**Topic 1.3:  Membrane Structure**

**Essential Idea:**The structure of biological membranes makes them fluid and dynamic.

**Statements & Objectives:**

**1.3.U1  Phospholipids form bilayers in water due to the amphipathic properties of phospholipid molecules.**

* Draw a simplified diagram of the structure of the phospholipid, including a phosphate-glycerol head and two fatty acid tails.

**(Draw** :Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler(straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted(if appropriate) and joined in a smooth curve. )

* Define hydrophilic and hydrophobic.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

* Define amphipathic and outline the amphipathic properties of phospholipids.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

* Explain why phospholipids form bilayers in water, with reference to hydrophilic phosphate heads and two hydrophobic hydrocarbon tails.​

(**Explain**: Give a detailed account including reasons or causes)

**1.3.U2  Membrane proteins are diverse in terms of structure, position in the membranes and function.**

* State the primary function of the cell membrane.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

* Contrast the structure of integral and peripheral proteins.

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

* List at least four functions (with example) of membrane bound proteins.

**(List**: Give a sequence of brief answers with no explanation.)

* Contrast the two types of transport proteins:  pumps and channels.​

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

**1.3.U3  Cholesterol is a component of animal cell membranes.**

* Identify the structure of cholesterol in molecular diagrams.

**(Identify**: Find an answer from a given number of possibilities)

* Describe the structural placement of cholesterol within the cell membrane.​

**(Describe**: Give a detailed account)

**1.3.A1  Cholesterol in mammalian membranes reduces membrane fluidity and permeability to some solutes.**

* Describe the function of cholesterol molecules in the cell membrane.​

**(Describe**: Give a detailed account)

**1.3.S1  Drawing of the fluid mosaic model.**

* Draw and label the structure of membranes.

**(Draw** :Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler(straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted(if appropriate) and joined in a smooth curve. )

**(Label** : Add labels to a diagram)

* Include:
  + Phospholipid bilayer
  + Integral proteins shown spanning the membrane
  + Peripheral proteins on membrane surface
  + Protein channels with a pore
  + Glycoproteins with a carbohydrate side chain
  + Cholesterol between phospholipids in the hydrophobic region
  + An indication of thickness (10nm)​

**1.3.S2  Analysis of evidence from electron microscopy that led to the proposal of the Davson-Danielli model.**

* Describe the observations and conclusions drawn by Davson and Danielli in discovering the structure of cell membranes.​
* **(Describe**: Give a detailed account)

**1.3.S3  Analysis of the falsification of the Davson-Danielli model that led to the Singer-Nicolson model.**

* Describe conclusions about cell membrane structure drawn from freeze-etched electron micrograph images of the cell membrane.
* **Describe**: Give a detailed account)
* Describe conclusions about cell membrane structure drawn from cell fusion experiments.

**(Describe**: Give a detailed account)

* Describe conclusions about cell membrane structure drawn from improvements in techniques for determining the structure of membrane proteins.

**(Describe**: Give a detailed account)

* Compare the Davson-Danielli model of membrane structure with the Singer-Nicolson model.​

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

**1.3.NOS1  Using models as representations of the real world-there are alternative models of membrane structures.**

* Explain what models are and their purposes in science.

(**Explain**: Give a detailed account including reasons or causes)

* Describe the observations and conclusions drawn by Gorter and Grendel in discovering the structure of cell membranes.​

**(Describe**: Give a detailed account)

**1.3.NOS2  Falsification of theories with one theory being superseded by another-evidence falsified the Davson-Danielli model.**

* Describe why the understanding of cell membrane structure has changed over time.​

**(Describe**: Give a detailed account)

**Key facts**

1. Cell membranes include phospholipids and proteins. These proteins may be classified as integral or peripheral proteins.
2. It is the hydrophobic and hydrophilic properties of phospholipids that maintain the structure of cell membranes.
3. Functions of membrane proteins include hormone binding sites, enzyme activity, cell adhesion, cell-to-cell communication, channels for passive transport, and pumps for active transport.
4. The term plasma membrane, not cell surface membrane, should be used for the membrane surrounding the cytoplasm.
5. Phospholipids form bilayers in water due to the amphipathic properties of phospholipid molecules.
6. Membrane proteins are diverse in terms of structure, position in the membrane and function.
7. Cholesterol is a component of animal cell membranes.

**Key Terms:**

Adhesion

Cholesterol

Enzyme

fatty acid

fluid mosaic

glycerol

facilitated diffusion

hyperosmotic

phosphorylation

cis-

bilayer

hydrocarbon

hydrophilic

hydrophobic

integral protein

glycoproteins

partially permeable

hypo-osmotic

intracellular

trans-

peripheral protein

phospholipid

receptor

recognition

surface area

polar

non polar

iso-osmotic

extracellular

phagocytosis

transport

volume

ratio

diffusion

osmosis

protein

phosphorylated alcohol

ATP

Pinocytosis

passive transport

active transport

vesicles

endocytosis

exocytosis

binding sites

equilibrium

protein pump

phosphate

saturated

unsaturated