	Pipette	1	722502
○	5	Sample container	2	722505
○	6	Slides	4	722506
○	7	Box of cover slips	1	722503
○	8	Permanent prepared slide (Onion skin specimen)	1	722507
○	9	Petri dish with lid	1	722504

YOU WILL ALSO NEED:

Two AA batteries (1.5-volt, type LR6, Mignon), small Phillips-head screwdriver, drinking 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, bottle cork, desk lamp. Also, for viewing under the microscope: Onion, aquatic plants, waterweed, pine needles, raw meat, hair and fabric samples, dust sample, honey (more precise descriptions accompany each experiment)

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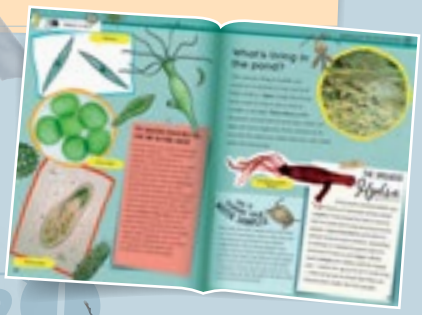
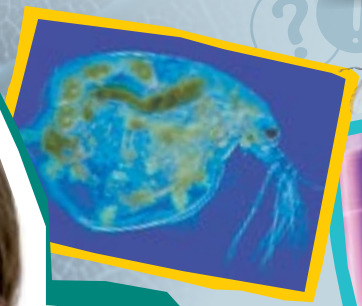
TIP

YOU CAN FIND ADDITIONAL INFORMATION IN THE CHECK IT OUT SECTIONS ON PAGES 8, 9, 10, 13, 14, 21, 25, 28, 29, 31, AND 32.





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SAFETY INFORMATION

WARNING!

This kit contains functional sharp edges or points. Do not injure yourself! Be careful when handling the sharp dissecting needle and when cutting objects with sharp blades.

WARNING! Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled.

Before starting, check the parts list to be sure that all of the correct pieces are included in the kit. Keep the packaging and instructions as they contain important information.

WARNING! Never leave the magnifying eyepiece unattended in the sun. Fire danger! Never look directly into the sun, either with your naked eye or through the magnifying eyepiece. You could blind yourself!

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 eat, drink, or smoke 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; and wash hands after carrying out experiments.
- → Keep young children and animals away from the experimental area.
- → Store this experiment kit out of reach of young children.

Safety for Experiments with Batteries

To operate the microscope, you will need two AA batteries (1.5-volt, type AA/LR6), which could not be included in the kit due to their limited shelf life. An adult should insert and change the batteries. For instructions on how to insert and change the batteries, see page 6.

- → Non-rechargeable batteries are not to be recharged. They could explode!
- → Rechargeable batteries are only to be charged under adult supervision.
- → Rechargeable batteries are to be removed from the toy before being charged.
- → Different types of batteries or new and used batteries are not to be mixed.
- → Do not mix old and new batteries.
- → Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- → Batteries are to be inserted with the correct polarity. Press them gently into the battery compartment.
- → Exhausted batteries are to be removed from the toy.
- → The supply terminals are not to be short-circuited.
- → Avoid a short circuit of the batteries. A short circuit can cause the wires to overheat and the batteries to explode.
- → Avoid deforming the batteries.
- → Dispose of used batteries in accordance with environmental provisions, not in the household trash.

Notes on environmental protection: The electronic components of this product are recyclable/reusable. For the sake of the environment, do not throw them into the household trash at the end of their lifespan. They must be delivered to a collection location for electronic waste, as indicated by the following symbol: Please contact your local authorities for the appropriate disposal location.

IMPORTANT INFORMATION

Dear Parents and Supervising Adults!

Children want to explore, understand, and create new things. They want to try things and do them by themselves. They want to learn! They can do all of this with Thames & Kosmos experiment kits. With every single experiment, they grow smarter and more knowledgeable.

With this microscope and biology kit, your child can discover the world of the smallest things, the microcosm. Please provide your child with advice and assistance during the experiments and support them where help is needed. The help of an adult is particularly necessary when using the dissecting needle or making thin slices with a sharp blade. You should insert and change the microscope's batteries for your child.

When setting up the microscope for the first time, go through the steps from the instructions together with your child to make sure it is used correctly. With a little practice, your child will soon be able to enjoy researching and carrying out experiments on their own with the microscope.

Find a suitable workplace where your child can experiment without interruptions. It should have a flat work surface on which the microscope can stand securely upright, and provide enough space for handling the accessories and specimens. If necessary, protect the work surface with a mat or an old newspaper. Always have some paper towels ready when you experiment, as it's always possible for some water or other investigation materials to spill.

Make sure that your child washes all of the tools and their hands after experimenting.

It is best to have all of the materials you will need ready before each experiment. The materials lists at the beginning of each experiment tell you what is needed for each experiment. The parts not included in the kit are marked in italics.

Please also read the safety information carefully and talk to your child about it. In particular, make them aware of how to handle the sharp needle and razor blade carefully.

We hope you and your child have a lot of fun experimenting!

Have fun!

Take a look!
Learn how to use the microscope correctly.

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 1

The water-drop magnifying glass


1

You will need

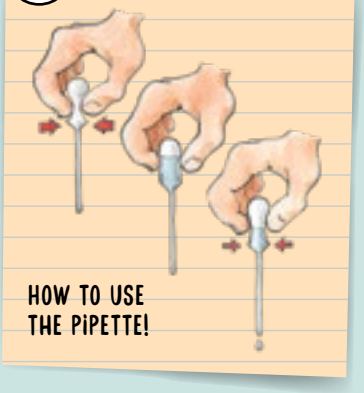
– 2 Slides
– Pipette
– Glass filled with tap water
– Newspaper or book

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 (or book). 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?

TIP



WHAT'S HAPPENING?

