

E·C·P·L·E·R·E
ONE

Where Learning Meets Fun



EXPERIMENTS BOOK



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Experiment Instructions

WARNING!

- Keep chemicals and corrosive liquids out of the reach of children.
- Do not ingest any chemicals.
- Wash your hands thoroughly with soap under running water after use.

Introduction

Here are a few tips about how to take a better look at the wonderful world of microorganisms and crystals. You will learn how to prepare your object so that you can look at it with the microscope. The numerous experiments described should make you curious and want to use your microscope more.

Objects to Observe

With a magnifying glass, you can look at non-transparent (i.e. opaque) objects like

small animals, parts of plants and tissues. When you use a magnifying glass, light falls onto the object and is reflected back through the magnifying lens and into your eye. With your microscope, however, you can observe transparent objects. The light from the lamp goes through the opening on the stage and through your prepared specimen. Then, it passes through the objective, the body of the microscope, and the eyepiece, and travels into your eye. In this way, the microscope is only meant for observing transparent objects. Many microorganisms in water, parts of plants, and the tiniest animal parts are naturally transparent. To observe opaque objects under the microscope, we must make them transparent. We can make them transparent through a treatment or penetration with the right materials (media), or by taking the thinnest slices from them (using our hand or a specimen slicer), and then examine them. Below you'll find out how to do this.

How to Produce Thin Specimen Slices

WARNING!

Only do this with an adult's supervision. Ask your parents to help you. As already mentioned, you need to get the thinnest slices possible from an object so that they are transparent and can be looked at under the microscope. First, get a candle and place it in an old pot, then heat it on the stove top until the wax becomes liquid. Now, use tweezers to dip the object in the liquid wax a few times. Be careful, the wax is very hot! After each dip, allow the wax to harden before you dip the object into the wax again. When the wax around the object has hardened completely, you can use the specimen slicer to cut it into thin slices. Place these slices on a slide and cover them with a cover slip.

The Production of Specimens

There are two basic types of specimens: permanent specimens and short-term specimens.

Short-term Specimens

Short-term specimens are produced from objects that you want to look at, but don't want to keep in your specimen collection. These specimens are only meant to be observed for a short period of time, after which they are disposed of. For short-term specimens, place the object on the slide and place a cover slip on top of it. After looking at the object, clean the slide and cover slip, disposing of the specimens. One of the secrets of successful observation with a microscope is the use of clean slides and cover slips. Spots or stains will distract you when looking at an object.

Permanent Prepared Specimens

Permanent prepared specimens are produced from objects that you would like to look at again and again. The preparation of dry objects (e.g. pollen or the wings of a fly) can only be done with special glue. You'll find such glue at a local hobby store or online, identified as "gum media." Objects that contain liquid must first have the liquid taken out of them before they can be prepared as permanent specimens.

How to Prepare a Dry Object

First, place the object in the middle of a clean slide and cover it with a drop of glue (gum media). Then place a cover slip on top of the object and glue. Lightly press the cover slip so that the glue spreads to the edges. Let the specimen harden for 2-3 days before observing it.

How to Prepare a Smear Specimen

For a smear specimen, place a drop of the liquid to be observed (e.g. water from a puddle in the forest) on the end of the slide using the pipette included or an eyedropper. Then smear the liquid across the slide with the help of a second slide. Before observing, let the slides dry together for a few minutes.

Experiment 1:

Black and White Print
Objects

1. A small piece of paper from a newspaper with a black and white picture and some text.
2. A similar piece of paper from a magazine with color pictures and text.

In order to observe the letters and the pictures, produce a short-term slide from each object. Now, set your microscope to the lowest magnification to look at the specimen from

the newspaper. The letters on the newspaper look frayed and broken, since they are printed on raw, low-quality paper. Now look at the specimen from the magazine. The letters on the magazine specimen look smoother and more complete. The pictures in the newspaper are made up of many tiny dots, which appear slightly smudged. The halftone dots of the magazine picture are clearly defined.

Experiment 2:

Color Print

Objects

1. A small piece of color-printed newspaper
2. A similar piece of paper from a magazine

Make short-term specimens from the objects and observe them with the lowest magnification. The colored halftone dots of the newspaper often overlap. Sometimes, you'll even notice two colors in one dot. In the magazine, the dots appear clear and rich in contrast. Look at the different sizes of the dots.

Experiment 3:

Textile Fibers

Objects

1. Threads from various fabrics (e.g. cotton, linen, wool, silk, rayon)
2. Two needles

Place each thread on a separate slide and fray the samples using the two needles. Next, wet the threads and cover them each with a cover slip. Set the microscope to one of the lower magnifications. Observe each slide in turn. Cotton fibers come from a plant and look like a flat, twisted ribbon under the microscope. The fibers are thicker and rounder at the edges than in the middle. Cotton fibers are basically long, collapsed tubes. Linen fibers also come from a plant, and they are round and run in one direction. The fibers shine like silk and exhibit many bulges along the length of the thread. Silk comes from an animal and is made up of solid fibers that are small in diameter, in contrast to hollow plant-based fibers.

Each fiber is smooth and even and looks like a tiny glass tube. The fibers of the wool also come from an animal. The surface is made of overlapping sleeves that look broken and wavy. If possible, compare wool from different weaving mills. In doing so, take a look at the different appearance of the fibers. Experts can determine which country the wool came from by doing this. Rayon is a synthetic material that is produced by a long chemical process.

