# **Unit 1 Cell biology**

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| ***1 Cell structure*** |  |
| *Mitochondria* | The site of respiration in plant and animal cells |
| *Chloroplasts* | The site of photosynthesis in a plant cell |
| *cell membrane* | Controls what comes in and goes out of all cells |
| *vacuole* | A large, cell sap-filled space in plant cells |
| *nucleus* | Contains DNA and controls the cell |
| *ribosomes* | Bead-shaped organelles which are the site of protein synthesis |
| *plasmids* | Small circular pieces of DNA in bacterial cells |
| *Cell walls* | Are fully permeable and are made of cellulose (plants) and other materials in bacteria and fungi |
| ***2 Transport across cell membranes*** |  |
| *The cell membrane consists of* | phospholipids and proteins |
| *It is* | selectively permeable |
| *passive transport is* | Down the concentration gradient and does not require energy. |
| *diffusion in cells is* | The movement of molecules down a concentration gradient |
| *Osmosis is* | The movement of water molecules from a high water concentration to a low water concentration through a selectively permeable membrane |
| *Animal cells in low water concentration will* | Shrink |
| *Animal cells in high water concentration will* | Burst |
| *Plant cells in low water concentration will* | Become plasmolysed |
| *Plant cells in high water concentration will become* | Turgid |
| *Active transport* | Requires energy for membrane proteins to move molecules and ions against the concentration gradient |
| ***3 Producing new cells*** |  |
| *Diploid is* | The normal number of chromosomes in a cell. In humans this is 23 pairs. |
| *Mitosis is* | Normal cell division, used for growth and repair |
| *Chromatids are* | Strands of duplicated chromosome |
| *The equator* | Is the middle of the cell where the chromosomes (pairs of chromatids) line up |
| *Spindle fibres are* | Where chromosomes attach to; they pull the chromatids apart to the poles |
| *Cell culture is* | Growing cells in the lab |
| *Cell culture needs* | Growth medium, controlled temperature, pH and oxygen and aseptic techniques |
| *Aseptic techniques* | Stop cell cultures becoming contaminated with other cells which are not required, e.g. bacteria |
| ***4 DNA and the production of proteins*** |  |
| *DNA carries* | The genetic information for making proteins |
| *A DNA molecules is* | A double-stranded helix |
| *DNA double strands are held together by* | Complementary base pairs |
| *The four bases in the genetic code are* | Adenine, cytosine, guanine and thymine (A,T,C,G) |
| *The base sequence determines* | The amino acid sequence in a protein |
| *mRNA carries* | A complementary copy of the code from the DNA, in the nucleus, to a ribosome |
| *The ribosome is where* | The protein is assembled from amino acids |
| ***5 Proteins and enzymes*** |  |
| *The sequence of amino acids* | Controls the shape and function of proteins |
| *Structural proteins* | Hold tissues together e.g. collagen |
| *Hormones* | Are chemical messengers which carry a message from a gland to a receptor via the blood |
| *Antibodies* | Are proteins, made by white blood cells, which bind to invading microbes |
| *Receptors* | Receive a signal from the environment and pass it on to a sensory neuron OR bind to a hormone and tell the cell what to do. |
| *Enzymes* | Are biological catalysts e.g. amylase and are made by all cells |
| *Biological catalysts* | Speed up chemical reactions in cells and remain unchanged in the process |
| *Active site* | Where the substrate fits into the enzyme and is a **complementary** shape to it |
| *Substrate* | The reactant(s) in a reaction, and is specific to an enzyme |
| *Product* | The molecule made by an enzyme-controlled reaction |
| *Optimum conditions* | Are the **temperature** and **pH** which the enzymes work best at |
| *Denatured* | When the active site changes shape and affects the rate of the reaction |
| ***6 Genetic engineering*** |  |