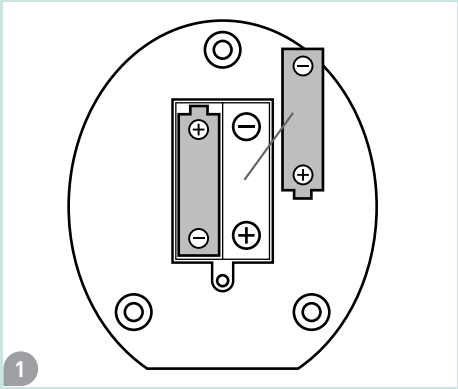
You see the letters of the newspaper enlarged as if they were under a magnifying glass. Your microscope works according to the same principle as this "two-water-drop microscope." Instead of the water-drop lens, your microscope has plastic lenses installed in its optical tube, and the viewed object lies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

EXPERIMENT 2

The first specimen: the skin of an onion

You will need

- **Microscope**
- **Permanent prepared slide (onion skin specimen)**
- *2 AA batteries*
- *Small Phillips-head screwdriver*



1

Here's how

1. Before you start, have an adult insert the batteries into your microscope. To do this, first remove the plastic stopper from the tube. Then turn the microscope upside down. The battery compartment is on the bottom.

   Unscrew the screw securing the battery compartment with the help of a small Phillips-head screwdriver. Lift up the lid and insert two new AA batteries. Pay attention to the correct polarity (see Figure 1). Then close the battery compartment and tighten the screw.

2. Now put the eyepiece (also called the ocular) in the tube. Turn on the illuminator with the power switch on the base of the microscope. The light shines through the hole in the stage.

   Under the stage, you will find a round disc with openings of different sizes. This is the aperture wheel. You can turn it to control how much light passes through the specimen on your slide. Always choose the largest aperture at the beginning.

2

3. Take the prepared slide of the onion skin. Scientists refer to the onion skin as the epidermis of the onion. Position the specimen as precisely as possible over the center of the opening in the stage (the aperture) so it is well illuminated by the light source.
4. Rotate the nosepiece so that the objective lens with the lowest magnification (4x) is above the slide. Looking through the eyepiece, 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. Next try rotating the nosepiece to the two other magnification levels, using the fine adjustment knob to sharpen the image each time.

WARNING! At the highest magnification (600x), the objective is so long that you have to be careful not to let it hit the slide!


5

TIP

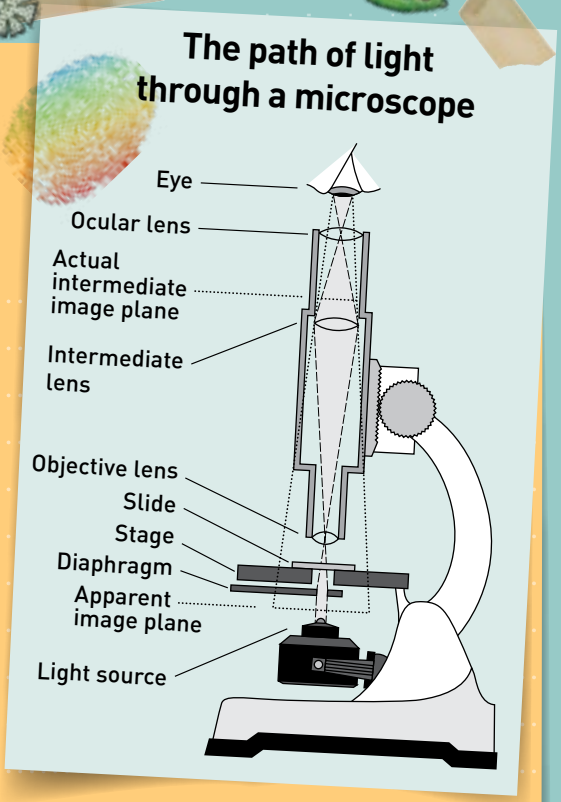
ALWAYS START WITH THE LOWEST MAGNIFICATION IN ORDER TO ORIENT YOURSELF WITH AN OVERVIEW OF THE OBJECT ON THE SLIDE.

WHAT TO DO ...?

- **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 will have to be adjusted (just like with the "two-water-drop microscope" in the first experiment). To do this, slowly (!) turn the fine adjustment knob while looking through the eyepiece, and you will get a clear image. Don't get frustrated if you don't immediately see something. Try again!
- **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.

CHECK IT OUT

How does a microscope magnify objects?



Inside your microscope, there are curved, clear plastic disks called **optical lenses,** which are located in the **eyepiece (ocular lens)** and lower down in the **nosepiece (objective lenses).** In principle, these lenses work in the same way as the two drops of water from your first experiment. The different lenses enlarge objects on the **stage** to different degrees. The lens in the eyepiece enlarges the object **15 times.** The objective lenses enlarge the object **4 times (red lens), 10 times (yellow lens) or 40 times (blue lens).** To calculate the **total magnification,** you have to multiply these two numbers together. The lenses are the most important parts of your microscope. Treat them with care. Dirty or scratched lenses will no longer give you sharp images!

TIPS FOR PROPERLY CARING FOR YOUR MICROSCOPE

Never touch the lenses with your fingers, and be careful not to let the lenses in the eyepiece or nosepiece bump against other objects. Dirty or scratched lenses will not produce a sharp, clear image!
If dust has collected on one of the lenses, gently wipe it away with a soft, dry cloth. Do not use a cleaning solution for cleaning your microscope, since it might damage some of the components.
Ideally, hold onto the microscope by the stand or the base only.

CHECK IT OUT

HOW TO USE THE *Microscope Accessories*

A **permanent prepared slide** is a slide with a specimen that has already been mounted in a stable, long-lasting way. Prepared slides are handy because they are ready-to-use and they can be quickly pulled out whenever you want to compare different samples.

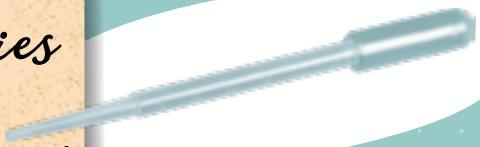
The **pipette** is used whenever you want to drip small amounts of water onto a slide.

