Definitions and Concepts for Edexcel Biology IGCSE

Topic 2: Structures and Functions in Living Organisms

Definitions marked by '' are for separate sciences only*

Level of Organisation

Cell - The basic building block of all living organisms.

Organelle - A specialised structure found inside a cell.

Organs - Aggregations of tissues performing specific functions.

Organ systems - Groups of organs that work together to form organisms.

Tissue - A group of cells with a similar structure and function.

Cell Structure

***Cell differentiation** - The process by which a cell becomes specialised to its function.

Cell membrane - A partially permeable barrier that surrounds the cell.

Cell wall - An outer, structural layer that surrounds some cells. In plant cells, it is made of cellulose. In fungi, it is made of chitin.

Chloroplast - An organelle which is the site of photosynthesis.

Cytoplasm - A jelly-like substance that contains all the organelles of the cell, dissolved nutrients and salts.

Mitochondria - An organelle which is the site of respiration.

Nucleus - An organelle found in most eukaryotic cells that contains the genetic material of the cell and controls the activities of the cell.

Ribosomes - Organelles that are the site of protein synthesis.

***Stem cell** - An undifferentiated cell that can divide to produce many specialised cells of the

same type.

Vacuole - An organelle found in plant cells that stores cell sap and supports the cell.

Biological Molecules

Active site - Part of the enzyme that is complementary to the shape of the substrate. The shape of the active site may change if the enzyme is exposed to high temperatures or extremes of pH.

Amino acids - Small molecules from which proteins are assembled.

Enzymes - Biological catalysts that increase the rate of reactions in living organisms.

Glycogen - A large carbohydrate made from many glucose molecules joined together. It serves as an energy store in animals.

Lipids - A group of large molecules that are made from long fatty acid chains and glycerol. Lipids include fats and oils.

Proteins - Large molecules made up of amino acids.

Starch - A large carbohydrate molecule made up of many glucose molecules. It contains the elements carbon, oxygen and hydrogen. It is an energy storage molecule in plants.

Movement of Substances into and out of Cells

Active transport - The movement of substances from a more dilute solution to a more concentrated solution (against the concentration gradient) with the use of energy from respiration.

Concentration gradient - The difference in concentration between two areas.

Diffusion - The spreading out of particles in solution, or particles of a gas, resulting in a net movement from an area of higher concentration to an area of lower concentration (down the concentration gradient).

Osmosis - The diffusion of water molecules from a more dilute solution to a more concentrated solution across a partially permeable membrane.

Surface area to volume ratio (SA:V) - The size of the object compared with the amount of area that contacts the environment.

Nutrition

Alimentary canal - The digestive tract running from the mouth to the anus.

Amylase - An enzyme produced in the salivary glands and pancreas that breaks down starch into maltose.

Bile - A green, watery fluid made in the liver and stored in the gallbladder that is used to neutralise stomach acid in the duodenum and emulsify fats.

Colon - The first part of the large intestine where water is reabsorbed.

Duodenum - The first section of the small intestine where digestive enzymes and bile are added to the ingested food.

Ileum - The second section of the small intestine where the products of digestion are absorbed.

Lipase - An enzyme produced in the pancreas that breaks down lipids into fatty acids and glycerol.

Maltase - An enzyme produced in the small intestine that breaks down maltose into glucose.

Oesophagus - A muscular tube that takes food from the mouth to the stomach.

Palisade mesophyll - A tissue found in plant leaves that is specialised to carry out photosynthesis.

Pancreas - An organ that produces digestive enzymes and releases them into the small intestine.

Peristalsis - The ‘squeezing’ movement of muscles that pushes the bolus of food along the digestive tract.

Photosynthesis - An endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.

Protease - An enzyme produced in the stomach and pancreas that breaks down proteins into amino acids.

Rectum - Part of the large intestine where faeces is stored.

Surface area - The total area occupied by the surface of an object. Leaves have a large surface area to catch sunlight.

Villi - Small, finger-like structures on the surface of the small intestine that increase the surface area for absorption.

Waxy cuticle - A layer on the top of the leaf that reduces water evaporation, but does not block sunlight.

