

Water flea *Daphnia pulex*

Materials

- glass microscope slides with pre-prepared chamber of electrical tape
- plastic cover slips
- paper towels or tissue
- plastic pipette or dropper
- *Daphnia pulex* collected from a pond/stream or acquired commercially
- empty petri dish (optional)

Methods

1. Suck up some of the water containing *Daphnia* with the dropper or pipette and place in a plastic dish if available (if not, proceed to 3). This can be tricky for small children, but is fun trying.
2. Look at the *Daphnia* with a stereomicroscope if available.
3. Place the *Daphnia* (in a small drop of water) in the microscope slide with the preprepared tape chamber.
4. Gently place a coverslip on top of the *Daphnia* without pressing. The *Daphnia* should live for a while like this, as long as there is the right amount of water on the slide. View with 4x or 10x objectives and adjust focus carefully to see different features.

TIPS: Many features of the *Daphnia* are spectacular, but special attention should be paid to the beating heart, eyes and surface of the animal (where individual cells are clearly visible).

Daphnia are small, planktonic crustaceans, which are commonly called water fleas because of their swimming style. They live in various aquatic environments ranging from acidic swamps to freshwater lakes, ponds, streams and rivers. *Daphnia pulex* was the first crustacean to have its genome sequenced. Its genome contains 31,000 genes (8,000 more than humans) as a result of extensive gene duplication

Daphnia reproduce in the spring until the end of the summer by making only female offspring (asexual reproduction). When winter approaches or in drought conditions, some eggs develop into males that can fertilise the eggs (sexual reproduction). The fertilised eggs (called **winter eggs**) can stay alive for long periods of time until the environmental conditions improve (e.g spring) when they finally hatch.

Banana cells

Materials

- Unripe banana
- Microscope slides
- Cover slips
- Paper towels
- Lugol Solution
- Tooth pick
- Plastic pasteur pipette

Methods

1. Smear a little (less than the size of a sesame seed) of an unripe green banana on a microscope slide to rub the cells apart, or ask one of the children to do this.
2. Place a drop of Lugol solution on top of the banana smear.
3. Place a coverslip on top and remove the excess of solution with a tissue.
4. Place the slide on the microscope, with 4 x or 10x objective in position and find a field of view to show the cells. Then view at higher magnifications.

These cells contain **starch grains** that are stained by the common laboratory chemical - Lugol solution. Lugol solution is a solution of iodine and potassium iodide in water and it is used as an indicator test for the presence of starches, with which it reacts by turning a dark-blue/black. This solution, first made in 1829, is named after the French physician J.G.A. Lugol and is often used as an antiseptic and disinfectant.

Starches include the plant starches amylose and amylopectin and glycogen in animal cells. Lugol's solution will not detect simple sugars such as glucose or fructose; that's why unripe bananas are best for visualisation of starch granules.

Lugol solution is not hazardous, however, contact with skin and eyes should be avoided and the solution should not be ingested.

Elodea (pondweed) cells

Materials

- Glass microscope slides
- Plastic cover slips
- Paper towels or tissues
- Salt solution (6g salt in 100 ml of water or approx. 2 teaspoons salt in a cup of water)
- Elodea
- Water

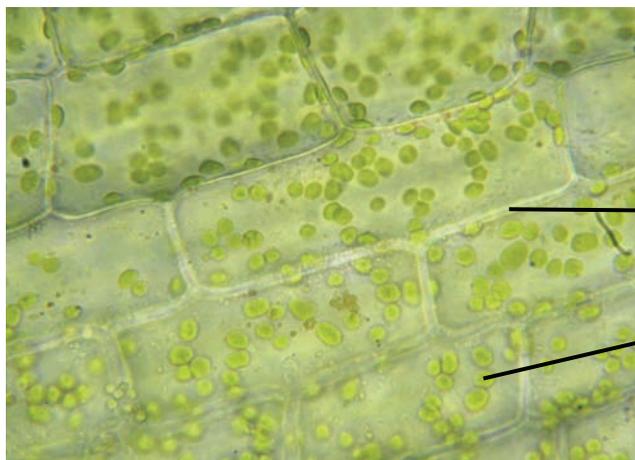
Methods

1. Pick off an entire healthy looking Elodea leaf, with fingers or small scissors and place it on the microscope slide.
2. Add a drop of water (hypotonic solution) and a coverslip and observe the chloroplasts (green structures) and the cell walls.
3. Add a drop of salt solution (hypertonic solution) to the side of the coverslip and observe the cell shrinking (optional).

When the salt solution is added, the salt ions outside the cell membrane cause the water molecules to leave the cell through the cell membrane causing it to shrink into a blob in the centre of the cell wall. The movement of water molecules is called **osmosis**.

Elodea is a genus of submerged aquatic plants used in aquariums. You should be able to buy this from pet shops. If not, you can purchase it from a school.

Elodea canadensis is a species that works well for this activity, because it has thin, straight leaves. However, most other species are satisfactory.



