

## IGCSE Co-ordinated Sciences 0654

### Unit 5: Coordination and Control

#### Recommended Prior Knowledge

Students will need an understanding of cell structure, and also knowledge of refraction by convex lenses.

#### Context

This Unit covers Topics B10 and B11. The sections covering structure and function of the eye link strongly with P9 Waves and also with P11 Making use of waves. The section on homeostasis links with B2, B7, B9 and also C10 Soil, rocks and rates.

#### Outline

This Unit deals first with the nervous system, and looks at the roles of neurones in a reflex arc. The structure and function of the eye is covered. Growth responses of plants to light are considered. Homeostasis is dealt with in terms of control of water content, glucose content and temperature. Extension students cover the functioning of the kidney; it is important not to try to put in too much detail here.

Topic	Learning outcomes	Suggested Teaching activities	Learning resources
B10	Appreciate that external stimuli can be detected by organisms and may result in responses which may increase the chances of the organisms' survival.	Students can investigate the responses of invertebrates (for example, woodlice) to stimuli such as light or humidity, using choice chambers. They can then be asked to consider how these responses could help survival.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 99
	Know the structure of a motor neurone and appreciate how its structure is related to its function.	Provide extension students with images of a motor neurone, and ask them to list features that it has in common with a cheek cell (as an example of 'basic' animal cell) and features that are different. They can then relate these features to its functions, possibly using an overlay to add annotations to a diagram.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 96  <a href="http://www.essex.ac.uk/speech/pubs/presents/intramuscular%20feedback/sld001.htm">http://www.essex.ac.uk/speech/pubs/presents/intramuscular%20feedback/sld001.htm</a> Diagram and excellent scanning electronmicrograph of a motor neurone; rather complex, but may interest extension

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	<p>Know that the human nervous system is made up of the central nervous system (brain and spinal cord) and many nerves which carry messages from receptors or to effectors.</p> <p>Understand a spinal reflex arc and appreciate the value of rapid, automatic responses (reflexes) to an organism.</p> <p>Understand accommodation and know the functions of rods and cones and their distribution in the human retina.</p>	<p>Diagrams or models can be used to illustrate the positions of brain, spinal cord and peripheral nerves in the human body. Lamb chops (or other cuts of meat) can be used to show the position of the spinal cord inside the vertebrae.</p> <p>Extension students can think of a variety of reflex actions, and discuss how these can help to protect an organism from harm. They can relate the rapidity of these actions to the simple pathway that is followed by the nerve impulse from receptor, through the central nervous system and to an effector, travelling through sensory and motor neurones.</p> <p>They could investigate reaction time and the effect of various factors on it (for example time of day, drinking caffeine-containing drinks) using the ruler-dropping method or one of various methods available on the internet.</p> <p>Accommodation is a difficult concept, and even extension students may need to spend some time on this topic in order to understand how changes in the shape of the lens are brought about, and how this helps to focus a clear image onto the retina. Students could research the distribution of rods and cones in the retinas of different animals, and relate this to the animal's pattern of activity. They can carry out a simple experiment in which a partner holds a coloured object at the edge of their visual field (where mostly rods will be stimulated) and compare the ease of identifying the colour with that of an object held directly in front of</p>	<p>students.</p> <p>Neuroscience for kids: <a href="http://faculty.washington.edu">http://faculty.washington.edu</a></p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 96–97</p> <p>Several sites provide ways of measuring reaction time, for example: <a href="http://www.topendsports.com">http://www.topendsports.com</a> <a href="http://www.exploratorium.edu">http://www.exploratorium.edu</a></p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 97–99</p> <p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 93–94 <a href="http://www.physics.uncc.edu">http://www.physics.uncc.edu</a> Animation showing how rays of light are focused in normal, far-sighted and near-sighted eyes. <a href="http://www.bbc.co.uk/schools/gcsebitesize/biology/humans/sorgansms/4nervoussystemrev7.shtml">http://www.bbc.co.uk/schools/gcsebitesize/biology/humans/sorgansms/4nervoussystemrev7.shtml</a> A very different style of animation showing accommodation.</p>

