

## **1.1.1 Biological Molecules**

### **Starch:**

- Polymer of  $\alpha$  glucose- held with glycosidic bonds
- Plant storage polysaccharide- ideal storage
  - Compact
  - Insoluble- no osmotic effect
  - Glucose added/removed easily
- Amylose:
  - Linear
  - Condensation reactions between  $\alpha$  glucose- many
  - 1-4 links
  - Coils into helix
- Amylopectin:
  - Condensation reactions between  $\alpha$  glucose
  - 1-4 links
  - 1-6 links also exist
  - Can fit inside the amylose

### **Glycogen:**

- Storage polysaccharide in animals
- 1-4 and 1-6 links
- Storage:
  - Compact
  - Insoluble- no osmotic effect
  - Glucose added/removed easily

### **Cellulose:**

- Plant cell walls
- Long, parallel chains of  $\beta$  glucose- H bonds
- Adjacent glucose mols rotated  $180^\circ$ - allow H bond between OH groups
- Microfibrils- lots of these make fibres

### **Chitin:**

- Exoskeleton of insects
- Strong, waterproof, lightweight
- Alternating isomers

### **Lipids:**

- Function= energy stores in animals and plants
- Contain elements CHO
- Triglycerides= fatty acids and glycerol- by condensation reactions- between carboxyl group (COOH) of fatty acid and hydroxyl group (OH) of glycerol- ester bond
- Fatty acid= R.COOH
- Saturated= double C-C - heart disease
- Unsaturated= single C=C - lower mp, not as compact

## Proteins:

- Functions= haemoglobin, antibodies, enzymes
- Primary:
  - Polypeptide chain
  - Bonds:
    - Peptide bonds
- Secondary:
  - Polypeptides twist or coil
  - $\alpha$  helix or  $\beta$  pleated sheet
  - Bonds:
    - H bonds
- Tertiary:
  - Folding of  $\alpha$  helix
  - Polypeptide folded into precise, compact structure
  - Bonds:
    - Disulphide bridges
    - H bonds
    - Ionic bonds
    - Hydrophobic interactions
- Quaternary:
  - Combo of 2+ polypeptide chains in tertiary structure
  - Bonds:
    - Ionic bonds
    - Disulphide bridges
    - H bonds
- **Fibrous:**
  - Polypeptide chains= parallel-  
no tertiary folding

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  - Insoluble

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  - Structural functions e.g: keratin  
and collagen

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  - Numerous cross-linkages- form  
long fibres

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  - Strong, tough, stable
- **Globular**
  - Polypeptide chains have  
tertiary structure

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  - Soluble

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  - Metabolic functions e.g:  
enzymes, antibodies, hormone

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  - Haemoglobin= example-  
quaternary

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  - Easily change chemically- not  
stable

## **Water:**

- The oxygen nucleus draws -ve electrons away from the +ve hydrogen nucleus
- Has uneven distribution of charge
- Polar
- Electrostatic attraction between +ve region and -ve region mols- makes weak H bonds
- Individual bonds are weak, but there's many- stick together in strong lattice- cohesion
- Properties:
  - Universal solvent
    - dissolves more substances than any other liquid
    - allows chemical reactions to happen- acts as transport medium
  - High surface tension
    - formed by the cohesion between mols
    - used by water skaters
  - High specific heat
    - large amount of heat to raise temp
    - stops large fluctuations in temp- aquatic habitats stable
  - High latent heat
    - large amount of heat to turn into vapour
    - important in temp control
  - Maximum density at 4°C
    - ice is less dense than water
    - ice on surface- insulated below- aquatic life survival
  - Transparent
    - light can pass through
    - photosynthesis
  - Cohesive
    - sentence about cohesion above
    - tall columns of water can be drawn up into xylem vessels in tall trees
  - Polar
    - attracts other charged particles. sentence about cohesion above
    - allows water mols to be cohesive

## **1.1.2 Cell Structure & Organisation**

### **Nucleus:**

- Largest organelle
- 10-20µm diameter
- Chromatin= dispersed genetic material (DNA)
- Contains DNA + controls activities of cell
- Nucleolus
  - makes rRNA
  - nucleoplasm
- Nuclear pores
  - 100nm diameter
- Nuclear membrane
  - double layered
  - continuous with ER
  - pores

### **Cytoplasm:**

- Contents of cell- organelles
- Cytosol- without organelles

### **Endoplasmic Reticulum (ER):**

- Network of membranes forming cisternae found throughout cytoplasm- originates from outer membrane of nucleus
- Rough
  - ribosomes are attached
  - made of cisternae
  - protein synthesis occurs
- Smooth
  - synthesise lipids and steroids

### **Mitochondria:**

- Found in cytosol of most eukaryotic cells
- 2-5µm length
- Convert energy into ATP in aerobic respiration
- They have:
  - outer membrane (whole structure)
  - inner membrane (fluid-filled matrix)
  - intermembrane space between membranes
  - inner membrane folded- cristae- form matrix- inc surface area for respiration
- Muscle cells- lots of mitochondria- require lots of ATP

### **Ribosomes:**

- Protein synthesis
- 2 parts- subunits- small and large
- Some found in cytoplasm- most found in ER
- When in ER- make proteins the cell needs

### **Golgi Body:**

- Formed by vesicles pinched off RER
- Protein is transported in vesicles
- Responsible for modifying proteins made in ER for secretion
- Other functions:
  - produce glycoprotein
  - form lysosomes
  - transport and store lipids

### **Lysosomes:**

- Small vacuoles from golgi body- contain enzymes which are isolated from rest of cell
- Use these enzymes to destroy worn out organelles and digest material taken into cell  
e.g: via phagocytosis
- ER and golgi make them

### **Centrioles:**

- Only in animal cells
- Found just outside nucleus in centrosome
- 2 hollow cylinders and right angles to each other
- Used in the formation of microtubules of spindle in cell division

### **Vacuoles:**

- Only in plant cells
- Large and permanent
- Surrounded by membrane- tonoplast
- Main function= storage
- Contain cell sap, storage site for chemicals and provide osmotic system

### **Chloroplast:**

- Large plasmid containing chlorophyll
  - absorb light for photosynthesis
- Double outer membrane
  - contains stroma with ribosomes, lipid and circular DNA
- Thylakoids
  - parallel flattened sacs
  - photosynthetic pigments found here- provides large SA for trapping light energy
- Grana
  - stack of thylakoids
- Lamelle
  - between grana and thylakoids
- Self-replicating

### **Cell Wall & Plasmodesmata:**

- Made of cellulose microfibrils in polysaccharide matrix
- Plasmodesmata