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

Use the sharp **dissecting needle** (handle with care!) when you want to place or move a specimen on the slide.

The **tweezers** and **sample containers** will come in handy when you're collecting new specimens.

You can use the **Petri dish** to store samples well.



CHECK IT OUT

HOW TO MAKE A SAFE *Slicing Tool* FROM A RAZOR BLADE

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.

To do this, use an ordinary double-edge safety razor blade from the drugstore or supermarket. Handle the sharp razor blade very carefully and make it safer to hold by covering one of its edges, using one of the methods described on the right.

How to cover the edge of the razor blade:

ELECTRICAL TAPE METHOD:

Using a thick insulating tape (electrical tape), wrap several layers around the cutting edge on one side of the razor blade.

BOTTLE CORK METHOD:

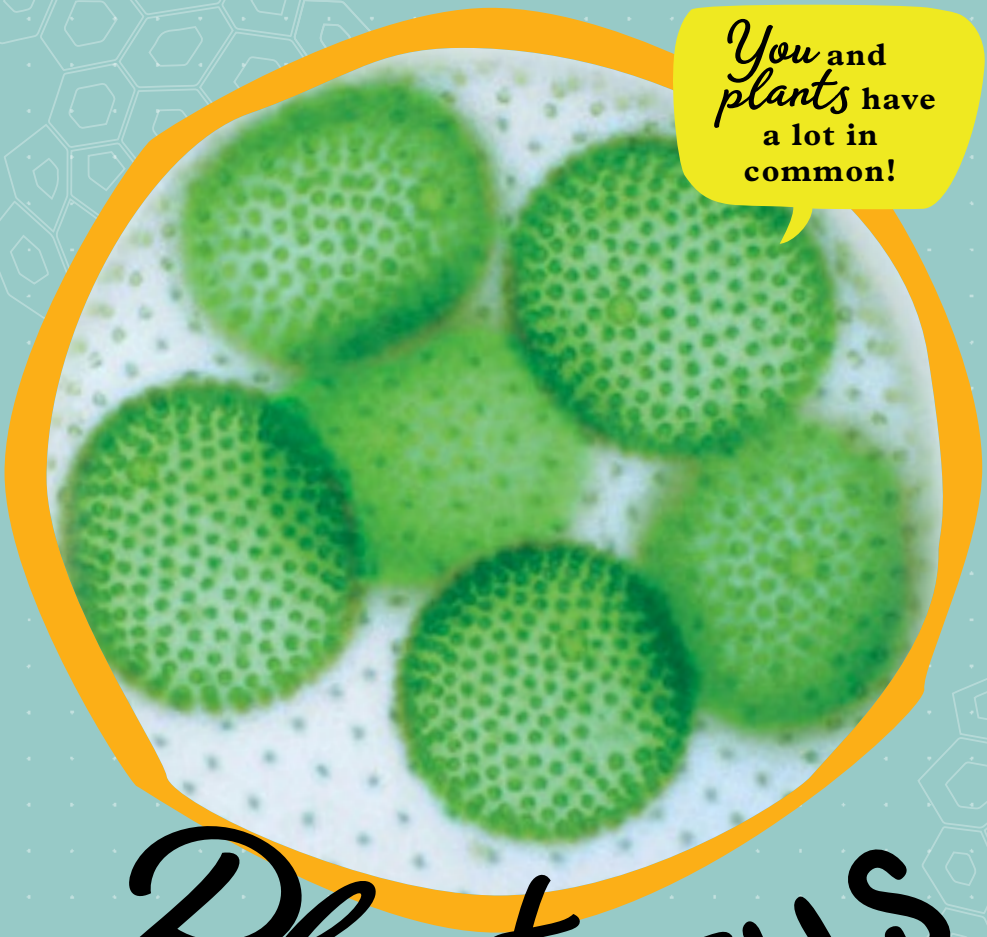
First, cut a slit lengthwise with a knife in a bottle cork, down to the middle. Insert the razor blade into this slit. Then the blade can easily be held by the cork handle.

PROFESSIONAL CUTTING TIPS

Many objects are naturally too thick to be placed under the microscope in their entirety. At the same time, however, they are flimsy or thin enough to stubbornly avoid the razor blade when trying to cut them. Here's a tip for how to slice them:

1. Take an expanded polystyrene foam cube and cut a slit in the top of it.
2. Carefully insert the specimen you want to cut (e.g., blade of grass, piece of root, pine needle) into the slit. Make sure it's as straight as possible.
3. Slice into the foam cube with the razor blade from the side and pull it laterally across the cube and through the specimen. Make several cuts, one after the other. This increases the likelihood of getting a perfectly thin cut.

WARNING: Make sure you have an adult help you prepare the razor blade for use!



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 of their tiny structures. Let's take a look at some plant cells first.

EXPERIMENT 3

Onion skin cells under the microscope

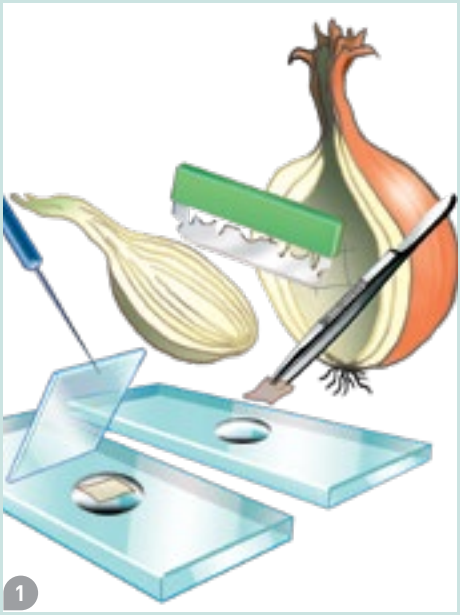
You will need

– Slide
– Cover slip
– Pipette
– Tweezers
– Blotting paper or paper towels
– Water
– Razor blade
– Electrical tape
– Half an onion

Here's how

1. You can also make a slide preparation of the onion epidermis yourself. Get all the materials ready and prepare the slide. First, suck up a little water with the pipette and place a drop on the center of the slide.
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.
4. View the slide like you did in Experiment 2. Compare it to what you saw in that experiment.

