SOLUTIONS

Unit 4: Cell membranes and transport

4.1: Fluid mosaic membranes

1. **B**
   The width of a typical cell membrane is within the range of 5–10 nm, which allows for its selective permeability and essential biological functions.
2. **D**
   The carbohydrate chains of both glycoproteins and glycolipids are found on the outer surface of the cell membrane, where they play roles in cell recognition and communication.
3. **C**
   Cholesterol stabilizes the membrane by reducing phospholipid movement, preventing excessive fluidity, especially at high temperatures.
4. **B**
   The β-adrenergic receptor is a protein. When adrenaline binds to it, the receptor changes shape, activating the G protein and triggering processes inside the cell.
5. **C**
   Cell recognition and signaling rely on glycolipids and glycoproteins, which have carbohydrate chains that extend from the cell surface. These molecules play a key role in cell adhesion, immune responses, and development. In contrast, cholesterol and phospholipids primarily maintain the structure and fluidity of cell membranes.
6. **D**
   Cholesterol regulates membrane fluidity by:
   – Inserting itself between phospholipid molecules, maintaining membrane structure.
   – Preventing phospholipid chains from packing too closely together at low temperatures.
   – Restraining phospholipid movement at high temperatures.
   – Reducing membrane permeability to ions and small molecules.
7. **B**
   Ligand binding to receptors and the consequent change in receptor shape is a core principle in cell signaling. This concept illustrates the dynamic nature of receptor-ligand interactions in cellular communication processes.
8. **D**
   Option D is correct, cholesterol is a lipid, thus it is non-polar and span between the phospholipids which would be hydrophobic, too. Carbohydrate chains of glycoprotiens and glycolipids usually are on the outer surface because they are hydrophilic.
9. **D**
   This question assesses knowledge of membrane transport mechanisms. Calcium ions (Ca^2) typically cannot pass directly through cell surface membranes without a carrier or channel protein due to their charge and hydration shell. Carbon dioxide (CO^2) is a small, nonpolar molecule that can diffuse directly through the phospholipid bilayer of cell membranes without the need for a carrier or channel. Glucose ($C_6H_{12}O_6$) is a large, polar molecule and therefore also requires a transport protein to cross the membrane efficiently.