| *Genetic engineering is* | Transferring genetic information (DNA) from one cell into another |
| 1. *Identify the section of DNA that has* 2. *Then you need to* 3. *And* 4. *Then insert* 5. *Then insert* 6. *Then the transformed cells need to* | The gene required, on the source chromosome  Extract (cut out) the gene  Extract the plasmid from the vector/bacterial cell  The cut out gene into a bacterial plasmid  The plasmid into the host cell (bacteria)  Grow and divide to produce a GM organism |
| *Enzymes are needed to* | Cut the DNA to extract the gene, cut the plasmid open and seal the gene into the plasmid |
| ***7 Photosynthesis*** |  |
| *Photosynthesis has two stages called* | Light reactions and carbon fixation |
| *Light reactions need* | light energy from the sun, and water |
| *Light energy from the sun is* | trapped by chlorophyll in the chloroplasts and is converted into chemical energy (ATP) |
| *Water is* | Split to produce hydrogen and oxygen. |
| *Hydrogen* | Attaches to hydrogen acceptor molecules |
| *Oxygen then* | Diffuses out of the cell, or is used in respiration |
| *Carbon fixation needs* | Hydrogen, ATP and carbon dioxide |
| *A series of enzyme-controlled reactions produces* | Sugar |
| *Sugar (chemical energy) can be used for* | Respiration, making starch (storage) or cellulose (structural) |
| *Limiting factors will limit the rate of* | Photosynthesis and plant growth |
| *They could be* | Carbon dioxide **concentration**, light **intensity** and temperature |
| ***8 Respiration*** |  |
| *Respiration is defined as* | A series of enzyme-controlled reactions which release the chemical energy stored in glucose |
| *The energy released is used to make* | ATP from ADP and Pi |
| *The chemical energy in ATP can be released by* | Breaking it down into ADP and Pi |
| *The released energy can be used for* | muscle cell contraction, cell division, protein synthesis, transmission of nerve impulses |
| *One glucose molecule, in oxygen, gets broken down into* | Pyruvate, then carbon dioxide + water, making 38 ATP |
| *One glucose molecule, without oxygen, undergoes* | Fermentation to give 2 ATP. |
| *Animal cells ferment glucose into* | Lactic acid, via pyruvate |
| *Plant and yeast cells ferment glucose into* | Ethanol + carbon dioxide, via pyruvate |
| *Respiration begins in* | The cytoplasm |
| *Fermentation is completed in* | The cytoplasm |
| *Aerobic respiration is completed in* | The mitochondria |
| *Respirometers* | Measure the rate of respiration |
| ***Unit 2 Multicellular Organisms*** |  |
| ***1 Cells, tissues and organs*** |  |
| *A tissue is* | A group of cells specialised for one function e.g. muscle |
| *An organ is* | A group of tissues working together to achieve a function e.g. heart |
| ***2 Stem cells and meristems*** |  |
| *stem cells in animals* | Can divide to become different types of cell |
| *Stem cells are normally involved in* | Growth and repair |
| *Meristems are* | The sites of production of non-specialised cells in plants; sites of mitosis |
| *Non-specialised cells can* | Become other types of plant cell and contribute to plant growth |
| ***3 Control and Communication*** |  |
| *The central nervous system (CNS) consists of* | The brain and the spinal cord |
| *The brain contains* | The cerebrum, cerebellum and medulla |
| *The cerebrum controls* | Conscious thought, intelligence, language |
| *The cerebellum controls* | Balance and co-ordination |
| *The medulla controls* | Unconscious control of body temp, heart and breathing rate, etc. |
| *Neuron types are* | Sensory, relay and motor |
| *Reflex actions are* | Involuntary protective movements |
| *The reflex arc is* | Receptor – sensory neuron – relay neuron – motor neuron – muscle |
| *Receptors* | Detect stimuli / sensory information |
| *Electrical impulses* | Carry messages along neurons |
| *Synapses* | Transfer messages between neurons by chemical messengers |
| *Endocrine glands* | Release hormones into the bloodstream |
| *Hormones are* | Chemical messengers which carry messages to target tissues |