WARNING! Razor blades are very sharp, so the first thing you have to do is cover one of the two edges of the blade with electrical tape. See page 10 for instructions. This will make the blade a lot safer to handle. Have an adult help you cut and apply the tape.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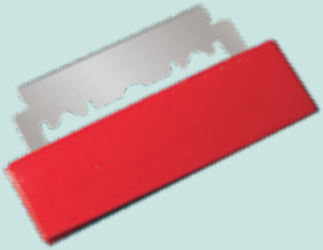


TIP

SOME SPECIMENS ARE EASIER TO SEE UNDER THE MICROSCOPE 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 (USING THE METHOD DESCRIBED IN THE TIP ON PAGE 14), 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.

CHECK IT OUT

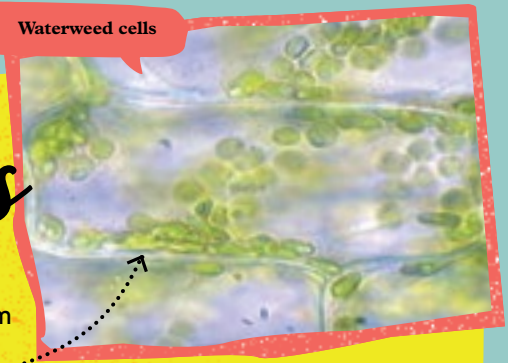
Onion skin cells

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 these plant cells under the microscope. Onion skin cells are a good example of common plant cells. They have a large, round **cell nucleus** and are surrounded by a solid, protective **cell wall.** The cells are filled with a liquid called **cytoplasm.** In red onions, the cell wall and cytoplasm are colored reddish-purple by a natural dye. In common white onions, the cell components appear colorless to slightly yellowish under the microscope.

How big is a real cell?

A bacteria cell is just one thousandth of a millimeter in size. That means that about 70 bacteria 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 centimeters in length. Giant cells like that are the exception however.

Green Cells



Waterweed cells

Draparnaldia algae

The green color of plant cells comes from tiny leaf-green structures inside the cells that biologists call **chloroplasts.** You can very easily study the way these green globules look and move in the elodea plant, also known as **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 slicing. 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, will work.

THE BATTLE OF THE BUBBLE

Bubbles of air in the microscope slide preparation 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. This will pull the drop of water under the cover slip and the bubbles will disappear. Repeat if necessary.

EXPERIMENT 4

Waterweed chloroplasts

You will need

– Slide
– Cover slip
– Pipette
– Tweezers
– Blotting paper or paper towels
– Waterweed leaf
– Water

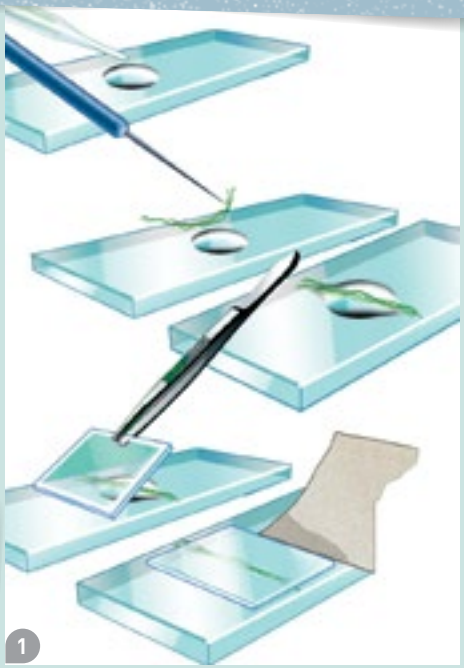
Here's how

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.
3. Clip the slide onto the stage and observe the waterweed leaf under the microscope. Make sure to start at the lowest magnification.

