

UNIT 2: Animal Nutrition

Recommended Prior Knowledge Students can come into this Unit with very little biological knowledge. However, they do need to understand the concepts of elements and compounds, and of atoms, molecules and ions, and should be familiar with simple chemical reactions.

Context The molecules that make up the bodies of living things are introduced here, and will be referred to in all of the subsequent Units.

Outline This Unit considers the molecules from which living organisms are made, and then looks in detail at how animals acquire the materials that they need to form the structure of their bodies, and also to supply energy. The way in which small molecules can be used to make larger ones is briefly considered, before thinking about how such large molecules need to be broken down again before they can be absorbed through the wall of the alimentary canal. The functions of the main digestive enzymes are considered, linking back to the work on enzymes in Unit 1. The use of food to supply energy will be covered in more detail in Unit 4, and the functions of the liver in glucose and amino acid metabolism, touched on very briefly here, will be treated in more depth in Units 5 and 6.

	Learning Outcomes	Suggested Teaching Activities	Online Resources	Other resources
II 6	Define <i>nutrition</i> as the obtaining of organic substances and mineral ions from which organisms obtain their energy and their raw materials for growth and tissue repair.	Discuss the need for materials to build bodies, and for energy to maintain their activities. A simple definition of an organic substance is one whose molecules contain carbon and hydrogen.		
II 6.1	List the chemical elements which make up: carbohydrates fats proteins Describe the synthesis of large molecules from smaller basic units, i.e. simple sugars to starch and glycogen amino acids to proteins fatty acids and glycerol to fats and oils.	Ensure that students have some understanding of the terms element, atom and molecule. Beads that string together, or simple chemical modelling kits, can be used to illustrate the idea of small molecules joining together to make larger ones. They should understand that starch is found only in plants, never in animals.		

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II 6.1	Describe tests for starch (iodine solution), reducing sugars (Benedict's solution), protein (biuret test) and fats (ethanol)	Students should have the opportunity to carry out each of these tests on a range of foods. This can also give useful practice in recording results and conclusions in a clearly presented results chart.		
II 6.1	List the principal sources of, and describe the importance of: carbohydrates, fats, proteins, vitamins (C and D only), mineral salts (calcium and iron only), fibre (roughage) and water - Describe the deficiency symptoms for vitamins (C and D only) and mineral salts (calcium and iron only).	Diets in most countries depend on a staple food such as bread or rice, which is usually the main source of carbohydrate. Students should be aware of the main sources of each type of nutrient in their own country, but also be prepared to consider how diets differ in other parts of the world. The Association for Science Education. College Lane, Hatfield, Herts, AL10 9AA, England, has a project called Science Across Europe, which includes a unit on diet, and which encourages schools in different parts of the world to share information.	US Agency for International Development's information on the nutritional contents of a wide variety of foods: http://www.usaid.gov/hum_response/crg/fssfcornmeal.htm	
II 6.3.1	Understand the concept of a balanced diet describe: a balanced diet related to age, sex and activity of an individual the effects of malnutrition in relation to starvation, coronary heart disease, constipation and obesity	Students can keep a record of the food that they eat during one day, and then consider whether they are obtaining the nutrients that they need. The booklet 'Food Tables', Bender and Bender, published by Oxford University Press, is a good source of information about energy and nutrient contents of a very wide range of foods. Malnutrition should be considered as the result of eating an unbalanced diet, not just the lack of a particular type of nutrient.	Balanced diet http://www.sambal.co.uk/diet.html	