| *Target tissues have cells with* | Receptors for a specific hormone |
| *Blood glucose levels need to be* | Controlled within safe limits (not too high and not too low) |
| *Insulin is released when* | The blood sugar rises above normal |
| *Insulin causes* | Liver and muscle cells to remove glucose from the blood |
| *Glucagon is released when* | The blood sugar falls lower than normal |
| *Glucagon causes* | Liver and muscle cells to release glucose into the blood |
| *The pancreas* | Is the endocrine gland which produces insulin and glucagon |
| ***4 Reproduction*** |  |
| *All body cells, except gametes, are* | Diploid |
| *Gametes are* | Haploid sex cells |
| *Diploid means* | The normal number of chromosomes in a cell. In humans this is 23 pairs (46). |
| *Haploid means* | Half the normal number of chromosomes in a cell. In humans this is 23. |
| *Gametes have* | Only one of each pair of chromosomes normally present in a diploid cell |
| *Male gametes are made in* | Testes (animals)/ anthers (plants) |
| *Male gametes are called* | Sperm (animals) / pollen (plants) |
| *Female gametes are made in* | Ovaries (animals)/ ovaries (Plants) |
| *Female gametes are called* | Eggs (animals) / ovules (plants) |
| *A diploid zygote is made from* | The fusion of two haploid gametes at fertilisation |
| ***5 Variation and inheritance*** |  |
| *Discrete variation* | Discontinuous, where the values do not occur in a range and fall into distinct groups (usually descriptions e.g. colour) |
| *Continuous variation* | Where there is a range of values on a scale e.g. height |
| *Polygenic characteristics* | Caused by many genes working together. They show continuous variation and very common in phenotypes. |
| *Phenotype* | The visible physical characteristic you see as a result of a gene |
| *Gene* | A section of DNA which codes for a protein (characteristic) |
| *Alleles* | Different forms of a gene which control one characteristic |
| *Genotype* | The pair of alleles a person has which control one characteristic, e.g. AA, aa or Aa |
| *Dominant* | An allele which is always seen in the phenotype if it is present (in the genotype) |
| *Recessive* | An allele which is only seen in the phenotype if there is no dominant allele present |
| *Homozygous* | When a genotype has two alleles exactly the same, e.g. AA or aa |
| *Heterozygous* | When a genotype has alleles which are different from each other e.g. Aa |
| *P1*  *F1*  *F2* | The genotypes of the parents in a cross  The genotypes of the offspring from a cross  The genotypes of the offspring resulting if two of the original F1 offspring were crossed |
| *Predicted ratios are not always achieved* | Because fertilisation is a random process |
| ***6 The need for transport*** |  |
| *Plants need water for* | Transporting materials and for photosynthesis |
| *Leaf cells, from top to bottom are* | Upper epidermis, palisade mesophyll, spongy mesophyll, vein, lower epidermis, guard cells, (stomata) |
| *Root hair cells* | Absorb water from soil |
| *Xylem vessels are* | Dead and contain lignin for support |
| *Xylem vessels transport* | Water and minerals up the stem |
| *The evaporation of water through leaves* | Transpiration |
| *Guard cells control* | The opening and closing of stomata |
| *The epidermis* | Covers the upper and lower surfaces of a leaf |
| *Phloem is made of* | Living cells |
| *In mammals, the substances transported by the blood are* | Nutrients (glucose and amino acids), oxygen and carbon dioxide |
| *The heart has four chambers. The top two are:*  *The bottom two are:* | Right and left atria  Right and left ventricles |
| *The heart contains valves which are found* | Between the atria and ventricles and between the ventricles and arteries |
| *Valves* | Prevent the backflow of blood |
| *Veins carry blood* | Back to the heart, into the atria |
| *Arteries carry blood* | Away from the heart, from the ventricles |
| *Coronary arteries* | Supply the heart muscle with oxygenated blood |