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		<p>them.</p> <p>Links can be made with the treatment of colour vision in P11.</p>	
	<p>Appreciate that receptors, such as those in the retina of the eye, convert a stimulus into an impulse in a nerve fibre which is carried to the central nervous system, which may then send an impulse to an effector.</p>	<p>An approximate value for the speed at which the nerve impulse travels can be found by asking the class to stand in a circle holding hands. The time that it takes for a 'squeeze' to travel around the circle can be measured. The distance travelled by the impulse from the receptor in one hand to the effector in the next can be measured, and multiplied by the number of students, and hence a very rough value for the speed can be calculated. Students can be asked to make a list of five different actions involving different receptors and effectors.</p>	<p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G page 95</p>
	<p>Know that the shoot of a plant grows towards the light and appreciate that there must be a receptor and an effector involved in this response.</p>	<p>Dealing with plant responses soon after animal responses can help students to appreciate the general similarities between them. Simple experiments on plant responses to light can be carried out. For example, students can grow seedlings in small dishes, and place them in different lighting conditions – e.g. no light, light all around and light from one side – and compare their direction of growth. They can investigate the position of the receptor by covering the tips of some seedlings (it is easiest to do this with coleoptiles) and comparing their growth with that of uncovered seedlings.</p>	<p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G pages 102–104</p> <p><a href="http://www.youtube.com/watch?v=Ze8NV7cvW8k&amp;search=timelapse">http://www.youtube.com/watch?v=Ze8NV7cvW8k&amp;search=timelapse</a></p> <p>Short time-lapse sequence of tomato plants growing towards light (although the direction of the light is not obvious!).</p>
	<p>Be able to suggest a possible method by which auxin could be involved in the growth of shoots towards the light.</p>	<p>Extension students can be provided with the results of experiments on the responses of coleoptiles to light and then asked to draw conclusions from them.</p>	<p><i>Biology for IGCSE and O Level</i>, CUP, Jones M and Jones G page 103</p>
B11	<p>Appreciate that cells function most efficiently</p>	<p>For most cells in the human body, the immediate environment is the tissue fluid that surrounds them. Students should think about</p>	<p>Homeostasis: <a href="http://http://www.bbc.co.uk/schools/gcsebiteze/biology/hum">http://http://www.bbc.co.uk/schools/gcsebiteze/biology/hum</a></p>

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	under particular conditions of temperature, water and glucose concentration and know that the maintenance of the internal environment is called homeostasis.	why it is important to keep this environment relatively constant, and what features of it need to be controlled. Thinking back to earlier work on osmosis, enzyme activity and respiration will help with this.	<a href="https://www.ansasorganisms.com/6homeostasisrev1.shtml">ansasorganisms/6homeostasisrev1.shtml</a> <i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 106
	Know that mammals maintain a constant internal body temperature despite fluctuations in environmental temperature.	Students can measure their own body temperature (for example under the armpit) and environmental temperature in different places at different times of day.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G pages 106–110
	Understand how sweating, vasodilation and vasoconstriction help in regulating body temperature.	Extension students can use boiling tubes of hot water to represent humans; use wet or dry cotton wool to cover some and leave others uncovered. Measure temperature at intervals as they cool, and then compare and explain the different rates of cooling. They can relate the cooling effect of the evaporation of water to sweating, and make links to the particle theory in P2. Students often think that blood capillaries move up and down through the skin, rather than simply becoming wider or narrower.	<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G pages 106–110
	Know that mammals regulate the concentration of glucose in the blood and understand that the secretion of insulin by the pancreas reduces high blood glucose levels and that failure of this mechanism may lead to diabetes.	Students can plot and interpret data relating to blood glucose concentrations before and after a meal. They could be given sets of comparable data for two people, one with diabetes, and attempt to explain them.	Diabetes <a href="http://www.diabetes.org.uk/diabetes/index.html">http://www.diabetes.org.uk/diabetes/index.html</a> <i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G pages 110–111

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	Know that urea is a nitrogenous waste product formed in the liver from excess proteins and is excreted by the kidneys in the urine.		<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 112
	Know the position of the kidneys in the mammalian body and their relationship to the renal artery, renal vein, ureter, bladder and urethra.		<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G page 112
	Know that the kidneys remove excess water and urea from the blood plasma and that urine is produced and stored in the bladder.		<i>Biology for IGCSE and O Level</i> , CUP, Jones M and Jones G pages 112–114
	Understand that the amount of water in urine can be varied by the kidney, in response to changes in the water content of the blood.		