Objectives

B1.1 Explain how the sub-cellular structures of eukaryotic and prokaryotic cells are related to their functions, including:

(a) animal cells − nucleus, cell membrane, mitochondria and ribosomes

(b) plant cells − nucleus, cell membrane, cell wall, chloroplasts, mitochondria and ribosomes.

B1.4 Demonstrate an understanding of number, size and scale, including the use of estimations and explain when they should be used.

B1.6 *Investigate biological specimens using microscopes, including magnification calculations and labelled scientific drawings from observations.*

Maths requirements

1d Make estimates of the results of simple calculations, without using a calculator.

2h Make order of magnitude calculations.

Learning outcomes

5th	**SB1.1**	Identify the parts of plant and animal cells.
5th	**SB1.1**	Recall the parts of plant and animal cells.
5th	**SB1.1, SB1.6**	Make drawings of plant and animal cells using a light microscope and identify their parts.
6th	**SB1.1**	Describe the functions of the sub-cellular structures commonly found in eukaryotic cells (nucleus, cell membrane, cell wall, chloroplasts, mitochondria and ribosomes).
6th	**SB1.4**	Estimate sizes using microscope fields of view.
6th	**SB1.4**	Estimate sizes using scale bars.

Exploring

1. Examining plant and animal cells – core practical

Students use Students' sheet CP1(Looking at cells) to look at simple animal and/or plant cells and identify their component parts. The first page of the worksheet looks at animal cells; students can use pre-prepared cells (Method 1) or prepare slides of their own cheek cells (Method 2). The second page of the worksheet gives various options for examining plant cells (Methods 3 and 4). The worksheet suggests a range of cell types that can be used. There is no requirement to cover all the cell types given on the worksheet, but students must prepare their own slides, use a microscope, calculate magnifications and make drawings of their observations.

It is recommend that all students do steps A and B of Method 1 to begin with, whatever cells they are then going on to observe. This will allow students to refresh their memories on microscope use, particularly those who have missed the work in the previous topic, and Skills Sheet UE 3 can be used to support this. These two steps at the start of Method 1 will also give students the opportunity to perform magnification calculations and measure the different fields of view that they will later use to observe cells. Skills Sheet UE 4 can be used to provide help with fields of view. When students are making their own slides, it is worth demonstrating what they need to do beforehand. Skills Sheet UE 2 can be used to support this.

Students should make drawings of their observations and add appropriate labels.

For demonstration, it is worth showing some pre-prepared cells in which mitochondria show up. These can be bought commercially or you can make your own using methylene blue − basic fuchsin stain, although the staining procedure (freely available on the Internet) is quite involved.

Support: Have an appropriate micrograph of human cheek cells/onion cells/rhubarb cells/*Elodea* cells on the board to help students identify the cells under the microscope and label them appropriately. You may need to give them the magnification. Help students with field of view measurements by giving them the sizes of the fields of view with the different objective lenses (or omit field of view work with very weak students). The diameters of the fields of view between different objective lenses are proportional, and so if you know the field of view with the low power objective you can work out the fields of view with the more powerful objective lenses. For example, if the total magnification using the lowest power objective is ×20 and using the next most powerful objective gives a total of x100, the conversion factor between them is 100/20 = 5. That is to say, the diameter of this field of view is 5 times smaller than the diameter of the lowest power objective field of view.

Stretch: Encourage students to complete as many of the different cell types as possible, and to add scale bars to their drawings.

⚠ Safety

Wear eye protection. Do not allow students to angle microscope mirrors towards the Sun, as this can seriously damage eyesight. Students should not eat the onion or rhubarb. Students should take care not to cut themselves when using glass slides. The use of one arm of a pair of forceps or a cocktail stick is preferred for lowering coverslips, rather than the use of mounted needles. Students should wear gloves if working with stains. Anything that has been in the mouths of students needs to be placed in disinfectant after use.

Expected results

Students should identify, draw and label cells and their parts. It is likely that they will not be able to see mitochondria, even on the highest magnification, although they may see small granules within the cytoplasm that may be a range of things depending on the cell type.

Course resources

Students' sheet CP1

Equipment

microscope, sterile (autoclaved) wooden spatulas/tongue depressors, access to beaker of 1% Virkon in which to dispose of used spatulas/tongue depressors, selection of pre-prepared slides of plant and animal cells (e.g. cheek cells, epithelial cells, palisade cells), plant material (e.g. onion, rhubarb and/or *Elodea* − decide before the practical whether to provide one tissue types for all students or to provide a range so that some or all students have the opportunity to observe different types of plant cells), stain (e.g. methylene blue, iodine solution), paper towel, gloves, plain glass microscope slide, coverslip, pipette, water