| *The pathway of blood through the heart, lungs and body is; beginning with the lungs:* | Lungs (oxygenated) – pulmonary vein – left atrium – valve – left ventricle – valve – aorta – body cells (deoxygenated) – vena cava – right atrium – valve – right ventricle – valve – pulmonary artery – lungs |
| *Arteries carry blood under* | High pressure |
| *The structures of arteries which help them to do this are* | 1 muscular walls  2 narrow central channel |
| *Veins carry blood under* | Low pressure |
| *The structures of veins which help them to do this are* | 1 Thinner walls  2 wide central channel  3 valves |
| *Capillaries are found in* | Organs and tissues as networks |
| *Capillaries are where* | Exchange of materials happens, e.g. glucose, carbon dioxide, oxygen, urea, by diffusion |
| *Capillaries are adapted for this by* | 1 having a large surface area for diffusion  2 having thin walls – one cell thick |
| *Red blood cells contain* | Haemoglobin (red) |
| *Haemoglobin carries* | Oxygen as oxyhaemoglobin |
| *Red blood cells are adapted for this role by* | 1 not having a nucleus to make more room for Hb  2 being biconcave to increase surface area for diffusion of oxygen |
| *In the lungs, airways are kept open by* | Rings of cartilage |
| *Gas exchange happens in the* | Alveoli |
| *In alveoli, the direction of gas movement is* | Oxygen in, carbon dioxide out |
| *The gases are exchanged from* | The blood capillaries surrounding the alveoli |
| *alveoli are adapted for diffusion by* | 1 having a large surface area  2 having a good blood supply  3 having thin walls (one cell thick) for more efficient diffusion |
| *The lungs are kept clean by* | Mucus trapping dirt and microbes. |
| *Cilia* | Move the mucus up and away from the lungs |
| *Food is moved through the digestive system by* | Peristalsis |
| *The small intestine is where* | Absorption of food happens |
| *The small intestine contains many millions of* | Villi |
| *Villi are* | 1 thin walled  2 have a large surface area  3 have a good blood supply to aid absorption |
| *Water soluble food products are* | Glucose and amino acids |
| *They are absorbed into the* | Blood capillary |
| *Fat soluble food products are* | Fatty acids and glycerol |
| *They are absorbed into* | The central lacteal |
| ***7 Effects of lifestyle choices on human transport and exchange systems*** |  |
| *Lifestyle choices include* | High-fat or high-salt diet, lack of exercise, use of tobacco or alcohol, high stress experiences |
| *Bad lifestyle choices can directly and indirectly increase* | Fatty deposits in blood vessels, blood clots, heart attacks, strokes, diabetes, stress |
| ***Unit 3 Life on Earth*** |  |
| ***1 Biodiversity and the distribution of life*** |  |
| *Biotic factors are* | Living, e.g. predators, competition for resources, grazing, disease |
| *Abiotic factors are* | non-living, e.g. temperature, pH, nutrient availability, light intensity, moisture |
| *Biodiversity is* | The variety of species living in a habitat |
| *Biomes are* | Large regions of the planet which have similar climate, flora and fauna |
| *Flora is* | Plant life |
| *Fauna is* | Animal life |
| *Biomes differ from each other by* | Their temperature and rainfall (abiotic factors) |
| *An ecosystem is* | All the organisms (community) living in a habitat and the non-living components with which the organisms interact (the abiotic factors) |
| *A niche is* | The role that an organism plays within a community |
| *A niche describes: 1*    *2* | The resources the organism uses in an ecosystem (light, temperature, nutrient availability)  The interactions and organism has in the community (competition, parasitism, predation) |
| ***2 Energy in ecosystems*** |  |
| *Species* | A group of similar organisms which can produce fertile offspring |
| *Population* | All the organisms of one species in a habitat |
| *Producer* | Organsims which produce their own food e.g. plants |
| *Consumer* | Organisms which rely on eating other organisms for food |
| *Carnivore* | A meat-eater |
| *Herbivore* | A plant-eater |
