

## IGCSE Coordinated Sciences 0654

### Unit 1: Cells and organisms

#### Recommended Prior Knowledge

Students need have very little science background before beginning this Unit.

#### Context

This Unit covers Topics B1 Biological classification, B2 Cellular organisation and B3 Support and movement. There are links to be made between B1 and Unit C2 Classifying elements; between B2 and P2 Particles and motion and between B3 and P1 Strength of solids. The work on cells and cell processes will be built on in later Biology Units.

#### Outline

This Unit begins with a brief consideration of the way in which living organisms are classified, and some of the characteristic features of the more familiar groups. From whole organisms the material then leads into the basic structures – cells – from which they are all made, and considers some of the functions of plant and animal cells. Support and movement in both animals and plants is then explored. There are ample opportunities for practical work and the development of practical skills, both in the laboratory and outside, where locally-occurring organisms could be identified and keys constructed.

Topic	Learning outcomes	Suggested Teaching activities	Learning resources
B1	Appreciate why organisms are classified into groups.	Ask students to devise a classification system for a collection of objects, for example the contents of their bedroom, the contents of their school bag or a pile of objects supplied by you to each group. Discuss the concept of using different systems for different purposes. Biologists classify according to probable relationships, to make it easier to study organisms and make generalisations about them.	A game that students will enjoy – download the pdf and cut out cards that students can classify: <a href="http://www.microbeworld.org/mlc/gifs/activities/pgs1-6.pdf">http://www.microbeworld.org/mlc/gifs/activities/pgs1-6.pdf</a>  Ideas about different ways of classifying things, and an explanation of how animals are classified: <a href="http://www.anthro.palomar.edu/animal/animal_2.htm">http://www.anthro.palomar.edu/animal/animal_2.htm</a>  <i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 181

Topic	Learning outcomes	Suggested Teaching activities	Learning resources
	Be able to use the binomial system of naming organisms and know the binomial names for two different organisms.	Students will probably already know a few binomials, such as <i>Homo sapiens</i> , and this makes a good starting point for discussing why Latin names are used and how they are constructed. Take care that the name of the genus is always given a capital letter, and that of the species a lower case letter.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 181
	Appreciate that organisms belong to different species, which are discrete breeding groups.	Ask for suggestions about why cows and horses are classed as different species; draw out a working definition of the term <i>species</i> .	<a href="http://www.gamealbum.com">http://www.gamealbum.com</a>
	Be able to use a simple dichotomous identification key.	Teachers should devise or select simple keys that can be used to identify a range of specimens available to students. Try to do this with living specimens in a habitat that students can visit – for example, trees in the school grounds, using keys to their leaves.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G, page 160  <i>Teaching and Assessing Practical Skills in Science</i> , CUP. Hayward D, page 18
	<b>Be able to construct a simple dichotomous key to enable identification of organisms.</b>	Extension students should devise their own key, using locally available specimens, for example fruits, flowers, shells.	
	Know the main features of the five main classes of vertebrates (fish, amphibians, reptiles, birds, mammals).	Provide a range of specimens and photographs of each of these classes, and ask students to make lists of features that they suggest could be used for distinguishing between them – if necessary, you could provide a blank chart to help them with this. Use their observations to draw together a simple list of external features for each group.	<b>Online</b> Photographs and descriptions of a range of mammals, reptiles, amphibians and fish. <a href="http://www.seaworld.org">http://www.seaworld.org</a>  <i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 185

Topic	Learning outcomes	Suggested Teaching activities	Learning resources
	<b>Know the main features of three classes of arthropods (insects, crustaceans and arachnids only).</b>	<b>For extension students, a similar exercise can be carried out for these three groups of arthropods.</b>	<b>Online</b> Arthropod classification and identification <a href="http://members.aol.com/YESedu/arthrocl.html">http://members.aol.com/YESedu/arthrocl.html</a>  <i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 184
B2	Appreciate that all living organisms are made up of cells.  Know the structure of a typical animal cell and a typical plant cell (cell membrane, cytoplasm, nucleus, cell wall, vacuole, chloroplast only).	Students can make temporary mounts of cheek cells (stain with methylene blue) and moss leaves, and observe these using a microscope. Palisade cells can be observed using prepared slides or transparencies of a transverse section through a leaf. If you have a video camera that can be attached to a microscope, you can project images for the whole class to see.	<b>Online</b> <a href="http://www.cellsalive.com">http://www.cellsalive.com</a> Illustrations of cells, including interactive images; much is at a rather higher level than required for IGCSE, but more able students may enjoy using this site.  <i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 1
	<b>Be able to interpret light micrographs and simple electron micrographs of plant and animal cells.</b>	Extension students should look at a range of light and electron micrographs of plant and animal, and try to identify the structures that they can see.	
	Understand the functions of the parts of animal and plant cells (as listed above) understand the significance of the differences in structure between animal and plant cells.	Set students the challenge of explaining why animal and plant cells have different features, and how this relates to their method of nutrition.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 2

