AQA Biology GCSE Student Progress

Unit 4.1 - Cell Biology

4.1.1. Cell Structure

4.1.1.1. Eukaryotes and Prokaryotes

a	I know that plant and animal cells (eukaryotic cells) have a cell membrane, cytoplasm and genetic material enclosed in a nucleus.			
b	I know that bacterial cells (prokaryotic cells) are much smaller than eukaryotic cells. They have cytoplasm and a cell membrane surrounded by a cell wall.			
c	I know that, in bacterial cells, the genetic material is not enclosed in a nucleus. It is a single DNA loop and there may be one or more small rings of DNA called plasmids.			

4.1.1.2. Animal and Plant Cells

a	I can name and locate the following parts of plant and animal cells: nucleus, cytoplasm, cell membrane, mitochondria and ribosomes.			
b	I know that in addition to the parts found in animal cells, plant cells often have chloroplasts, a permanent vacuole filled with cell sap and a cell wall made of cellulose.			
c	I can explain how the main sub-cellular structures, including the nucleus, cell membranes, mitochondria, chloroplasts (in plant cells) and plasmids (in bacterial cells) are related to their functions.			

4.1.1.3. Cell Specialisation

a	I know that cells may be specialised to carry out a particular function, such as sperm cells, nerve cells and muscle cells (in animals) and root hair cells, xylem and phloem cells (in plants).			
b	I can explain how the structure of different types of cell relate to their function in a tissue, an organ or organ system, or the whole organism.			

4.1.1.4. Cell Differentiation

a	I can explain that as an organism develops, cells differentiate to form different types of cells and that most types of animal cell differentiate at an early stage, whilst many types of plant cells retain the ability to differentiate throughout life.			
b	I can explain that as a cell differentiates it acquires different sub-cellular structures to enable it to carry out a certain function. It has become a specialised cell.			
c	I know that in mature animals, cell division is mainly restricted to repair and replacement of damaged/worn out cells.			

4.1.1.5. Microscopy

a	I can describe how microscopy techniques have developed over time.			
b	I can explain that an electron microscope has much higher magnification and resolving power than a light microscope which means that it can be used to study cells in much finer detail. This has enabled biologists to see and understand many more sub-cellular structures.			

4.1.1.6. Culturing Microorganisms (Biology only)

a	I know that bacteria multiply by simple cell division (binary fission) as often as once every 20 minutes if they have enough nutrients and a suitable temperature.			
b	I know that bacteria can be grown in a nutrient broth solution or as colonies on an agar gel plate.			
c	I know that uncontaminated cultures of microorganisms are required for investigating the action of disinfectants and antibiotics.			
d	I can describe how to prepare an uncontaminated culture using aseptic technique.			
e	I can explain why: • Petri dishes and culture media must be sterilised before use; • inoculating loops used to transfer microorganisms to the media must be sterilised by passing them through a flame; • the lid of the Petri dish should be secured with adhesive tape and stored upside down; • in school laboratories, cultures should generally be incubated at 25°C.			
f	I can calculate the number of bacteria in a population after a certain time if given the mean division time.			
g	I can calculate cross-sectional areas of colonies or clear areas around colonies using πr^2.			

4.1.2. Cell Division

4.1.2.1. Chromosomes

a	I know that the nucleus of a cell contains chromosomes made of DNA molecules. Each chromosome carries a large number of genes. In body cells the chromosomes are normally found in pairs.			

4.1.2.2. Mitosis and the Cell Cycle

a	I know that cell division by mitosis is important in the growth and development of multicellular organisms.			
b	I can describe the three overall stages of the cell cycle (including mitosis): • Before a cell can divide it needs to grow and increase the number of sub-cellular structures such as ribosomes and mitochondria. The DNA replicates to form two copies of each chromosome. • In mitosis, one set of chromosomes is pulled to each end of the cell and the nucleus divides. • Finally, the cytoplasm and cell membranes divide to form two identical cells.			

4.1.2.3. Stem Cells

a	I know that a stem cell is an undifferentiated cell of an organism which is capable of giving rise to many more cells of the same type, and from which certain other cells can arise from differentiation.			
b	I can describe the function of stem cells in embryos, in adult animals and in the meristems in plants.			
c	I can describe how stem cells from human embryos can be cloned and made to differentiate into most different types of human cells. Such as: • Stem cells from adult bone marrow can form many types of cells including blood cells. • Meristem tissue in plants can differentiate into any type of plant cell, throughout the life of the plant.			

4.1.3. Transport in Cells

4.1.3.1. Diffusion

a	I know that substances may move into and out of cells across the cell membranes via diffusion.			
b	I can recall that diffusion is the spreading out of the particles of any substance in solution, or particles of a gas, resulting in a net movement from an area of higher concentration to an area of lower concentration.			
c	I can name some of the substances transported in and out of cells by diffusion: oxygen and carbon dioxide in gas exchange, and of the waste product urea from cells into the blood plasma for excretion in the kidney.			
d	I can describe the factors which affect the rate of diffusion: • the difference in concentrations (concentration gradient); • the temperature; • the surface area of the membrane.			
e	I can recognise, draw and interpret diagrams that model diffusion.			
f	I can explain that a single-celled organism has a relatively large surface area to volume ratio and that this allows sufficient transport of molecules into and out of the cell to meet the needs of the organism.			

4.1.3.2. Osmosis

a	I know that water may move across cell membranes via osmosis.			
b	I can recall that osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.			
c	I can recognise, draw and interpret diagrams that model osmosis.			

4.1.3.3. Active Transport

a	I can recall that active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient) and that this requires energy from respiration.			
b	I know that active transport allows mineral ions to be absorbed into plant root hairs from very dilute solutions in the soil and that plants require ions for healthy growth.			
c	I know that active transport allows sugar molecules to be absorbed from lower concentrations in the gut into the blood which has a higher sugar concentration and that sugar molecules are used for cell respiration.			
d	I can describe how substances are transported into and out of cells by diffusion, osmosis and active transport and explain the differences between the three processes.			