| *Omnivore* | An organism which eats both plants and animals |
| *Between levels in a food chain, 90% energy is* | Lost as heat, movement or undigested materials |
| *10% of energy is* | Used for growth (adding biomass) |
| *Pyramids of numbers* | Show how many organisms are at each level in the food chain |
| *Pyramids of biomass* | Show how much total mass (per m2) of each organism there is eat each level in the food chain |
| *Pyramids of energy* | Show the energy contained within the total number of each organism at each level in the food chain |
| *Irregular pyramids of numbers are due to* | Different body sizes, e.g. a large oak tree and small caterpillars |
| *Interspecific competition is* | When individuals of different species compete for the same resource in an ecosystem |
| *Intraspecific competition is* | When individuals of the same species compete for exactly the same resources (most intense) |
| *Plant proteins are produced using* | Nitrogen from nitrates |
| *Nitrifying bacteria* | Convert ammonium to nitrites to nitrates |
| *Denitrifying bacteria* | Convert soil nitrates into nitrogen gas |
| *Nitrogen-fixing bacteria* | Convert nitrogen gas to ammonium |
| *Nitrogen fixing bacteria can live in either* | Root nodules or in the soil |
| *Decomposers are* | Bacteria and fungi |
| *Decomposers convert* | Proteins and nitrogenous wastes to ammonium |
| *Ammonium compounds are converted into* | Nitrites then nitrates |
| *Animals obtain their nitrogen for protein by* | Consuming plants |
| ***3. Sampling techniques and measurement of biotic and abiotic factors*** |  |
| *Sampling plants and animals: techniques include* | Quadrats or pitfall traps, plus transect, Tullgren funnel, pooters, tree beating, sweep net, pond netting |
| *All sampling techniques need to be evaluated for* | Limitations and sources of error |
| *Organisms can be identified using* | Paired statement keys |
| *Abiotic factors which can be measured include* | Light intensity, temperature, pH and soil moisture |
| ***4. Adaptation, natural selection and the evolution of species*** |  |
| *A mutation is* | A random change to genetic material: the only source of new alleles |
| *Mutations may be* | Neutral, advantageous or disadvantageous |
| *Environmental factors which increase the rate of mutation are* | Radiation, high temperatures and some chemicals |
| *Natural selection is also called* | Survival of the fittest |
| *Natural selection occurs when: (4 points)* | 1. More offspring are produced than the environment can sustain 2. There are selection pressures 3. Only the best adapted individuals survive and breed 4. They pass on their advantageous alleles that give the selective advantage |
| *Speciation occurs when: (5 points)* | 1. Part of a population becomes isolated by an isolation barrier 2. Mutations occur in each sub-population 3. natural selection follows selects for different mutations in each group 4. due to different selection pressures 5. each sub-population evolves until their genetic differences make them different species |
| *Isolating barriers can be* | Geographical, ecological or reproductive |
| ***4. Human impact on the environment*** |  |
| *Increasing human population requires* | Increased food yield |
| *Fertilisers can leach into fresh water causing* | Algal blooms |
| *Algal blooms lead to* | A reduction in light levels, killing aquatic plants |
| *Dead plants and dead algae* | Become food for bacteria, which increase greatly in number |
| *The bacteria* | Use up large quantities of oxygen, reducing availability for other organisms |
| *Indicator species are* | Species that by their presence or absence indicate environmental quality/pollution levels |
| *Pesticides sprayed onto crops can* | Accumulate in the bodies of organisms over time |
| *Pesticides are passed along food chains and* | Toxicity increases and can reach lethal levels |
| *Biological control may be* | An alternative to pesticides |
| *GM crops may be* | An alternative to fertiliser use |