S1 - S3

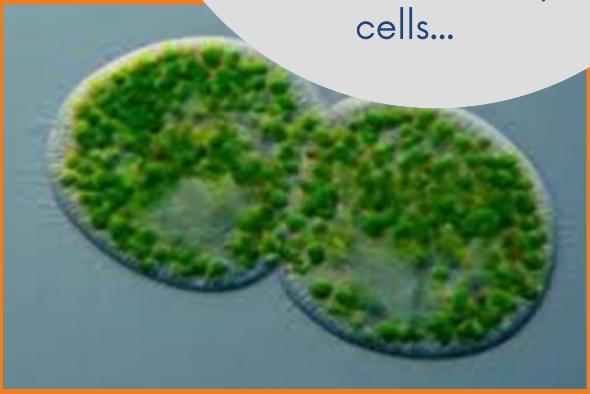
Third / Fourth Level

"In Bloom"
- a hanging drop protocol to observe mixed algae and make an identification key

SCN3-01a: I can sample and identify living things from different habitats...
SCN3-13a: Using a microscope, I have developed my understanding of the structure and variety of cells...

Materials

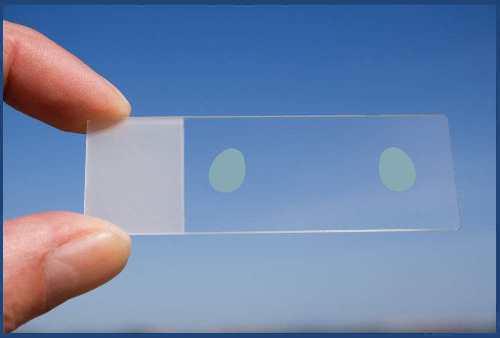
- Light microscope
- Droping pipette
- Paper towels
- Lens tissue
- Blu tack
- 2 glass microscope slides
- Mixed algal suspension/Pond water species [1].



1

Clean 2 glass slides by rubbing each of them gently with a piece of lens tissue.

Stick 2 small pieces of blu tack on one slide, about 3 cm apart.



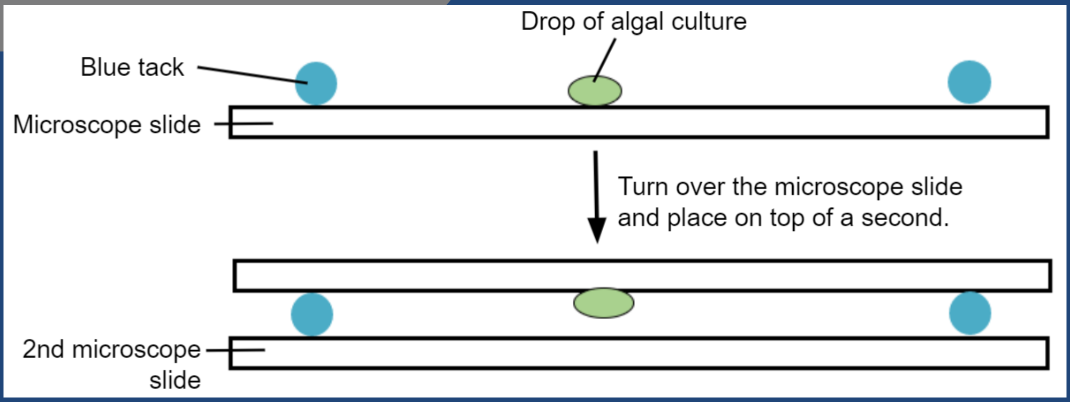
2

Gently swirl the flask containing the algal culture to mix the contents. Using a pipette, draw up some of the suspension and place a single drop in the middle of the second glass slide.

3

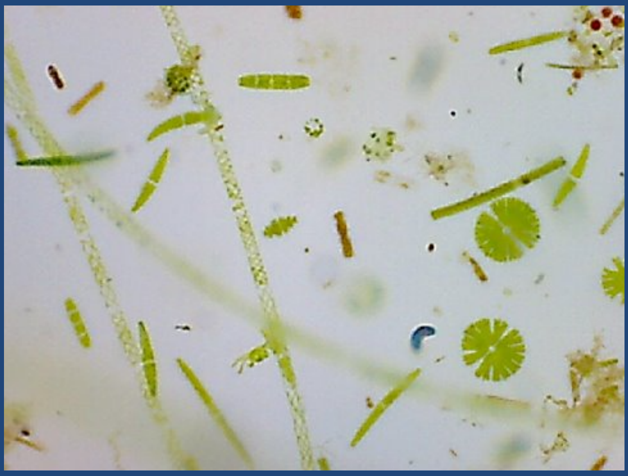
Working quickly, turn the slide over so that the drop hangs down and place the slide with the drop over the first slide and stick it down on the blu tack.