Respiration

Aerobic respiration - A form of respiration that uses oxygen to release energy from the breakdown of molecules like glucose. Represented by the following word equation:

$$\text{glucose} + \text{oxygen} \longrightarrow \text{carbon dioxide} + \text{water}$$

Anaerobic respiration - A form of respiration that releases energy from the breakdown of molecules like glucose without using oxygen. Represented by the following word equation:

$$\text{glucose} \longrightarrow \text{lactic acid}$$

ATP - A molecule that releases energy quickly. Many cellular processes require ATP for energy.

Cellular respiration - An exothermic reaction that takes place continuously in living cells and produces energy from nutrient molecules.

Gas Exchange

Alveoli - Tiny air sacs in the lungs that serve as the gaseous exchange surface.

Bronchi - The two airways branching from the trachea that lead into the lungs.

Bronchioles - The small airways branching from the bronchi in each lung.

Capillaries - Thin, narrow blood vessels that are the site of exchange of substances between the blood and the tissues.

Coronary heart disease - A disease caused by the build-up of fatty deposits inside the coronary arteries, narrowing them and reducing blood flow to the heart tissue. Smoking increases the risk of coronary heart disease.

Diaphragm - The muscle separating the thorax and the abdomen.

Intercostal muscles - Groups of muscles situated between the ribs. They are responsible for the movement of the ribs during breathing.

Pleural membranes - The airtight membranes covering the lungs and the chest wall.

***Spongy mesophyll** - A tissue found in plant leaves that is specialised for gas exchange.

***Stomata** - Small holes found on the surface of a leaf that allow carbon dioxide and oxygen to diffuse in and out of the leaf for photosynthesis. They also control water loss.

Trachea - The windpipe connecting the lungs to the mouth and nose.

Transport

Adrenaline - A hormone produced by the adrenal glands in response to fear or stress. It increases the heart rate and boosts the delivery of blood to the brain and muscles as part of the 'fight or flight' response.

Aorta - The main artery that takes oxygenated blood away from the heart to the body.

Artery - A type of blood vessel that carries blood at high pressure away from the heart to the tissues.

Atria - The two upper chambers of the heart that receive blood from the veins and pump blood into the ventricles

Blood - A tissue containing red blood cells, white blood cells, platelets and plasma.

Coronary heart disease - A disease caused by the build-up of fatty deposits inside the coronary arteries, narrowing them and reducing blood flow to the heart tissue.

Haemoglobin - The red protein found in red blood cells that transports oxygen in the blood.

Heart - An organ that pumps blood around the body in a double circulatory system.

Hepatic artery - The artery that supplies the liver with oxygenated blood.

Hepatic vein - The vein that carries blood away from the liver.

Lymphocyte - A type of white blood cell that produces specific antibodies against a pathogen.

***Memory cell** - An immune cell that can recognise a pathogen previously encountered (either from infection or vaccination) and produce specific antibodies against the pathogen quickly.

Phagocyte - A type of white blood cell that ingests pathogens.

Phloem - A transport tissue found in plants which is specialised to transport sugars from sources to sinks.

Plasma - The straw-coloured liquid in blood that transports carbon dioxide, urea, digested food, hormones and heat energy.

Platelets - Tiny fragments of cells found in the blood that are involved in clotting.

Pulmonary artery - The main artery that takes deoxygenated blood away from the heart to the lungs.

Pulmonary vein - The main vein that carries oxygenated blood back to the heart from the lungs.

Red blood cells - Cells in the blood that transport oxygen. They have a biconcave shape, no nucleus, and contain haemoglobin.

Renal arteries - The arteries that supply blood to the kidneys.

Renal veins - The veins that take blood away from the kidneys.

***Root hair cells** - Specialised cells responsible for the absorption of water and mineral ions from the soil in plants.

Translocation - The movement of sugars through the phloem tissue from sources to sinks.

***Transpiration** - Water loss from plant leaves and shoots via diffusion and evaporation.

***Vaccination:** The introduction of small quantities of dead or inactive forms of a pathogen into the body to stimulate antibody production by white blood cells.

Vein - A blood vessel that carries blood at low pressure back to the heart.

Vena cava - The main vein that takes deoxygenated blood back to the heart from the body.

Ventricles - The two lower chambers of the heart that receive blood from the atria and expel blood into the arteries.

White blood cell - Cells of the immune system that protect the body from invading pathogens via the production of antibodies and antitoxins.

Xylem - A plant transport tissue that is specialised to transport water and dissolved minerals from the roots of the plant to the leaves.