KEYWORD

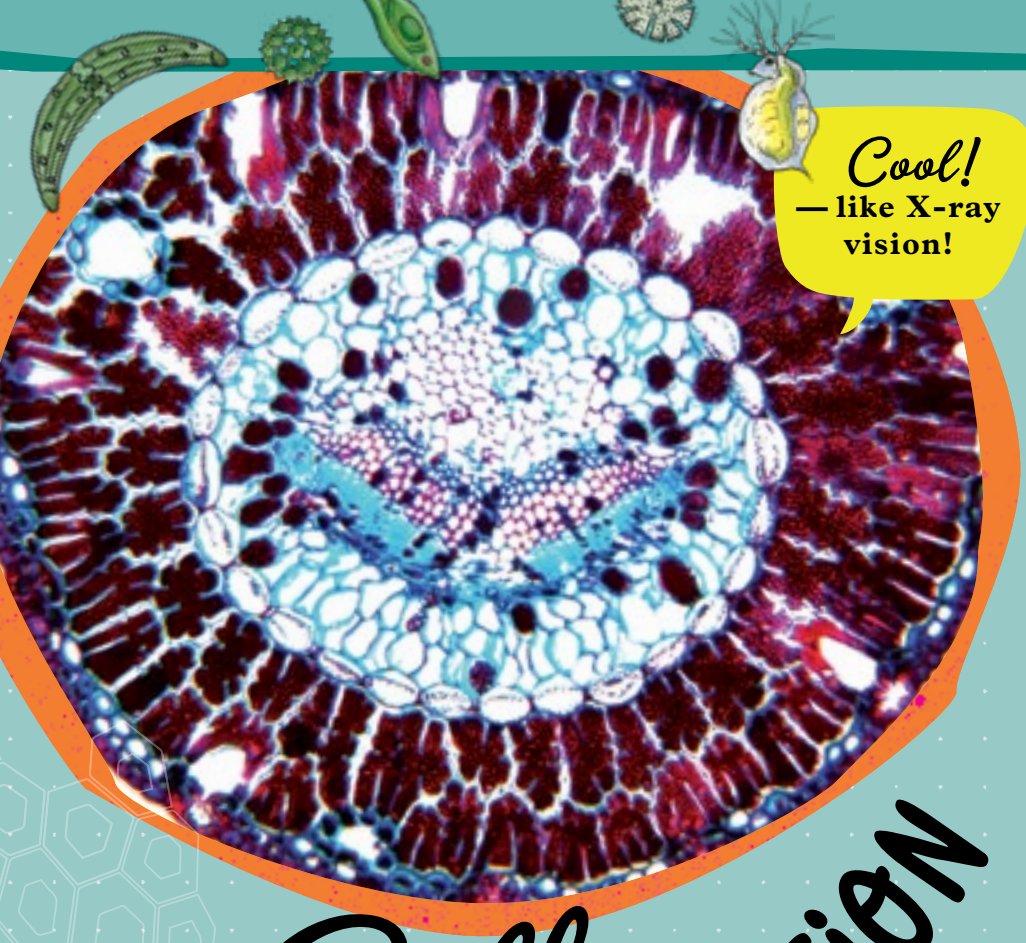
CHLOROPLASTS

The chloroplasts get their green color from a plant pigment inside them called **chlorophyll.** This also enables the chloroplasts to perform **photosynthesis,** a biological process in which sugar and starch are produced with the help of water and sunlight. You can see individual chloroplasts inside the plant cells under your microscope. Due to the bright LED light in the microscope, the chloroplasts are in constant motion.


1

TIP

MOST LEAVES CONSIST OF SEVERAL LAYERS OF CELLS. THAT IS WHY YOU FIRST HAVE TO CUT THESE SPECIMENS IN ORDER TO GET A LAYER THIN ENOUGH FOR THE LIGHT OF THE MICROSCOPE TO PASS THROUGH. 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. 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.



Cells in Cross Section

Just as our bodies have different organs with very specific functions, plants also have specialized cell tissues that perform various tasks. In leaves, stalks, and roots, you will discover a dynamic 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

Pine needles

You will need

- **Slide**
- **Cover slip**
- **Pipette**
- **Razor blade**
- **Tweezers**
- **Dissecting needle**
- *Water*
- *Needle from pine tree*
- *Expanded polystyrene foam piece*

Here's how

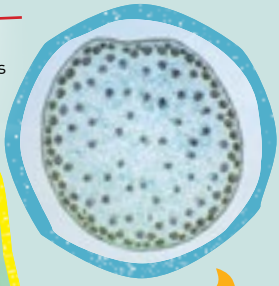
1. Prepare a slide. Make sure you have a sharp razor blade that you have covered on one side according to the instructions on page 10.
2. Cut a slit in the piece of expanded polystyrene foam and insert the pine needle into the slit. Cut very thin slices, as described on the bottom of page 10.
3. Examine your pine needle slices and choose the thinnest. Use the tweezers or dissecting needle to carefully place this slice in the water droplet on the slide.

KEYWORD

TISSUE

In biology, tissue is a group of similar cells. You can see a variety of tissue types in the pine needle 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.

WARNING! The razor blade is very sharp — and it needs to be!



Corn stalk cross section

Ivy shoot cross section

TIP

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.

Animal Cells AND "GUINEA PIGS"

We have learned that all living things are made up of cells and that there are smaller and larger cells. The question remains: Do large organisms have larger cells than small ones? Or is a larger body just made up of more cells than a smaller one? Let's find an adult "guinea pig" who can help us investigate this further!

EXPERIMENT 6

Human cell size comparison

You will need

– 2 Slides
– 2 Cover slips
– Pipette
– Water
– 2 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" (your parent or other adult supervisor) 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.

   What do you observe? Are the cells swabbed from your "guinea pig's" mouth larger than the cells swabbed from your own mouth?

WHAT'S HAPPENING?

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. You should see that these cells are about the same size regardless of the age of the person they came from. This swabbing method is used to take cell samples to solve criminal cases and for various health tests. More extensive examinations are usually necessary for these types of things than just looking at the cells through a microscope.

EXPERIMENT 7

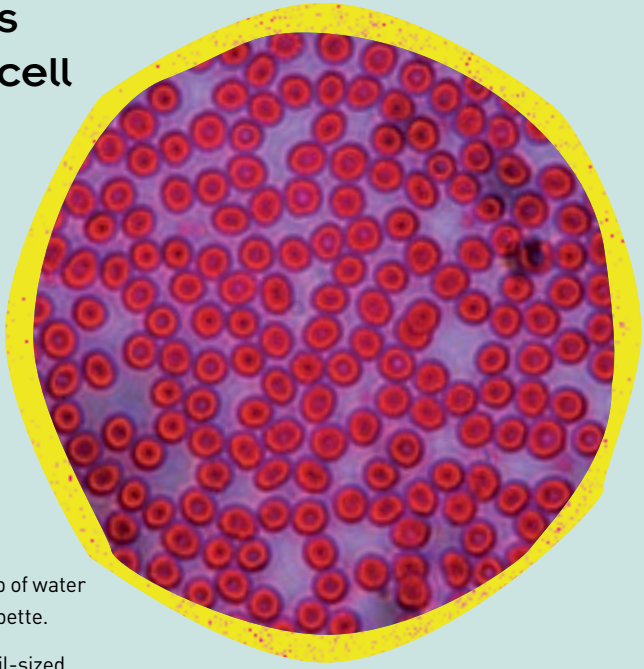
Different cell jobs require different cell shapes

