

Micro-Explorations Science & Nature Project

Ages: 5–13 (K–Grade 7)

Duration: 30–45 minutes

Materials and tools needed:

- Something to use as a microscope, for example:
 - Magnifying glass
 - Loupe
 - "Third hand"
 - Google Cardboard
 - Binoculars
 - Old pair of reading glasses
- Something to look at through a microscope, for example:
 - Flowers and plants
 - Soil
 - Insects
 - Vegetables
 - Water samples from outside
- Cardstock paper or index card
- Scissors
- Plastic wrap
- Tape
- Paper
- Pencil / colored pencils / crayons



Part 1: Background

There is life all around you, but it's almost all far too small to see. The most common living things on Earth are **microorganisms**—things you need a powerful microscope to spot. Some living things are big enough to see, but just barely. Even living things that are big enough to see have intricate parts and details that **magnification** can help you discover. Magnifying them helps you appreciate some of the complexity of life.

This activity is about finding—or making!—a magnifier, and then exploring the living world at a level smaller than can be seen with the eye alone.

You probably won't be able to see individual **cells** with this project, and some things (like the infamous coronavirus) are so small that a refrigerator-sized microscope, called an electron microscope, is needed to see them. We'll be sticking with tools you can easily hold in your hand.



Part 2: Activity

Step 1a: Find a scope.

Most of us don't have actual microscopes in our homes. If you do have one, great! If not, there are other things you may have in your house that could be used as simple magnifiers. Some things you can use as a magnifier are:



Magnifying Lens: Small lenses like this are often found in science project sets, or come with kits for raising butterflies or keeping ants at home. Look through old bags of party favors—that's where this one was found!



Loupe: This is a specialized magnifier that is made to rest on the surface you are examining. The clear skirt lets in light from the side.



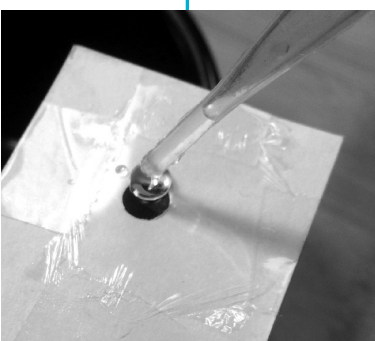
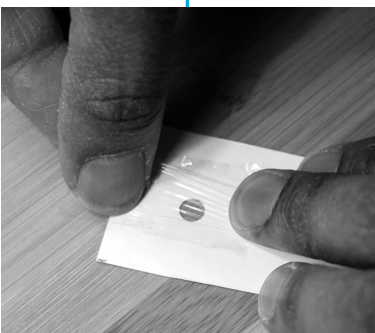
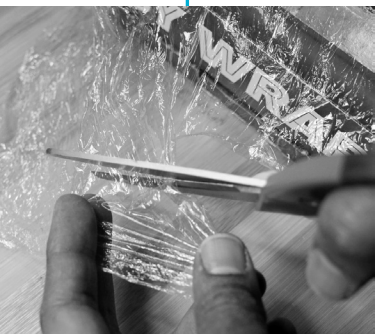
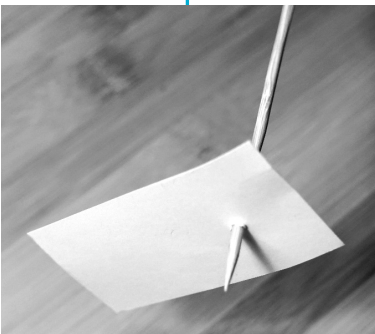
“Third Hand”: Look in your toolbox for a “third hand.” These are used by electronics hobbyists and makers of miniature models. It's called a “third hand” because of the attached clips, which can be moved into various positions and secured there. It's for all those times you wished, in the middle of some intricate task, that you had an extra hand to help you hold something.



Google Cardboard: Maybe you have one of these lying around. The **convex** lenses are intended to focus the wearer's eyes on the screen of an inserted smartphone. They are also good magnifying lenses. Just leave the back open to let in light, hold the specimen in front of one eye, and close the other.



