Biological Molecules

Q: Explain the meaning of the term primary structure.

- Sequence/arrangement and number of amino acids in a polypeptide

Q: Describe the secondary structure of an enzymatic protein.

- Regular pattern due to hydrogen bonds
- Hydrogen bonds between -CO- of one amino acid and -NH- of the other
- Give rise to tight a-helices, coils/cylinders
- Loose beta-pleated sheets, arrows

Q: Describe the tertiary structure of an enzymatic protein.

- Further coiling and folding of the secondary structure
- Interactions between R groups/side chains
- New bonds and interactions
- Ionic bonds, hydrogen bonds, disulfide bonds
- Functional protein forms
- Globular structure
- Precise active site

Q: State what is meant by the term hydrolysis.

- Breakdown of a covalent bond by addition of water

Q: Explain why an amylose molecule and a cellulose molecule have very different structures, even though both have glucose as the constituent monomer.

- Amylose has alpha glucose, cellulose has beta glucose
- 180 rotation of adjacent beta glucose molecules
- Alpha 1,4 glycosidic bonds vs. beta 1,4 glycosidic bonds
- Amylose has energy storage function; cellulose has structural function in plant cell walls

Q: Describe the molecular structure of glycogen and explain how this makes it suitable for storage.

- Polysaccharide
- Highly branched
- Branching due to alpha 1,6 glycosidic bonds
- Alpha 1,4 glycosidic bonds
- Allows compact structure so more can be stored
- Insoluble so doesn't affect osmotic properties of cells
- More ends to easily add/remove glucose

Q: Describe the structure of cellulose.

- Polymer, macromolecule, polysaccharide
- Monomer is beta glucose
- Adjacent monomers rotated through 180
- Beta 1,4 glycosidic bonds
- Hydrogen bonding between cellulose molecules
- Form fibers and microfibrils

Q: Describe the roles of spindle fibers during mitosis.

- Attach to centromere/kinetochore of chromosomes during prophase
- Arranges chromosome at the equator/metaphase plate
- Fibres contract
- Pull sister chromatids to opposite poles
- Allows equal number of chromosomes to be present in the two daughter cells

Q: Explain how uncontrolled cell division can result in cancer.

- Mutation occurs
- Protooncogenes converted to oncogenes
- Formation of tumor, mass of unspecialized cells
- No response to signals to control mitosis
- No contact inhibition
- No cell death/apoptosis
- Metastasis

Q: Explain the importance of telomeres.

- Permit continued replication
- Prevent loss of genes
- Protect ends of chromosomes from being degraded

Q: Explain why stem cells are important in tissue repair.

- Cell cycle remains continuous
- Produce cells that can differentiate
- Can produce cells that can still function as before
- Can divide to produce a cell that can divide and a cell that can differentiate

- Increased wind speed, steeper w.p gradient, increased transpiration rate
- Increases light intensity, stomata open more widely, increased transpiration rate

Q: Outline the roles of plasmodesmata in transport in plants.

- Allows transport of water/organic substances etc. from cell to cell
- Without crossing membranes/walls
- Movement through the symplast
- E.g., from companion cell to phloem sieve tube element
- Allows communication and signaling b/w cells

Q: Describe how the structure of xylem vessel is adapted to its function.

- Thickened/lignified walls prevent collapse
- Lignified wall prevents leakage, waterproofs
- Cellulose lining allows adhesion to water molecules
- Large lumen allows a greater volume to flow per unit time
- No cytoplasm allows unimpeded flow
- Elongated so ease of water movement
- Pits allow lateral movement

Q: Explain how hydrogen bonding is involved in the movement of water through xylem.

- Adhesion of water to cellulose lining of xylem vessel
- Polar/hydrophilic cellulose fibers

- Cohesion between water molecules
- Maintain columns of water

Q: Describe the pathway taken by water as it moves from root hair cells into xylem vessels.

- Through cortex, via cortical cells
- Apoplast pathway via cell walls of adjacent cells
- Symplast pathway via cytoplasm and plasmodesmata
- Vacuolar pathway
- At endodermis, only symplast
- Apoplast pathway blocked due to suberin forming the Casparian strip
- Water moves via passage cells

Q: Explain how the structure of a sieve tube element is related to its function.

- Elongated cells forming long tubes
- Little cytoplasm/few organelles reduce resistance to flow of phloem sap
- Sieve plates have pores so little barrier to flow from cell to cell, allows mass flow
- Sieve plates stop bulging of sieve tube elements
- Plasmodesmata b/w sieve tube and companion cell allow ease when loading/unloading
- Membrane around sieve tube to allow osmosis

Q: Describe what causes oxygen to be released from oxyhemoglobin as blood flows through respiring tissues.

- Lower partial pressure of O2
- Higher partial pressure of CO2
- Formation of carbaminohemoglobin
- Carbonic acid dissociation to form H+ and hydrogen carbonate ions
- Formation of hemoglobinic acid
- Hb has higher affinity for H+, combines with it
- Lowers affinity of Hb for O2
- Bohr effect
- Oxygen released

Infectious Diseases

Q: Explain the term infectious disease.

- Transmissible
- Caused by a pathogen
- Condition that reduces the effectiveness of functions in the organism

Q: Outline how penicillin acts on bacterial cells.

- Inhibits bacterial cell wall synthesis
- Prevents formation of cross links between peptidoglycan chains
- Inhibits enzymes involved in forming cross links
- Weakens cell wall
- Uptake of water by osmosis down the w.p gradient
- No cell wall to withstand the high turgor pressure created
- Bacterium bursts
- Bacteria die
- Stop bacteria reproducing
- Acts on growing bacteria

Q: Explain how resistance to antibiotics develops.

- Overuse of antibiotics
- Not completing course of antibiotics
- Reservoir of bacteria remains
- A gene mutation in bacterial DNA occurs
- This gene is resistant to antibiotics