Cell wall

Chloroplast

Human cheek cells

Materials

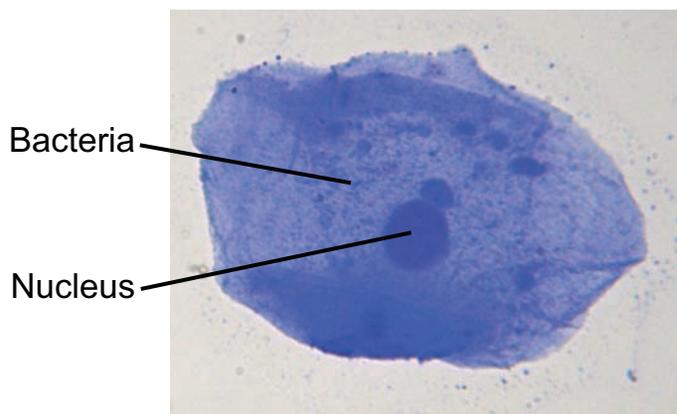
- Glass microscope slides
- Plastic cover slips
- Paper towels or tissue
- Methylene Blue solution (0.5% to 1%)
- Plastic pipette or dropper
- Sterile, individually packed cotton swabs

Methods

1. Take a clean cotton swab and gently scrape the inside of your mouth.
2. Smear the cotton swab on the centre of the microscope slide for 2 to 3 seconds.
3. Add a drop of methylene blue solution and place a coverslip on top. Concentrated methylene blue is toxic if ingested. Wear gloves and do NOT allow children to handle methylene blue solution or have access to the tube.
4. Remove any excess solution by allowing a paper towel to touch one side of the coverslip.
5. Place the slide on the microscope, with 4 x or 10 x objective in position and find a cell. Then view at higher magnification.

Methylene blue stains negatively charged molecules in the cell, including DNA and RNA. This dye is toxic when ingested and it causes irritation when in contact with the skin and eyes.

The cells seen are squamous epithelial cells from the outer epithelial layer of the mouth. The small blue dots are **bacteria** from our teeth and mouth.



Observing life from a pond

Materials

- Glass microscope slides
- Plastic cover slips
- Paper towels or tissues
- Samples of protists and/or volvox
- Plastic pipette or dropper

Methods

1. Place a drop of pond water or commercially bought Volvox or protozoa on a microscope slide with a pipette or dropper.

TIPS:

- Too small a drop may result in the specimens being crushed, so be prepared to make another slide if necessary.
 - Larger volvox can be prevented from being crushed using a **chamber made of tape**.
 - A stereomicroscope may be helpful to find organisms for transferring to a slide.
2. Place a coverslip on top and observe.

Protists or Protozoa are a diverse group of eukaryotic microorganisms. They often have little in common besides a relatively simple organisation: either they are unicellular, or they are multicellular without specialised tissues (e.g. Volvox).

Many protists are photosynthetic and are vital primary producers in ecosystems, particularly in the ocean as part of the plankton (*phytoplankton*). Other protists, such as the Kinetoplastids and Apicomplexa, are responsible for a range of serious human diseases, such as malaria and sleeping sickness. Please find attached supplemental information on pond life.

Watching bread yeast make bubbles

Materials

- Bowl
- Warm water
- Active dry bread yeast
- Sugar
- Balloon
- Bottle
- Tooth Pick
- Glass microscope slide
- Plastic cover slips

Methods

1. Put a pack of yeast in a bowl.
2. Add warm water and 2 tablespoons sugar and mix with a spoon.
3. Transfer the mixture into a bottle.
4. Place a balloon around the bottle neck and wait approx. 10 min, during which time the balloon should inflate due to the released carbon dioxide gas.

To observe the yeast under the microscope:

1. Place a drop of the yeast mixture on the microscope slide (it might be necessary to dilute it a bit more with water).
2. Place a coverslip on top and observe under different magnifications. High magnifications will be needed to see the yeast well.

Yeasts are microscopic unicellular fungi that are used to make bread, beer and wine by **fermentation**. Yeasts reproduce by budding (asexual reproduction), when a small bud forms and splits to form a new daughter cell, but under stress conditions they can produce spores (a form of sexual reproduction).

The bread yeast *Saccharomyces cerevisiae* uses the sugars in the flour to produce energy, releasing the alcohol ethanol (which evaporates) and bubbles of the gas carbon dioxide, which makes the bread dough rise. The bread yeast is also used to make some types of beer; in this case the yeast uses the sugars from cereals like barley, to produce ethanol and carbon dioxide.

The bread yeast has been widely used by scientists to study important cellular processes.

Yoghurt bacteria

Materials

- Glass microscope slides
- Plastic over slips
- Yoghurt with live culture (eg: Actimel, Activia, Yakhult)
- Toothpicks
- Paper towels or tissues
- Methylene blue solution (0.5 to 1%) Optional

Methods

1. Take a very small drop of yoghurt with the toothpick and smear it for 2 to 3 seconds on the slide
2. Place a small drop of methylene blue solution on a microscope slide (optional). Wear gloves and do NOT allow children to handle methylene blue solution.
3. Place a coverslip on top. Remove excess solution around the coverslip with a paper towel or tissue.
4. View in the compound microscope at 4 x or 10 x initially, before moving to higher magnification. Bacteria will appear small even at the highest magnification.

NOTE: Step 2 is optional. You will be able to see the bacteria even without using the stain.

Bacteria can be found isolated, in pairs (diplo), in clusters or in threads (strepto), and they can have different shapes like rods (bacilli), sphere (coccus) etc.

Yoghurt is made from the **fermentation** of the lactose in milk by the rod-shaped bacteria *Lactobacillus delbrueckii subsp. bulgaricus* to produce lactic acid, which acts on milk protein to give yoghurt its texture and its characteristic acidic taste. Other bacteria found in yoghurt are *Lactobacillus acidophilus* or *casei*, *Streptococcus salivarius subsp. thermophilus* and *Bifidobacterium bifidus*.