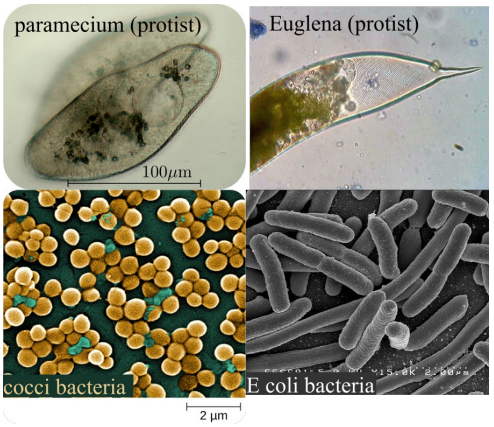
Names: _____, _____, _____, _____, _____
Plate Label: _____

Microbes: Living creatures all around us

- **Microorganisms** are tiny living creatures – single cells that are too small to see.
- Like all living things, they grow and divide. Many can swim or crawl.
- Microbes are found everywhere. Some can make us sick, but others are helpful: they help plants grow, make cheese, or help us digest food.



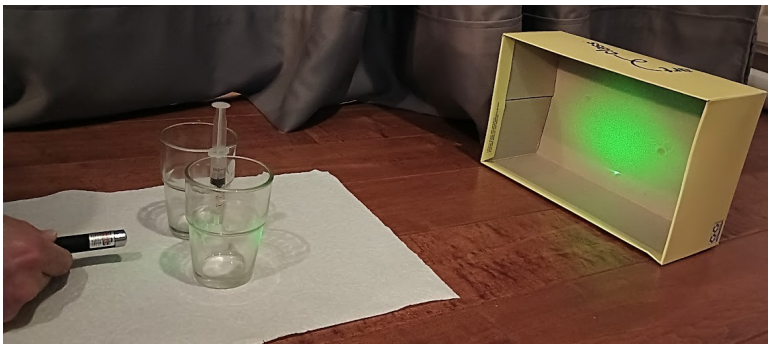
Part 1 : Seeing microorganisms

You will make a very simple microscope to see microbes in a drop of pond water.

1. Draw some pond water into a syringe
2. Hang the syringe tip-down between the rims of 2 cups. Place a bottle cap below the tip.
3. Push down the plunger gently until a drop of water hangs from the tip.
4. Place a shoebox (or lid) sideways 1-2 feet away from the syringe setup
5. Use a green laser pointer to shine a beam of light through the drop of water to fall on the shoebox "screen". You will have to experiment with alignment. You can tell you've got it right when the laser makes a spread out green patch on the back of the shoebox.

Safety warning:
Laser pointers can cause eye damage.
Shine them **only** on the shoebox.

Discuss: What do you see?



Circle below:

Are the spots you see: staying still or moving?

Look at spots near each other. Do they tend to:

move in the same direction or move independently?

Do you think most of the spots you see are: alive or not alive

Discuss: what makes you think most of the spots are alive or not?

Do you see some spots that are alive? Yes No

(you might need to be patient)

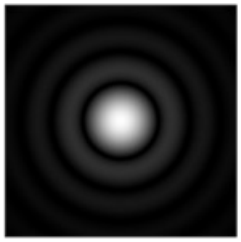
Discuss: how do you know?

Why could you not see all these spots with your naked eye?

The pond water contains both specks of dirt and live **microorganisms** that swim around. They are too small to see with your naked eye. The curved drop of water acts like a **lens** on a magnifying glass or microscope, making an enlarged image for you to see.

Draw one of the spots you see:

The circles around each spot are called a **diffraction pattern**. Striped patterns like this are formed whenever light passes around a tiny obstacle, one that is not much bigger than the wavelength of the light itself. The smaller the object, the wider the circles. This is why we can see microbes with a light microscope but we can't see individual molecules.



Airy diffraction pattern

Part 2: Growing Bacteria

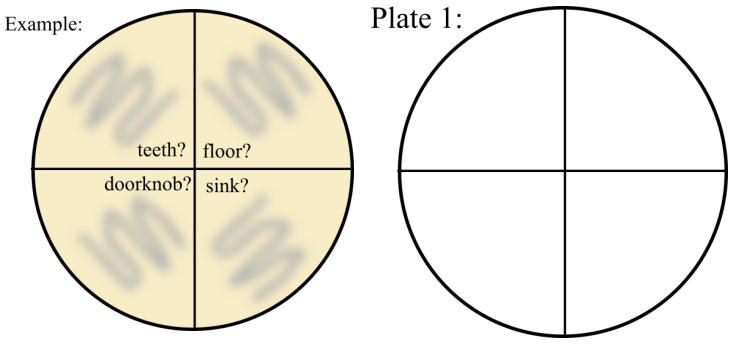
You will grow some of the smallest living organisms: bacteria.

1. Flip the agar plates upside down. Use a marker to divide each plate into 4 sections. Make sure the label letter written on your plate matches the one on your worksheet.

2. Decide on 4 surfaces that you will swab for bacteria. For example: someone's teeth, bottom of your shoe, a door handle, …

3. Write a short label (one word) in the corner of each section of the plate. In the "Plate 1" diagram , write down where each swab will come from.

4. Wet a q-tip by pouring a little clean water over it. Then rub the tip on the desired surface.



5. Lift up the well of the agar plate and streak (zig-zag) the q-tip on the specific section of the agar, rolling it around as you go. Do not break the agar surface.

6. Repeat for the other three sections. Use a **clean** moist q-tip for each section.

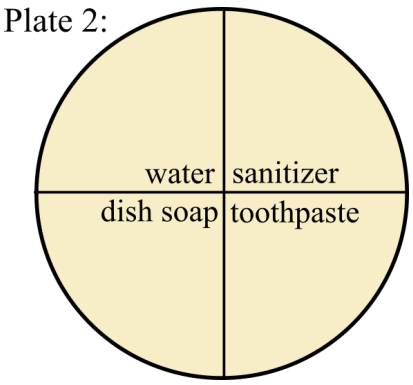
The agar contains all the food bacteria need to grow and divide. By transferring bacteria to them from different surfaces, you may be able to start some bacterial **colonies** growing. We will bring back your agar plates next week and see what grew!

Make some hypotheses:
Which surface do you think has the most bacteria? _____
Which do you think has the least? _____

Part 2: Killing Bacteria

Let's make a 2nd plate to test how well some hygiene products kill bacteria.

1. Label a second agar plate in four sections as shown: (water, sanitizer, dish soap, toothpaste)



2. Collect bacteria using clean q-tips from someone's teeth. Use the same person for all four sections.
Discuss: Why do you think you should use just one person's teeth?

3. Tear a little piece of paper towel and dip it into each of the liquids: water, hand sanitizer, dish soap, toothpaste. Place the piece on top of each of the four sections where you streaked bacteria.

Make a hypothesis:
Which section do you think will have the least bacterial colonies forming around the piece of soaked paper towel? _____

Science experiments usually involve a **control**, where you know what simple outcome is expected. The purpose of the control is to make sure the experiment is working correctly.

Which section of your plate is the control in this experiment? _____