DIY Science – Laser Microscope

Build a microscope with over 200 times magnification, using a laser pointer and a syringe.

Safety

When doing science activities outdoors, wear sun protection and comfortable, closed-in shoes. Beware venomous creatures such as spiders, snakes, and wasps. Always treat the natural environment with care and try to leave it as you found it. Take care to avoid falling into open waterways. Wash hands after handling water samples.

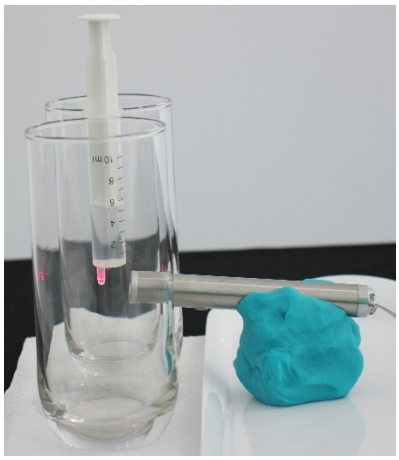
A laser pointer is not a toy and must only be used under direct adult supervision. Avoid shining the laser beam at a person or at reflective surfaces. Never stare into a laser beam. This activity works well with low power laser pointers, Class 1 or 2, with less than 1mW power output.

What you need

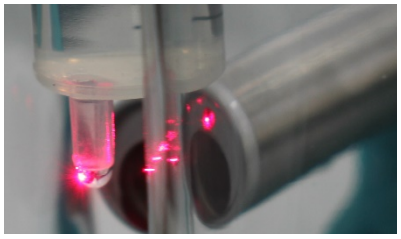
Darkened room, 3 or more clean jars for collecting water samples, laser pointer (Class 1 or 2), plastic syringe, 2 tall glasses, paper towel, white cardboard or a blank wall for projecting an image, and household objects for holding the laser pointer in place (for example, play dough, a stack of books, or a camera tripod).

What to do

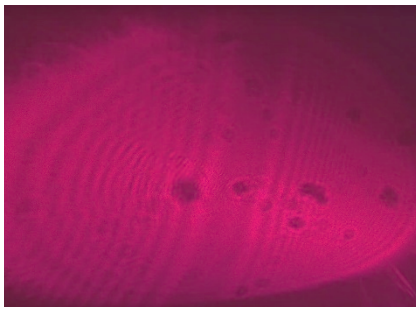
1. You will be making a microscope to look for living things in water. Collect water samples from a few separate locations. For example: a fishpond, creek, estuary, or bird bath. Collect about 50 ml of each sample in a clean jar and keep the water samples in a safe place while you make the microscope.
2. Before making the room dark, set up the microscope rig so you can see what you are doing. The laser microscope is made up of the laser pointer held in a stable position with the beam of laser light aimed at a single drop of water. The drop of water is suspended from the syringe. The rig in the photograph has two tall glasses supporting the syringe and the laser pointer held in position by a lump of play dough. The laser is pointing at a plain, white wall which acts as a projection screen for the microscope.



3. Take one of the water samples and suck a few millilitres of water into the syringe. Put the syringe in place with some paper towel underneath to catch any drops and carefully squeeze down the plunger until a single drop of water is suspended from the tip of the syringe.
4. Position the front of the laser pointer about 1-2 cm from the drop of water and adjust the direction of the laser beam until it is aiming at the drop of water. It can take some time to get the position right and you might need to make some changes to your rig to get the laser beam in the ideal position.
5. Darken the room and make tiny adjustments to the position of the laser pointer until you can see a projected image of the water drop. If you are lucky, you might see the shadows of tiny living things straight away! If not, try making some more adjustments to the rig, or use a different water sample. Take care to rinse the syringe thoroughly between different water samples.



For each water sample, make notes on what you see, using the table below. There will be a lot of movement in the water drop and this makes it difficult to take a photograph of the image, but video is an excellent way of recording the results. After looking at all of the water samples using the laser microscope, rinse the syringe and fill it with plain tap water. Look at the tap water using the laser microscope and compare the results with the water samples.



What's happening?

A microscope works by using lenses to magnify an image. In this microscope, the drop of water acts as the lens. As the laser light passes through the drop of water, the light is bent (refracted) as it enters and leaves the round water drop. Any tiny living things in the path of the light block some of the laser light, creating shadows.

Water in natural or artificial waterways is teeming with plant and animal life. In your samples, you might see a few different living things. Round cells drifting around in the water could be algae or other single-celled organisms. You might see larger living things, such as microscopic animals swimming around in the drop of water.

Results

Record descriptions of what you see in the magnified image of each water sample. You might like to include some drawings. Look at the first link under 'Find out more' below to help identify what you see.

Water sample location	Description of objects in the magnified image of the water sample For example, drifting objects, moving organisms, size and number of organisms
1	
2	
3	
Tap water	

Did you know?

Chlorine was first added to drinking water in the late 1800s to kill living organisms to make water safe to drink. Not all organisms in water are dangerous, but viruses and bacteria in water can lead to the spread of diseases, such as typhoid, cholera, and polio, if they are not removed from drinking water.

Find out more

- Explore images of microscopic organisms in pond water: https://rsscience.com/microscopic-organisms-pond-water/
- Zoom in to see the amazing detail in a butterfly wing and other samples with the MyScope Explore online resources from Microscopy Australia: https://myscope-explore.org.au/index.html
- Discover how the World Health Organisation is working to improve access to safe drinking water: https://www.who.int/news-room/fact-sheets/detail/drinking-water