Binoculars: Turn the binoculars the wrong way around, put one eye (not both) up to the “wrong side,” and hold the other end close to your specimen. The image is heavily distorted, but with some patience you can get amazing magnification.



Step 1b: Make a Water Microscope (Optional)

If you don't have a microscope, mini magnifying lens, loupe, "third hand," Google cardboard, or binoculars, you can make a magnifier yourself! Remember, in order to work as a magnifier, a lens has to be clear, and it has to have a convex shape, so it can focus light to a point.

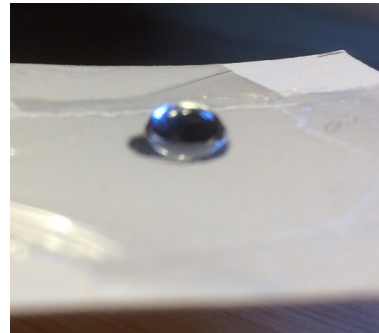
Under the right conditions, water will work! Clean liquid water is transparent, and it can refract, or change the path, of light. You may have noticed this when trying to see something on the bottom of a fountain or pool—the image is bent and wavy.

As far as being the right shape, water is always trying to pull itself into the roundest shape possible. This shape will focus light to a point. A small drop of water on the right kind of surface will naturally take the shape of a magnifying lens.

Follow the directions below, and you can make a microscope similar to the very first microscopes ever made, which had a single, thick glass lens.

Materials and tools needed:

- Cardstock or index card
- Scissors
- Hole puncher or skewer
- Plastic wrap
- Tape
- Eyedropper
- Water



Procedure:

1. Cut a piece of cardstock or an index card a few inches on a side.
2. Punch or poke a hole in the card.
3. Cut a piece of plastic wrap about 1" square.
4. Put tape on one side of the wrap, and attach it to the card so the wrap (not the tape) covers the hole.
5. Stretch the plastic tight over the hole, and secure all sides with tape.
6. Using an eyedropper or heavy needle, carefully place a drop of water, centered on the hole, on top of the plastic wrap.

To use your water microscope, hold the card flat, let light under the side of the card nearest the hole, and put your eye close to the drop.

Step 2: Explore objects with your magnifier.

Start off your exploration by examining items like these close up:

Salt, starch, flour, sugar, yeast: They look very similar to the naked eye. Now examine them with your magnifier. What shape are the different grains? Which one is the brightest white? Which ones are clear and which are opaque? Only one of these is not from a living thing. Can you tell which one?

Spices: Spices generally come from plants. Some are dried and ground up, but some are just dried. These will say “whole” on the jar. Examine some whole spices, like cloves or peppercorns. What part of the plant do you think that spice came from?

Broccoli and cauliflower: The part of these plants that most people eat is the bumpy part, called a crown. Take a look at the crowns with your magnifier. Do you recognize what part of the plant these “bumps” are?

Mushrooms: Look at the undersides of the caps. The thin sheets on the underside are called gills. Dust-like mushroom spores are released from the gills, although you probably won’t find spores in store-bought mushrooms.

If you can’t get outside right now, here are some places to look for living things in your house:

Houseplant: If there’s something like an insect or spider crawling around on your houseplant, that doesn’t mean your house is over-run. It may have come into the house when you got the plant, or come in through a window. You can also look at the soil in the pot for hitchhiking bugs, or for other plants that have taken root.

Windowsill: Sometimes you can find insects that are either trying to get out, or trying to get in your windowsills. Don’t try to examine wasps or bees!

There are more possibilities outdoors:

Brick walls, tree trunks, rocks: Look for lichens and mosses growing on these. These are intricate, miniature communities of plants, fungi, and animals. Because they are so complex and grow slowly, don’t remove them from what they’re growing on, unless they would have been removed anyway.

Leaves: Lots of tiny insects like to avoid direct sunlight (and predators) by hiding on the undersides of leaves.