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II 6.3.1	Discuss: the problems of world food supplies the problems which contribute to famine (unequal distribution of food, drought and flooding, increasing population)	Material to illustrate this topic, and to form the basis of discussion, can be collected from newspaper and television reports. Students may like to consider whether new technologies, such as the development of genetically modified varieties of crops, are likely to improve the situation or exacerbate it.	Technology to Feed the World http://www.nationalacademies.org/webextra/crops/ A discussion of the problems of feeding the world's growing population, with excellent links to many other site	
II 6.1	Describe the use of micro-organisms in the food industry, with reference to yoghurt, bread and single cell protein.	There is plenty of opportunity for practical work involving yoghurt production, and the use of yeast for bread-making. A good source of ideas for this is the booklet 'Practical Biotechnology'.	downloadable booklet 'Practical Biotechnology', with practical investigations into yoghurt production and bread-making http://www.ncbe.reading.ac.uk/NCBE/PROTOCOLS/	
II 6.1	Describe the uses, benefits and health hazards associated with food additives including colourings.	The health benefits of preservatives, in terms of greatly reduced risk of food poisoning, should be emphasised. Antioxidants also increase storage times for many foods. Flavourings and flavour enhancers increase palatability. A few artificial colourings, such as tartrazine, have been associated with problems such as hyperactivity.		

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II 6.3.2	<p>Identify the gross structure of the alimentary canal and associated organs (mouth, oesophagus, stomach, small intestine: duodenum and ileum, large intestine: colon and rectum, anus, pancreas, liver)</p> <p>Define ingestion, digestion, absorption, assimilation and egestion</p> <p>Describe the functions of the alimentary canal's various parts in relation to ingestion, digestion, absorption, assimilation and egestion of food</p>	<p>Students often do not understand that the alimentary canal is a long tube - albeit a coiled one - through which food passes. They also need to understand that food cannot be considered to have entered the body until it crosses the wall of the canal.</p> <p>The need for digestion before absorption can take place can be investigated using Visking tubing (to represent the alimentary canal) containing a mixture of glucose, starch and water. This is placed in a beaker of water (to represent the blood), and left for long enough for the glucose to diffuse across the tubing. The contents of the tubing and of the beaker can be tested for starch and for glucose</p>	<p>http://borg.com/~lubehawk/hdigsys.htm</p> <p>Includes a quiz on the parts of the alimentary canal</p>	
II 6.3.3	<p>Identify the types of human teeth and describe their functions.</p> <p>State the causes of dental decay and describe the proper care of teeth</p> <p>describe the processes of chewing and peristalsis.</p>	<p>Students can think about the functions of the different types of teeth as they eat. Chewing increases the surface area of food, making it easier for enzymes to act on it during the later stages of digestion. Dental decay should be thought of as the result of bacteria producing acids, which damages enamel.</p> <p>It should be made clear that peristalsis happens all through the alimentary canal, not just in the oesophagus.</p>		

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II 6.3.3	Explain the probable action of fluoride in reducing tooth decay and present arguments for and against its addition to public water supplies.	Although most health professionals strongly support the addition of fluoride to water supplies, there are also some arguments against this.	Fluorides and fluoridation http://www.ada.org The American Dental Association's site dealing with the fluoride issue. The Story of Fluoridation http://www.nidcr.nih.gov/HealthInformation/OralHealthInformationIndex/Fluoride/StoryFluoride.htm A history of the introduction of fluoride into water supplies in the USA, from the National Institute of Dental and Craniofacial Research.	
II 6.3.4	Describe: Digestion in the alimentary canal, the functions of a typical amylase, protease and lipase, listing the substrate and end-products.	This topic should be linked with earlier work on enzymes, in Unit 1 (section II.5). Students should also know in which parts of the alimentary canal these enzymes are found.		
II 6.3.5	Identify the small intestine as the region for absorption of digested food. Describe the significance of villi in increasing the internal surface area.	Core students do not need any detail of the villus structure.		
II 6.3.5	Describe the structure of a villus including the role of capillaries and lacteals. Indicate the role of the hepatic portal vein in the transport of absorbed food to the liver.	The absorption of glucose should be linked with earlier work on active transport, in Unit 1 (section II.3).		
II 6.3.6	Describe: the role of the liver in the metabolism of glucose and in the destruction of excess amino acids, the role of fat as a storage substance.	For Core students, no detail of the hormonal control of glucose levels is required. They should, however, know that the liver stores excess glucose as glycogen (link back to section II 6.1) and converts this back to glucose again if blood glucose levels fall. The conversion of excess amino acids to urea should be dealt with very simply; this will be covered again in Unit 5.		

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