The drop should hang between the two slides without touching the bottom one.



4

Now observe the algae using the light microscope, starting with the x10 objective lens.



5

Following your observations, make a branching or paired-statement key to support the identification of the organisms you have found. Use the diagram on the next page to help.

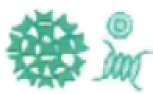
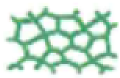
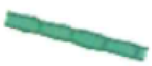
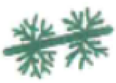
Suggest why algae might be important in our oceans and rivers?

Can you spot any protozoa that have cilia? Discuss the possible purposes of these structures.

Many protozoa lack a cell wall. Based on your observations, predict which ones these might be.

What did you notice?

Algae are diverse, the majority of which are unicellular. You might have noticed a wide range of shapes and sizes; some are motile and may swim across the field of view during observation. You might have spotted a "desmid", with their 3 planes of symmetry. Symmetrical "diatoms" might also be observed. Algae are green; this is because they carry out photosynthesis and are therefore important in carbon fixation and as producers in our water ecosystems. If you observed a culture of protozoa, you might have noted their motility and ability to change shape; this is because they lack a cell wall. Some of these organisms have tiny hair-like structures called cilia, which create "currents" to draw in food materials.

Desmids (Gamophyta: conjugating green algae)		green, no flagella, mainly solitary, some colonial, various shapes, two semi-cells which are mirror images <0.5 mm
Green algae (Chlorophyta)		green, don't move, no flagella, not attached to a surface starshaped colony: Pediastrum <0.3 mm bottom right: Scenedesmus <0.03 mm
Other algae of various growth forms		
Water net		a sock-like colony, green algae (related to Pediastrum) up to 20 centimeters
Filamentous forms		
Pond scum (Gamophyta: conjugating green algae)		non-branching, green, chains of cells with distinctly shaped cell contents cell with <0.1 mm. length: centimeters
Other non-branching forms		several non related groups
Branching forms		mostly green algae
Red algae (Rhodophyta)		mainly marine, but some freshwater forms, not always red

6 When you finish your observations, place organisms back in their sample container and put slides and pipettes in a discard jar.

Push Yourself Further: This podcast [2] examines a current use of algae in the clean up of industrial carbon-rich fumes in the global fight against climate change.

Let's Talk...Environmental Issues

I can explain some of the processes which contribute to climate change and discuss the possible impact of atmospheric change on the survival of living things - SCN3-05b.

Following on from microscopic observations of algae and protozoa, the SSERC Let's Talk...Environmental Issues can provide a great opportunity to discuss and debate current global issues.

Download Let's Talk by clicking on the icon.

Click the icon to see how algae is helping one industry become more sustainable.

Watch this video from NASA to learn more about climate change.

An interesting alternative to observing cells from bought-in algae cultures or pond water is to observe a "**Moss Safari**" [3].
In this activity, you will aim to spot the "Big Five" moss micro-organisms at lower (x10 and x40) and higher (x400) magnifications.

The Big 5 at lower magnifications	The Big 5 at higher magnifications
nematodes	naked amoeba
rotifers	testate amoeba
tardigrades	heliozoans
mites	vorticella
gastrotrichs	protozoa

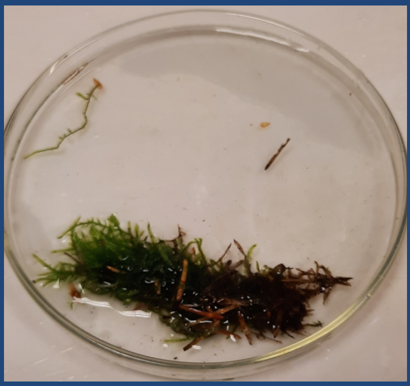
The moss squeeze technique

Materials

- Light microscope
- 2x glass microscope slide
- Paper towel
- Piece of moss
- Metal forceps
- Petri dish
- Filter paper
- Dropping pipette
- Blu-tack

1

Collect a small piece of moss and soak overnight, indoors, in a Petri dish of distilled water. This moss was collected from a tree stump in a Scottish forest.

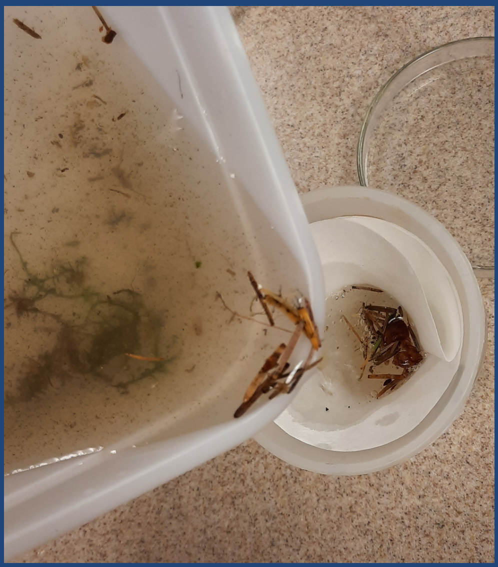


2

Agitate the moss using metal forceps to release the organisms into the surrounding water. Squeeze the moss, using your fingers, from the rhizoids to the ends of the moss.