You will need

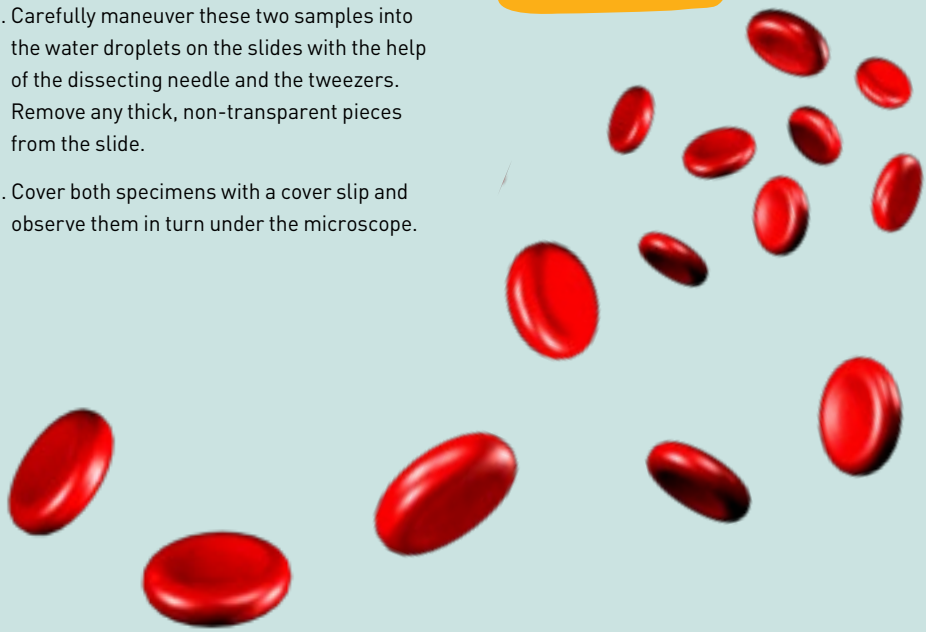
– Slide
– Cover slip
– Dissecting needle
– Tweezers
– Pipette
– Water
– Small piece of raw meat with fat

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.

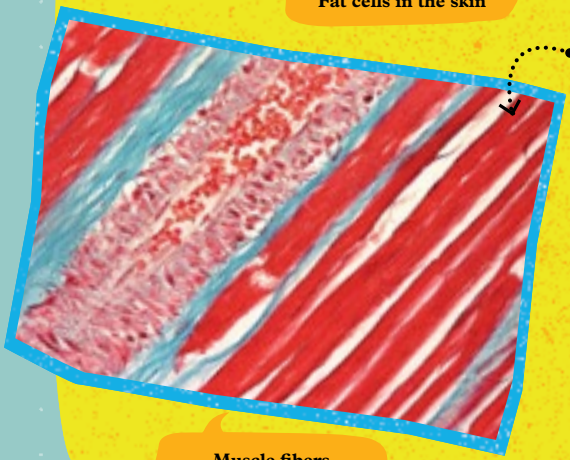


Red blood cells



CHECK IT OUT

Fat cells in the skin



Muscle fibers

TYPES OF ANIMAL CELLS

Animal cells have very different shapes and colors, depending on what task they take on in the body. From the piece of meat, you were able to examine two types of cells. The colorless **fat cells** are large round or oval shapes packed together in groups. They are almost completely filled with a fat reservoir, like a big bubble of oil inside the cell, and are therefore 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 fat reservoirs inside the fat cells!

There are dozens of **different types of cells** 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!

The Cell Wall

Do you remember the onion cells? When you viewed them with the microscope, you could clearly see the protective cell walls. But you may not have noticed any cell walls when you examined the cells from the oral mucosa and the meat. Rightly so! Because like all animal cells, they have no cell wall at all.

In simple terms, one can say that animal cells do not need the cell wall because a skeleton or armor takes over their protective function and gives the animal its necessary stability. The cells of plants and animals also differ from one another in other ways. Animal cells, for example, have no chloroplasts.

Whodunit?

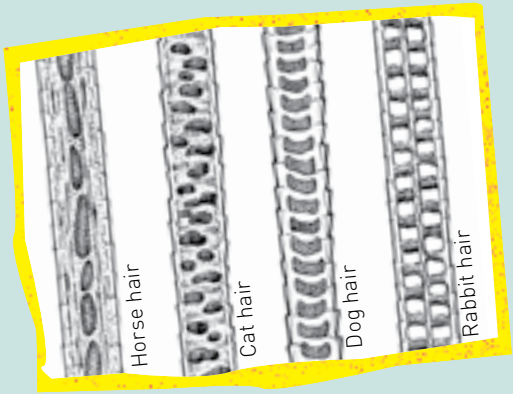
Solving mysteries with the microscope

Detectives on the Trail

The fridge has been raided! But who was the hungry perpetrator? Collect traces, such as hair or threads of fabric, at the crime scene, and take comparative samples from the suspects to solve the mystery.

EXPERIMENT 8

Fridge detective: Who stole the bacon?



You will need

- **Slides**
- **Cover slips**
- **Pipette**
- **Sample containers**
- **Tweezers**
- *Water*
- *Various hair and fiber samples (from around your home)*
- *Small resealable plastic bags*
- *Permanent marker (for identifying the bags and slides)*

TIP

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.

Here's how

1. Collect hair and fiber samples that you find around your home and keep them in your sample containers. Then pack a hair or thread from the pretend suspect's clothing in a bag as a reference sample and label it.
2. Label the slides to match your samples. Then use the pipette to place a drop of water in the center of each slide.
3. Set the hairs or fibers in the water droplets, place a cover slip on top of each, and study the samples using the lowest-power objective lens. Then try the lens with medium magnification power, followed by the one with the greatest magnification power, which will let you see the fiber structures most clearly.

Human hairs

EXPERIMENT 9

On a "carpet safari" in your house dust

House dust mite

You will need

– Slide
– Cover slip
– Pipette
– Tweezers
– Water
– Sheet of white letter-size paper
– Sample from the vacuum cleaner
– 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 groups.
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.

KEYWORD

HOUSE DUST MITE

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.

