Definitions

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- **Gene:** a section of DNA that contains coded information for making polypeptides.
- **Allele:** one of a number of alternative forms of a gene.
- **Locus:** position of a gene on a chromosome or DNA molecule.
- **Meiosis:** produces four daughter nuclei, each with half the number of chromosomes as the parent.
- **Mitosis:** produces two daughter nuclei, with the same number of chromosomes as the parent cell.
- **Cell differentiation:** each cell becomes specialised in structure to suit the role that it will carry out.

- **Interspecific variation:** variation between different species.
- **Intraspecific variation:** variation within a species.
- **Species:** a group of similar organisms that can breed together to produce fertile offspring.

The Triplet Code

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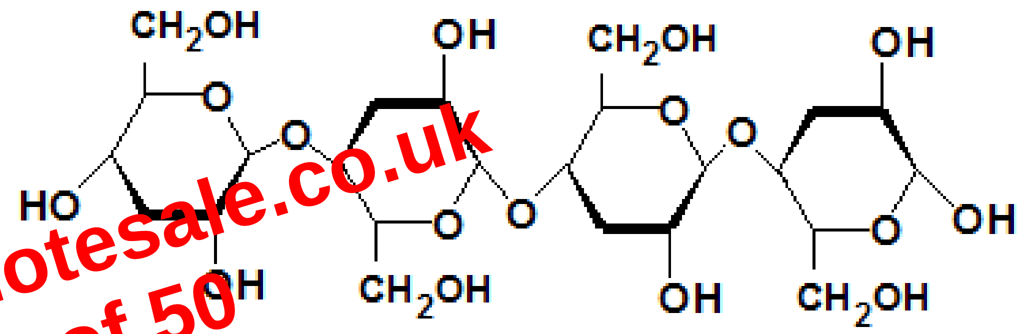
- Genes determine the proteins of an organism.
- Sequence of DNA bases determine a polypeptide.

- Scientists suggested there must be a minimum of three bases that code for each amino acid:
- Only 20 amino acids regularly occur in proteins.
- Each amino acid must have its own code.
- Only four different bases.
- If one base codes for one amino acid, there must only be four.
- Using pairs, only sixteen types.
- Three bases produce 64 codes – triplet code.

- **In eukaryotes, much of the nuclear DNA does not code for amino acids – these sections are called introns and can occur within genes and as multiple repeats between genes.**

Cellulose



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- **Cellulose →**
- Made of β-glucose monomers.
- -OH group is above the glucose ring – to form glycosidic bonds, each β-glucose must rotate by 180˚ compared to neighbour – position of CH_2OH alternates.
- Forms straight, un-branched chain – run parallel to one another so hydrogen bonds are formed – strengthens cellulose.
- Cellulose molecules group together to form microfibrils which are arranged in parallel groups called fibres.

- **Function and properties →**
- Major component of plant cell walls – provides rigidity.
- Prevents cell from bursting as water enters by osmosis – exerts inward pressure that stops any further influx of water.
- Living plant cells are therefore turgid making herbaceous parts of plants semi-rigid – important in maintaining stems and leaves in turgid state – provides maximum surface area for photosynthesis.

Tissue Fluid

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- A watery liquid containing glucose, amino acids, fatty acids, salts and oxygen.
- After supplying cells, it receives carbon dioxide and other waste.
- It is the immediate environment of cells and formed from blood plasma.

- **Formation →**
- The pressure of blood from arteries to arterioles to capillaries is called hydrostatic pressure at the end of the capillaries.
- The hydrostatic pressure forces tissue fluid out of the blood plasma.
- The outward pressure is opposed by the hydrostatic pressure of the tissue fluid outside of the capillaries which prevents outward movement of liquid and the lower water potential of the blood, due to plasma proteins, pulls water back into the blood.
- The combined effect of all these forces creates an overall pressure that pushes tissue fluid out – only enough to force small molecules out – ultrafiltration.

Tissue Fluid

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- **Once tissue fluid has exchanged materials, it returns to the blood plasma via the capillaries →**
- The loss of tissue fluid from the capillaries reduces hydrostatic pressure inside.
- Hydrostatic pressure is less than that of the outside tissue fluid.
- Tissue fluid is therefore forced back in.
- Osmotic forces pill water back into the capillaries.
- Not all tissue fluid can return to capillaries, the rest is carried back via the lymphatic system.
- The lymphatic system resembles capillaries – it gradually merges into larger vessels – these drain the contents back into the bloodstream via two ducts that join veins close to the heart.

- **Contents in system moved by →**
- Hydrostatic pressure of fluid that has left the capillaries.
- Contraction of body muscles – these squeeze the lymph vessels – valves ensure fluid moves to the heart.

Gas Exchange in the Leaf

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- When photosynthesis takes place although some carbon dioxide comes from cell respiration, most is take from the external air.
- Some oxygen produces is used for respiration, most diffuses out.
- When photosynthesis doesn't occur, oxygen diffuses into the leaf.
- No living cell is far from external air – short diffusion pathway, very large SA:V ratio – no specialised transport system.

- **Adaptions for rapid diffusion:**
- Thin, flat shape – large surface area.
- Many small pores (stomata) in lower epidermis.
- Numerous interconnecting air-spaces throughout mesophyll.

- **Stomata:**
- Occurs mainly on leaves – each are surrounded by a pair of special cells.
- Pore can open and close – controls rate of gaseous exchange.

- Plants have to balance conflicting needs of gas exchange and water loss – they completely or partly close stomata at times when water loss would be excessive.

Movement of Water up Stems

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- **Movement of water out through stomata →**
- Humidity of air in atmosphere is less than air space next to the stomata.
- When stomata open, water vapour diffuses out – water is replaced by evaporation from cell walls of surrounding mesophyll cells.

- **Movement of water across the cells of a leaf →**
- Water lost from mesophyll cells is replaced by water from the xylem.
- **Water movement occurs because:**
- Mesophyll cells lose water to air spaces – lowers water potential.
- Loss of water from neighbouring cells by osmosis lowers water potential.
- They, in turn, take in water from neighbours by osmosis.

Antibiotics

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- **Antibiotics:** substances produced by living organisms that can destroy or inhibit the growth of microorganisms.

- In bacterial cells, water constantly enters by osmosis.
- This would normally burst the cell – osmotic lysis – the wall protects it.
- The wall is made of a tough material – not easily stretched.
- Water enters the cell, the contents push against the cell wall – it resists further expansion and no more water enters.

- **Ways antibiotics work →**
- Certain antibiotics kill bacteria by preventing them forming cell walls – they inhibit synthesis and assembly of peptide cross-linkages – this weakens the wall so that it can't withstand pressure – osmotic lysis can occur.
- Since they inhibit formation of the wall, antibiotics are only effective when bacteria is growing.
- Viruses have different coverings – antibiotics are ineffective.