SLE111 – CELLS AND GENES

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Sample Pages from Notes

Atoms, Bonds and Importance of Water

- Living matter consists of carbon, oxygen, nitrogen and hydrogen predominantly.
- Elements are joined through ionic and covalent bonds.
- Atoms with incomplete valence are considered reactive.
- Ionic bonds form when an atom or molecule loses or gains and electron.
- Negative charge - anion.
- Positive charge - cation.
- Covalent bonding involves sharing a pair of valence electrons, thus producing a molecule.
- Water is a molecule formed via a covalent bond.
- Water is a polar molecule (oxygen is more electronegative than hydrogen)
- Hydrogen on water can form hydrogen bonds with other molecules.
- Water is a solvent.
- High PH = low amount of H+ ions, Low PH = High amount of H+ ions.
- PH has the ability to alter the charge and hence the shape of biological molecules.

Biological Molecules

- Carbon can form 4 covalent bonds.
- Macromolecules are formed by dehydration reactions.
- Macromolecules are broken down via hydrolysis.

Carbohydrates:

- Monomers (monosaccharides)
- Polymers (polysaccharides)
- Carbon, Hydrogen and oxygen make up carbs.
- For each carbon there are 2 hydrogens and 1 oxygen.
- Monosaccharides tend to form ring structures.
- Monosaccharides are joined by covalent bonds (called a glyosidic linkage)
  Starch is an energy storage polysaccharide in plants.
- Cellulose is a structural polysaccharide in plants.
- Glycogen is the storage polysaccharide in animals.
- Chitin is the structural polysaccharide in animals.

Lipids:

- Contain lots of carbon and hydrogen and limited oxygen.
- Three fatty acids form a glycerol.
- Fats are hydrophobic.
- Phospholipids contain hydrophilic head and hydrophobic tail.

Proteins:

- Contain C, H, O and N
- Dehydration reaction between COOH group and NH2 of two different amino acids form polypeptide chains
- Protein Functions include structure, storage, transport, hormonal, receptors, contraction, defence, enzymatic degradation.
- Structures of protein structure include primary - secondary - tertiary - quaternary
- Primary - polypeptide chain
- Secondary - hydrogen bonds form between O and H forming either Alpha helices or b pleated sheets
- Tertiary - Disulphide bridges form, ionic bonds, hydrophobic interactions form which causes a 3D shape.
- Quaternary - Multiple tertiary structure proteins coming together to form one protein.

Nucleic acids

- RNA - ribose nucleic acid
- DNA Deoxyribose nucleic acid
- DNA is the template which RNA takes a copy so that it can be produced into proteins.
- Nucleic acids are polymers of nucleotides.
- Contain C, O, H, N, P
- Nitrogenous base - purines (Adenine, Guanine) or pyrimidines (Uracil, Thymine, Cytosine) family's.
- Sugar (ribose or deoxyribose) -

Cells

- All cells have ribosomes.
- All contain nucleic acids
- Prokaryotes:
- Don't have DNA enclosed in a membrane (no nucleus)
- Don't have membrane bound organelles.
- Are unicellular.
- Very small.
- Eg Bacteria and Archaea
- Eukaryotic cells:
- DNA enclosed within nucleus.
- Contain membrane bound organelles
- Multicellular or unicellular.
- Much larger.

Identification of Bacteria

- Size and shape.
- By their metabolism (ability to grow in the presence or absence of oxygen.)
- Nutrient requirements.

Binary Fission

- First chromosome is duplicate.
- Each daughter cell receives a single copy of the chromosome.
- Genetically identical.

Bacteria and Disease

- Pathogenic bacteria - cause disease
- Opportunistic pathogens - have the ability to cause disease in favouring conditions eg chemotherapy
- Some bacteria disrupt physiology by growth and invasion. Eg turbuclosis.
- Most bacteria produce toxins usually in the form of proteins that affect the body (exotoxins)
- Some bacteria have components on their cell membrane that cause problems (endotoxins)
- Antibiotics - defence chemicals naturally produced by bacteria and fungi.
- They can affect cell wall synthesis, protein synthesis, etc.
- Many prokaryotes are symbiotic.