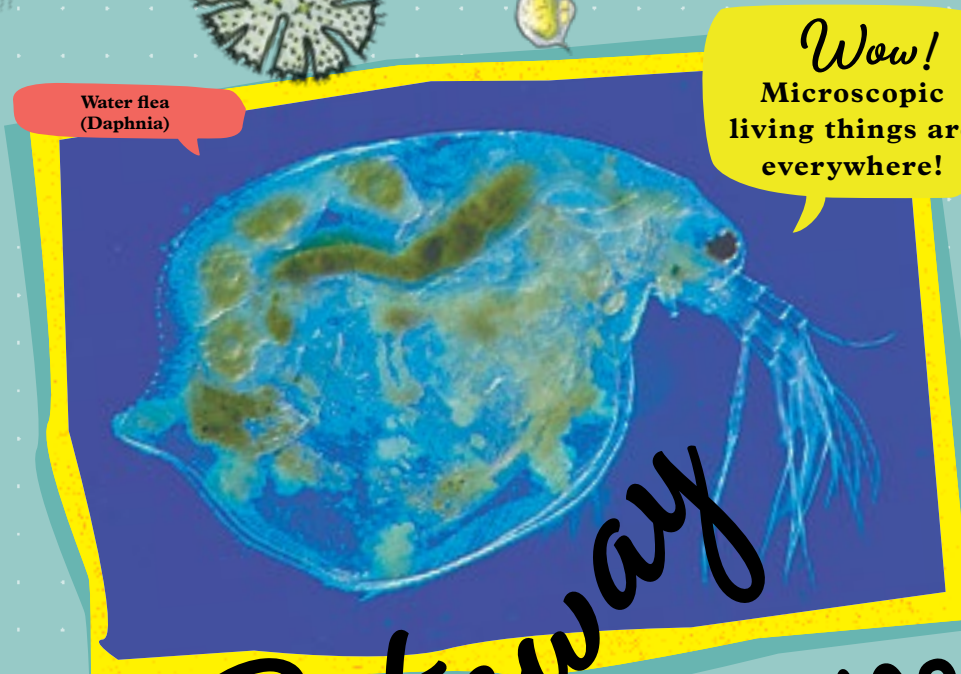
CHECK IT OUT

THE SKIN FLORA

There are scientists who claim that the number of microorganisms living on and inside a human body is greater than the number of all of the body's cells. Collectively, all of these microorganisms, which include bacteria and fungi, are known as the **skin flora.** But don't worry! These little "roommates" are a natural part of the surface of healthy skin. Almost all of these living things are not harmful to us. In fact, many of them even help protect us from harmful pathogens. And in any case, our body possesses a lot of defense mechanisms against any microorganisms that might cause diseases or otherwise be out to harm us.

How many legs DO YOU HAVE?

The close biological relationship between mites and spiders is suggested by the number of legs they each have. Under the microscope, you can see that mites have eight legs, like spiders. Along with scorpions, spiders, and ticks, mites belong to a family known as arachnids. True insects, by contrast, have just six legs.

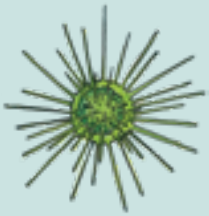


Gateway to the Microcosmos

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.

EXPERIMENT 10

Fishing for pond creatures

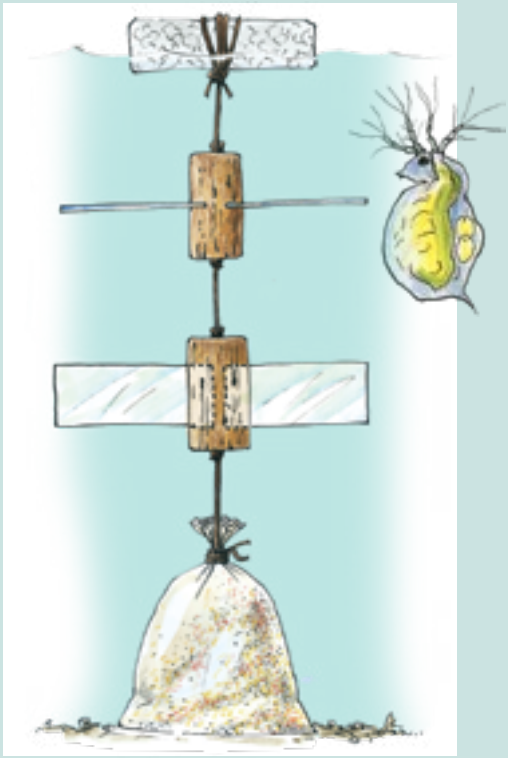


You will need

– 4 Slides
– Cover slip
– 2 Corks (from bottles)
– Pocket knife
– String
– Plastic bag of sand or pebbles
– Piece of expanded polystyrene foam
– Waterproof pen for marking your slides
– Hand drill

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.



WARNING! 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.

CHECK IT OUT

Diatoms

Volvox algae

Paramecium

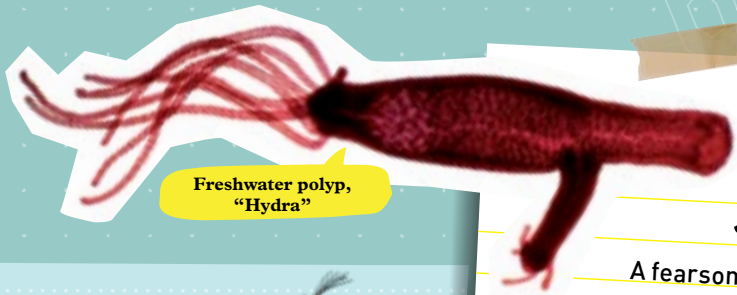
THE AMAZING CREATURES YOU CAN FIND IN POND WATER

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.

CHECK IT OUT

What's living in the pond?

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.