Topic	Learning outcomes	Suggested Teaching activities	Learning resources
	<p>Appreciate that different types of cells perform different functions and that their structure is related to their function.</p> <p>Know that cells are arranged in groups to form tissues.</p> <p>Know that osmosis is the diffusion of water molecules through a partially permeable membrane and be able to relate this to the effects of solutions of different concentrations on animal and plant cells.</p>	<p>Show students images of a range of specialised cells – for example root hair cells, red blood cells, ciliated cells – and ask them to suggest how their structure helps them to carry out their function.</p> <p>Examine a temporary mount of epidermal tissue peeled from the inner surface of an onion bulb.</p> <p>Students will probably already have an understanding of diffusion; their work on particles in motion in P2 will also reinforce this concept. Treat osmosis as a special case of diffusion. Students can use visking tubing to investigate osmosis; they could be asked to plan and carry out an investigation into the effect of difference in concentration on the rate of osmosis (by measuring the rate of movement of the solution up a glass tube inserted into the tubing). They can measure the change in mass or length of potato chips placed in a range of different sugar solutions and use this to estimate the concentration of the contents of the potato cells. Discuss differences in the effects of water uptake and loss on animal cells and plant cells in terms of the absence and presence of the plant cell wall. Turgor in plant cells is an important mechanism of support. Relate water uptake by osmosis back to the structure of the root hair cell covered earlier in this Unit.</p>	<p><b>Online</b> Examples of specialised cells <a href="http://www.iacr.bbsrc.ac.uk">http://www.iacr.bbsrc.ac.uk</a></p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M page 5</p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M pages 3–4</p> <p><b>Online</b> Diffusion and osmosis interactive animations <a href="http://physioweb.med.uvm.edu">http://physioweb.med.uvm.edu</a></p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 7–9</p> <p><i>Teaching and Assessing Practical Skills in Science</i>, CUP. Hayward D, page 50, page 59</p>

Topic	Learning outcomes	Suggested Teaching activities	Learning resources
B3	<p>Know that the skeleton of a mammal is made of bone and cartilage and appreciate the differences in properties of these substances.</p> <p>Know the structure of the skeleton and muscles of the human arm (ulna, radius, humerus, scapula, tendons, biceps and triceps only) and understand how antagonistic muscles and bones act together to flex or extend the arm.</p> <p><b>Be able to appreciate that the contraction of the biceps muscle produces a turning effect, with the elbow joint as pivot.</b></p> <p><b>Understand that the small</b></p>	<p>Students will be aware that many of our muscles are attached to bones. They can look at samples of bone and cartilage (obtained from a butcher) and compare their properties.</p> <p>Looking at animal bones, or models of human bones, will help students to understand the skeleton of the arm (or forelimb).</p> <p>Extension students can use a simple model of an arm, using lengths of wood or plastic to represent the ulna and the humerus. They are joined at the 'elbow' in such a way as to allow movement. A newton meter can be hooked on to the 'ulna' at varying distances from the 'elbow' and the force needed to lift a mass hanging on the end of the</p>	<p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G page 116</p> <p>Descriptions of how antagonistic muscles work, and good clear diagrams:  <a href="http://www.helicon.co.uk">http://www.helicon.co.uk</a></p> <p>A little animation showing what happens when the biceps and triceps contract:  <a href="http://www.sambal.co.uk">http://www.sambal.co.uk</a></p> <p>Notes for teachers with some ideas about how to teach this topic.  <a href="http://www.ase.org.uk/sen/pdf/focus/muscles/musc_teach.pdf">http://www.ase.org.uk/sen/pdf/focus/muscles/musc_teach.pdf</a></p> <p>Simple animations of how the arm is moved, plus a game that students can play to construct a moving robot:  <a href="http://www.channel4.com/science/microsites/R/robots/m_getarnd.html">http://www.channel4.com/science/microsites/R/robots/m_getarnd.html</a></p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 117–118</p>

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	<b>distance between the attachment of the biceps and the pivot means that a large force is required to produce a large effect and be able to relate this to the ability of muscles to produce large forces and their inability to contract over large distances.</b>	<p>'ulna' measured.</p> <p>Students can relate their results to topics covered in P1, on the turning effects of forces.</p>	
	Know that a synovial joint allows the movement of two bones and that cartilage and synovial fluid reduce friction between bones.	An animal's foot, obtained from a butcher, can be used to show the shiny, smooth surfaces of cartilage where two bones meet. Students should make links with work on friction in P4.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 117
	Understand the importance of lignin in supporting woody parts of plants and turgid cells in supporting non-woody parts of plants.	Show students a wilting plant and ask them to suggest why it is only the leaves that wilt. Help them to think back to what they learned about turgor, and then discuss the dual role of xylem vessels in transport and also support.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 118