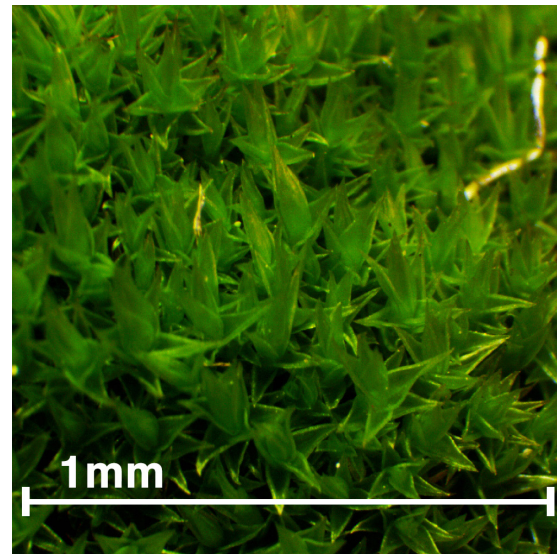
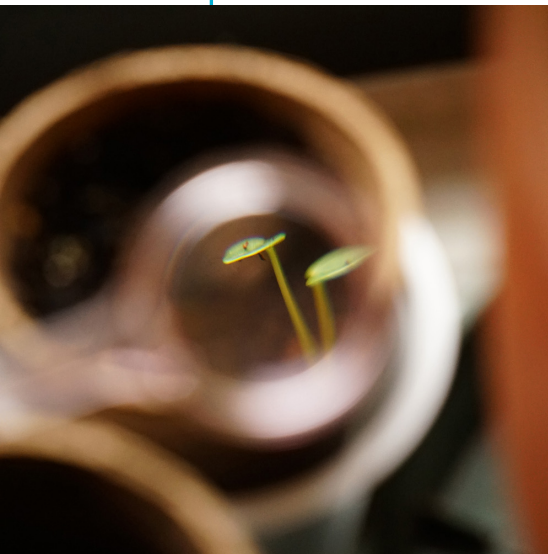
Where plant stems meet: This is another good place to hide from predators. These are also spots that collect water, and hold on to it long after it rains.

In or under bodies of water*: Water removed from the edge of a small pond, a stream, a riverbank, or a tidal lagoon can be teeming with life.

***CAUTION:** Keep in mind that getting to and from the water's edge might be dangerous, so make sure that an adult is with you when you collect your sample. Although almost everything in the water is harmless to you, there are some things you don't want to get in your mouth, or leave on your skin. So make sure you wash your hands afterward.

Step 3: Draw what you found and show the world!

Draw what you found with your magnifier, then take a picture and post it to Instagram using the hashtags #MuseumFromHome and #MicroExplorations, and tag the Hudson River Museum. We can't wait to see your discoveries!



Part 3: Glossary

Cells: The “building blocks” of living things. Every cell contains a set of life-instructions (genes) so it can perform its function within the living thing.

Convex: Curved outward, so it is thicker at the middle than on the edges.

Gills: Not the kind on fish. These are paper-thin sheets under the cap of a mushroom. The source of mushroom **spores**, which are how mushrooms make more mushrooms.

Lichen: A structure made by a community of microorganisms and fungi. They are often found in areas with little direct sunlight, alongside mosses, and usually attached to rock or tree bark.

Magnification: Making very small things look bigger so they can be seen by the eye.

Microorganisms: Living things so small they cannot be seen at all without a microscope or magnifying lens.

Mosses: Plants that grow in small, dense masses, with tiny, thin leaves. They are often found in areas with little direct sunlight, alongside lichen, and usually attached to rock or tree bark.

Opaque: Opaque objects and materials prevent light from passing through them.

Predators: Animals (of whatever size) that catch and eat other animals.

Refract: To bend the path of a beam of light as it passes through a clear (transparent) material. Different colors bend more or less, and not all transparent materials will bend light the same way.

Tidal basin: Found in some places along the Hudson River that are underwater at high tide and exposed (but still saturated with water) at low tide.

Virus: A tiny package of life-instructions which is wrapped in a protective coat. All the virus’s life-instructions do is take over a cell and make it produce more copies of the virus.