Excretion

***Antidiuretic hormone (ADH)** - A hormone produced by the pituitary gland that increases the reabsorption of water in the kidney tubules.

*Bladder - The organ that collects and holds urine.

*Bowman's capsule - The cup-like structure at the start of a nephron where the filtrate from the glomerulus is collected and taken to the tubules.

*Collecting duct - The final part of the nephron before the ureter in which water is selectively reabsorbed. Its permeability to water is altered by ADH.

*Convoluted tubules - Tubes of the nephron through which the filtrate flows. Substances from the filtrate are reabsorbed into the blood in the convoluted tubules.

Excretion - The removal of waste products and toxic substances from the body.

*Glomerulus - A collection of capillaries that is involved in the filtration of blood under high pressure.

*Loop of Henle - Part of the nephron in which water and salts are reabsorbed.

*Nephron - The functional unit of the kidney.

Organs of excretion - The lungs, kidneys and skin. The lungs excrete carbon dioxide and water vapour; the kidneys excrete water, urea and salts; and the skin excretes water and salts.

*Osmoregulation - The regulation of the volume of water in body fluids.

*Selective reabsorption - The selective reuptake of useful substances (all sugars, some water and some ions) into the blood. This takes place along the nephron.

Stomata - Small holes found on the surface of a leaf that allow carbon dioxide and oxygen to diffuse in and out of the leaf. They also control water loss.

*Ultrafiltration - The filtration of the blood at the glomerulus to produce a filtrate which contains water, ions, glucose, urea and other molecules. Proteins and cells are not present in the filtrate.

*Ureters - The tubes that carry urine from the kidneys to the bladder.

*Urethra - The tube that carries urine from the bladder to outside the body during urination.

*Urine - The waste product of the kidney that contains water, urea and ions.

Coordination and Response

Adrenaline - A hormone produced by the adrenal glands in response to fear or stress. It

increases the heart rate and boosts the delivery of blood to the brain and muscles as part of the 'fight or flight' response.

***Antidiuretic hormone (ADH):** A hormone produced by the pituitary gland that increases the reabsorption of water in the kidney tubules.

Auxins - A group of plant hormones that control cell elongation and plant growth.

Central nervous system (CNS) - The brain and spinal cord. It coordinates the response of effectors.

Coordination centres - Areas of the body (e.g. brain, spinal cord, pancreas) that receive and process information from receptors.

Effectors - Muscles or glands which bring about responses to restore optimum levels.

Eye - A sense organ containing receptors sensitive to light intensity and colour.

***Follicle-Stimulating Hormone (FSH)** - A hormone produced by the pituitary gland that stimulates the growth of follicles in the ovary and the secretion of oestrogen.

Geotropism/Gravitropism - A plant's directional growth response to gravity.

Homeostasis - The maintenance of a stable internal environment in the body despite fluctuations in internal and external conditions.

Insulin - A hormone secreted by the pancreas when blood glucose concentration is too high. It reduces blood glucose concentration.

***Luteinising Hormone (LH)** - A hormone secreted by the pituitary gland that initiates ovulation (the release of an egg from the ovary).

Nerves - Cells that link the central nervous system to sense organs. They transmit electrical impulses.

Neurotransmitters - Chemicals that are released at synapses and used for communication between neurones and their target cells.

Oestrogen - A female sex hormone released by the ovaries that causes the growth and repair of the uterus lining.

Phototropism - A plant's directional growth response to light.

Progesterone - A hormone produced in the ovaries and placenta that maintains the uterus lining.

Receptors - Organs or cells that detect stimuli.

Reflex action - A rapid and automatic response to a stimulus. It serves as a protective mechanism.

Reflex arc - The pathway of neurones involved in a reflex action: stimulus → receptor → sensory neurone → interneurone → motor neurone → effector → response.

Stimulus - A change in an organism's internal or external environment that can be detected.

Sweating - The secretion of sweat onto the surface of the skin by sweat glands. The evaporation of water in sweat removes heat energy from the skin, cooling the body down.

Synapse - A junction between two nerve cells where neurotransmitters are released.

Target organ - The organ which a hormone acts on to produce an effect.

Testosterone - The main male reproductive hormone produced by the testes. It stimulates sperm production.

Vasoconstriction - The constriction of blood vessels near the surface of the skin to conserve heat.

Vasodilation - The dilation of blood vessels near the surface of the skin to lose heat.