Freshwater polyp, "Hydra"

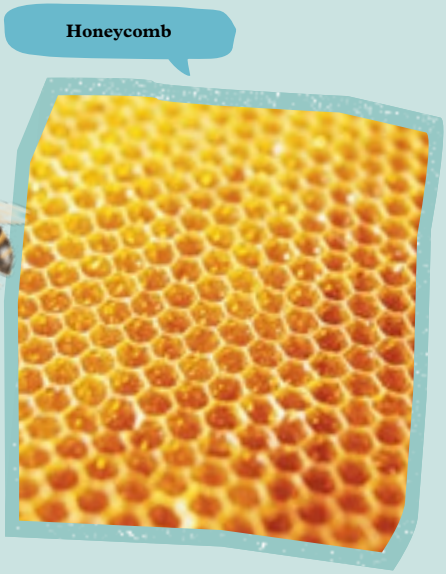
THE DREADED *Hydra*

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. It would be quite scary to humans if it were a lot bigger! While some **polyps** are visible with the naked eye — some are up to 2.5 cm (1 inch) long — their prey are so small that they can only be seen under the microscope.

HOW TO EXAMINE YOUR WATER SAMPLES

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.

Hunting for pollen in a honey sample



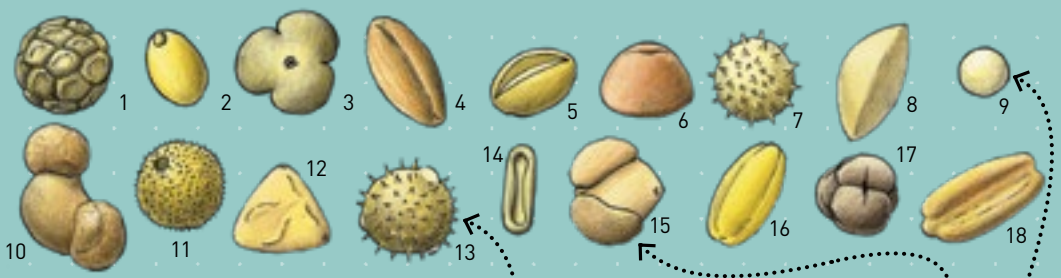
You will need

- **2 Slides**
- **2 Cover slips**
- **Pipette**
- *Water glass, teaspoon, flat saucer, natural honey (ordinary quality from the supermarket), permanent marker (for marking the slides), 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.

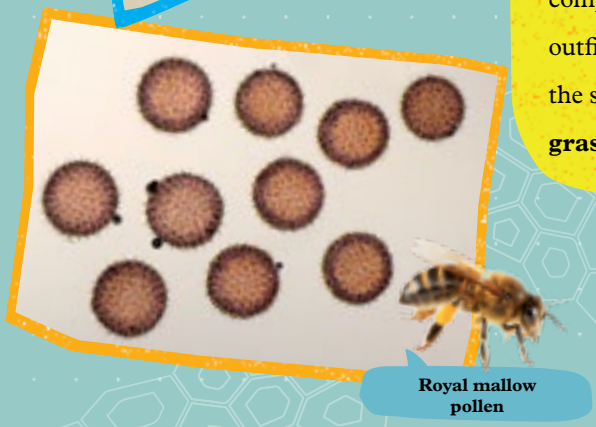
CHECK IT OUT



Pollen comes in all shapes and sizes:
1. acacia; 2. cuckooflower; 3. maple tree;
4. oak tree, 5. dead-nettles, 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.

Pollen

All seed-forming plants produce **pollen.** It is a powdery substance that plays a critical role in the plant reproduction process. Pollen consists of many tiny components called **pollen grains.** They are usually 10–100 µm (micrometers) in size — that is 0.01–0.1 mm. Their shapes and surface structures can be very different from one another. The round, prickly pollen of a **sunflower,** for example, looks completely different from the air-sac-outfitted pollen grain of a **pine tree** or the smooth, small pollen grain of a **grass plant.**



CHECK IT OUT

POLLEN AND Bees

Attracted by fragrant, sugary nectar, honeybees fly from flower to flower in the spring and summer. They collect the nectar to make honey from it. When a honeybee lands on a flower, some pollen sticks to its fuzzy body. The honeybee appears to be covered in **yellow powder** from head to toe after visiting a flower with a lot of pollen.

Some of the pollen that is coating the honeybee then rubs off on the next flower that the honey visits. In this way, the honeybee **pollinates** the flower.

Many plants depend on bees for pollination and cannot reproduce without them. The remaining pollen makes it back to the beehive together with the bee. There, it is used as food for the bee larvae. A few pollen grains end up in honey — and thus on your breakfast toast, in your tea, or even under your microscope!

POLLEN GRAINS — FLOWERS' FINGERPRINTS

Honey often contains pollen from a variety of plants that are attractive to bees in fields, forests, and meadows. The pollen grains in honey can provide information about which flowers were visited by the bees that produced the honey.

In your **honey sample,** you can see different shapes and structures of the pollen under the microscope. By comparing it with the pictures, you may even be able to check whether the honey actually comes from the sources stated on the label. In the scientific world, there are actual **pollen grain specialists** who use a microscope to examine the pollen compositions of a wide variety of samples to determine, among other things, which country a honey sample comes from.

Project Manager: Dr. Mark Bachofer, Christina Wirtz
Concept and Original Text: Jan Haller
Technical Product Development: Linda Kiegel, Hanna Augustin
Manual Style Guide: Atelier Bea Klenk, Berlin
Layout and Design: Michael Schlegel, komuniki, Würzburg
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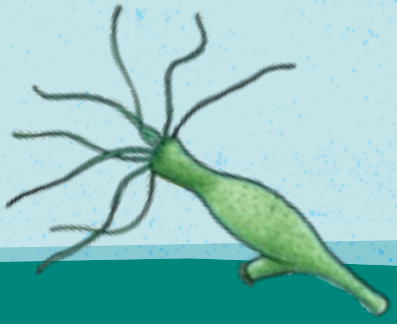

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