3

Pour the surrounding liquid through a cone of filter paper to collect any organisms. Allow the majority of the "moss squeeze" to drain through the filter paper.

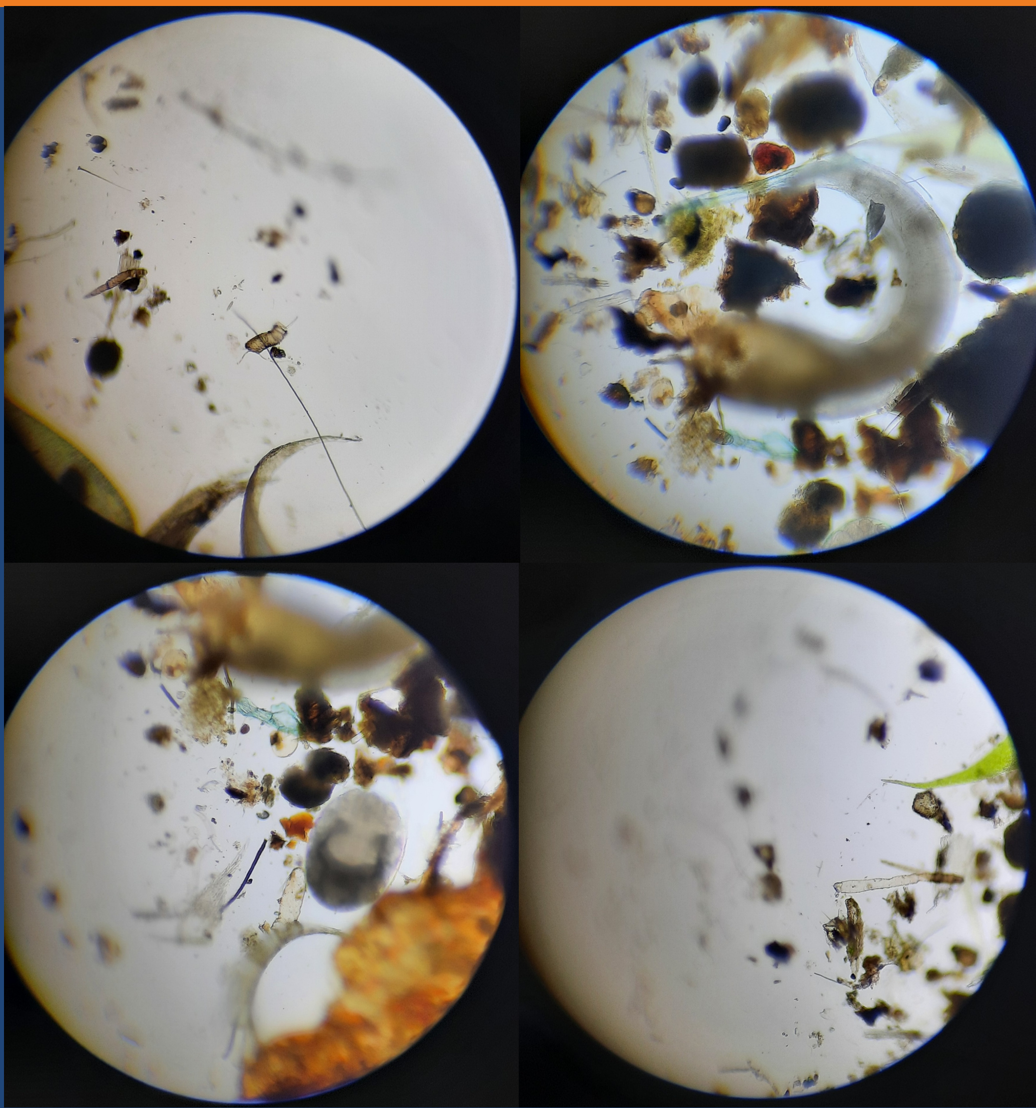


4

When ~1ml of moss squeeze remains in the filter paper cone, extract this using a dropping pipette. Place one drop of this onto a microscope slide and prepare a hanging drop as described in the protocol above.

Can you spot "the big 5"?