All the fibers have solid, dark lines on the smooth, shiny surface. After drying, the fibers curl into the same position. Observe the differences and the similarities between the different types of fibers.

Experiment 4:

Table Salt

Object - Common table salt

Place a few grains of salt on a slide, and observe the salt crystals with the lowest setting of your microscope. The crystals are tiny cubes and are all the same shape.

Experiment 5:

Production of Salt Crystals

Objects

1. Table salt
2. A graduated cylinder filled halfway with warm water to dissolve the salt
3. Cotton thread
4. Paper clips
5. A matchstick or pencil

Add salt to the water until the salt will no longer dissolve. You now have a saturated salt solution. Wait until the water has cooled. Attach a paper clip to the end of the cotton thread. The paper clip serves as a weight. Tie the other end of the cotton thread into a knot around the match, and dip the end with the paper clip in the salt solution. Place the match horizontally on top of the graduated cylinder, which prevents the cotton thread from slipping all the way down into the graduated cylinder. Now, place the graduated cylinder in a warm place for 3-4 days.

If you take a look at the glass after a few days under the microscope, you can see that a little colony of salt crystals has formed on the cotton thread.

Experiment 6:

Raising Brine Shrimp

Objects

1. Brine shrimp eggs (at your local hobby store)
2. Sea salt (if included)
3. Hatchery (if included)
4. Dry-powdered yeast (if included)

WARNING! The shrimp eggs and the shrimp are not meant to be eaten!

Artemia salina are a species of shrimp typically found in salt lakes, bodies of water with a higher salinity than even the ocean. During a drought, a salt lake can become a hostile habitat for organisms, and entire populations of *Artemia salina* sometimes die off. During drought conditions, to ensure that the species

will repopulate the salt lake when the drought ends, *Artemia salina* lay thick-shelled eggs called winter eggs that can survive for up to ten years in a dormant state. Winter eggs can withstand heat, cold and chemicals. These eggs hatch when favourable conditions return to their ambient environment.

Incubate Your Brine Shrimp

To hatch the shrimp, create a solution with an appropriate salinity and temperature. First, fill two containers (any household container will work) with a half litre of freshwater, and let them both stand for about thirty hours. Next, pour half of the provided salt into one container and stir the solution until the salt dissolves. Pour some of this solution into the prawn hatchery. Place a few eggs close to the lid. Position the hatchery somewhere with plenty of light, but not in direct sunlight. The ambient temperature should ideally hover around 77 °F. As water in the hatchery evaporates, gradually add fresh water from the second container.

After two to three days, the eggs will hatch prawn larvae, called *nauplii*.

Observe Your Brine Shrimp

The animal that hatches from the egg is known as a *nauplius* larva. With the help of a pipette (or an eyedropper), you can place a few of these larvae on a glass slide and observe them. The larvae will move around in the salt water by using their hair-like appendages. Take a few larvae from the container each day and observe them under the microscope. Remember to return them to their container when you're done observing them. In case you've hatched the larvae in a hatchery, simply take off the cover of the tank and place the tank on the stage. Depending on the room temperature, the larvae will be mature in 6-10 weeks. Soon, you will have raised a whole generation of brine shrimp, which will constantly grow in numbers.

Feed Your Brine Shrimp

Feed your brine shrimp often to keep them alive. The best food is dry-powdered yeast. Give them some every other day. Be careful not to overfeed them, as doing so can cause the water to stagnate and poison the shrimp. If the water does begin to stagnate (you'll see it darkening), transfer the shrimp to fresh salt water solution.

Experiment 7:

Observing Stem and Root Sections
Objects

1. A celery stalk
2. A carrot

Cut several very thin slices from the middle of the celery (a stem) and from the middle of the carrot (a root). Make a wet mount by placing a drop of water on the slide. Then put the specimen on the water-covered slide, and top it with a cover slip. The water will help support the sample. It also fills in the space between the cover slip and the slide.

Start by viewing the specimens at the lowest magnification, and then increase the magnification for more detailed observation. What differences are there between the stem and the root?

Experiment 8:

Observing Cork Cells

Object - A small cork

With an adult's supervision, cut a very thin slice from the cork. The thinner you cut the slice, the better you'll be able to observe it. Prepare a wet mount of this cork slice as you did with the celery and carrot in Experiment 8. When applying the cover slip over the slide, the water, and the cork, make sure no air bubbles are trapped beneath it. Begin observing the specimen with the lowest power, and increase the magnification as desired. The cells you see, called lenticels, are actually the air pockets that are left after the plant material inside has died.

Experiment 9:

Observing Leaf Cells

Objects - A fresh leaf, clean and dry, without holes or blemishes

With an adult's supervision, cut a one-inch-wide cross section out of the center of the leaf from one side of the leaf to the other.

Tightly roll that section up, starting from one uncut edge of the leaf. The central vein of the leaf will be in the center of the roll and not be visible. Then cut several very thin slices off of one end of the roll. The central vein will be in the middle of this almost transparent slice. You'll be observing the cells around that central vein. Using a droplet of water, make a wet mount (as in Experiments 8 and 9), placing the leaf segment so that the inner part faces up. Start with the lowest power, and gradually increase the magnification for more detail. What do you observe about the leaf cells?

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