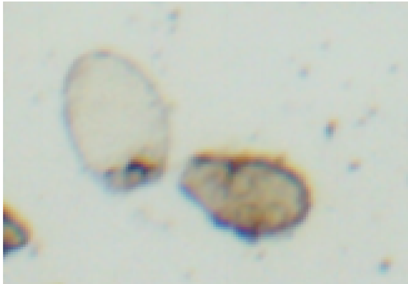
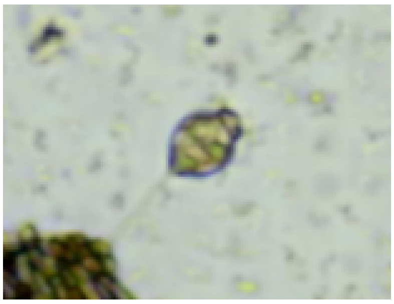
The images and videos below show some of the organisms you might observe from your moss squeeze. This might vary depending on where you found your moss, the weather conditions prior to collection and how long you soak your moss. The following page includes an image and description of key organisms to pick up; these have been called "the big 5" at lower and higher magnification.



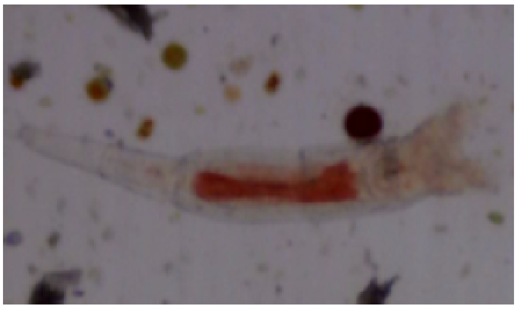
Downloadable identification guides (as included below) are available from the Moss Safari website [4].

CLICK HERE

The Big 5 at higher magnifications

Naked amoeba There are several species. These are often transparent blobs with particles inside them. You need to look carefully to see them. They move quite slowly. Some glide, others push out long arms (pseudopods). Length: 100-500 µm	 Photo: A. Chandler-Grevatt
Testate amoeba Numerous species. They are all types of amoeba which have a case or shell around them. The cases (teste) come in a variety of shapes: flat disks, bottle, flask, cups etc. Length: 10-400 µm, most are around 100 µm.	 Photo: A. Chandler-Grevatt
Heliozoans These are types of amoeba with what look like long spines coming out of them (axopodia). More likely to see at higher magnifications. Various sizes 40-500 µm	 Photo: A. Chandler-Grevatt
Vorticella Stalked ciliated protozoa. The main body (zooid) is supported by a stalk. These are often first seen because of the disturbance they cause in the surrounding water. Size: 20-150 µm and stalk up to 1000 µm	 Photo: A. Chandler-Grevatt
Single celled organisms (Protozoa) Ciliates and flagellates. Cilia are short hair like structures that microorganisms use to move and eat. Flagella are longer hairs that have a whipping motion to allow them to move.	 Photo: A. Chandler-Grevatt

The Big 5 at lower magnifications

Nematodes known as 'roundworms.' These are smooth worms with pointed ends. They are often observed thrashing or stationary. They are often transparent, but you may observe coloured food in their gut. At higher magnifications you can see their mouth parts and internal organs including their digestive system and reproductive system. Length: 200-400 µm	 Photo: A. Chandler-Grevatt
Rotifers known as 'wheel animals' There are several kinds, but the basic body plan is a top end with fast moving cilia that create big currents, a mouth mid-way and a kind of foot at the end. However they can contract into a ball shape. They are transparent and you will see their digestive systems and sometimes eggs inside them. Length: approx. 350 µm	 Photo: A. Chandler-Grevatt
Tardigrades known as 'waterbears' or 'moss piglets' This can be found stationary or moving. They have distinctive movement as they walk on chubby clawed legs. They have a pointy 'snout' through which they feed. If you look carefully at their head you may see two red eyes. These are made of a single cell. Sometimes you will see a shedded skin with eggs inside it. Length: 450 µm	 Photo: A. Chandler-Grevatt
Mites Scientific name: Oribatida A variety of mites are found in moss. They have a relatively large dark body and eight legs that move in a similar way to a spider or beetle. Mites are arthropods (spider family) with eight legs. Adjusting the lighting often allows the body to become translucent. Length: 600 µm	 Photo: A. Chandler-Grevatt
Gastrotrichs A flat worm-like organism covered in 'hairs', cilia with a forked tail. Using it's cilia against a surface, it glides gracefully. Length:100-300 µm	

References

[1] Darwin Biological, "Pond Water Species". Click here for purchase details.
[2] Swansea University, College of Engineering, "Using algae to clean up industry waste fumes", YouTube.
[3] Chandler-Grevatt, A. (2021), "Moss SafariL inspiring interest in nature under the microscope", School Science Review, 102(381), p.49-55.
[4] Moss Safari website: weblink here.