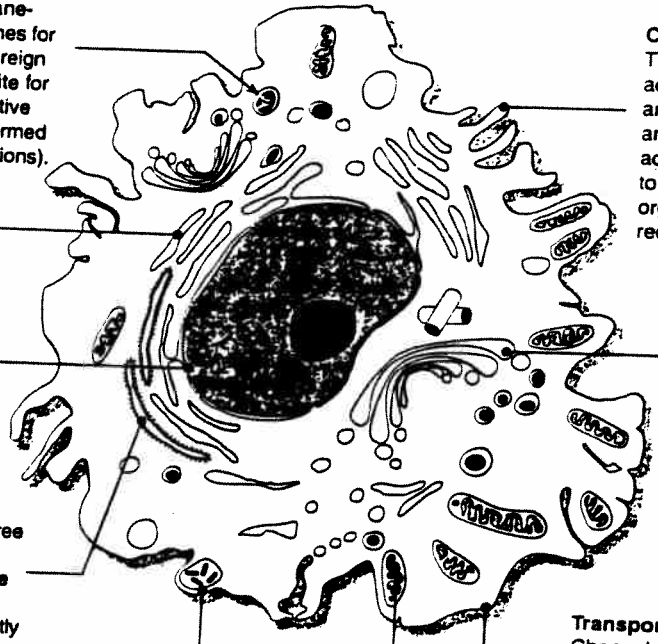
A 2

The Role of Membranes in Cells

Many of the important structures and organelles in cells are composed of, or are enclosed by, membranes. These include: the endoplasmic reticulum, mitochondria, nucleus, Golgi body, chloroplasts, lysosomes, vesicles and the cell plasma membrane itself. All membranes within eukaryotic cells share the same basic structure as the plasma membrane that encloses the entire cell. They perform a number of critical functions in the ce serving to compartmentalise regions of different function withi the cell, controlling the entry and exit of substances, and fulfillin a role in recognition and communication between cells. Some c these roles are described below. The role of membranes in th production of macromolecules (e.g. proteins) is shown opposite



Isolation of Enzymes Membrane-bound lysosomes contain enzymes for the destruction of wastes and foreign material. Peroxisomes are the site for destruction of the toxic and reactive molecule, hydrogen peroxide (formed as a result of some cellular reactions).

Role in Lipid Synthesis The smooth ER is the site of lipid and steroid synthesis.

Containment of DNA The nucleus is surrounded by a nuclear envelope of two membranes, forming a separate compartment for the cell's genetic material.

Role in Protein Synthesis Some protein synthesis occurs on free ribosomes, but much occurs on membrane-bound ribosomes on the rough endoplasmic reticulum (ER). Here the protein is synthesised directly into the ER.

Entry and Export of Substances The plasma membrane may take up fluid or solid material and form membrane-bound vesicles (or larger vacuoles) within the cell. Membrane-bound transport vesicles move substances to the inner surface of the cell where they can be exported from the cell by exocytosis.

Cell Communication and Recognition The proteins embedded in the membrane act as receptor molecules for hormones and neurotransmitters. Glycoproteins and glycolipids in the plasma membrane act as cell identity markers, helping cells to organise themselves into tissues and organs, and enabling foreign cells to be recognised.

Packaging and Secretion The golgi apparatus is a specialised membrane-bound organelle which produces lysosomes and compartmentalises the modification, packaging and secretion of substances such as proteins and hormones.

Transport Processes Channel and carrier proteins are involved in selective transport across the membrane. Cholesterol contained in the membrane can reduce the entry and exit of substances across the membrane by acting as a plug.

Energy Transfer The reactions of cellular respiration take place in the membrane-bound energy transfer systems occurring in mitochondria. In plants, the energy transformations of photosynthesis occur in chloroplasts.

1. Explain the crucial role of membrane systems and organelles in the following:

   (a) Providing compartments within the cell: _____

   _____

   _____

   (b) Increasing the total membrane surface area within the cell: _____

   _____

   _____

2. Explain the importance of the following components of cell membranes:

   (a) Glycoproteins and glycolipids: _____

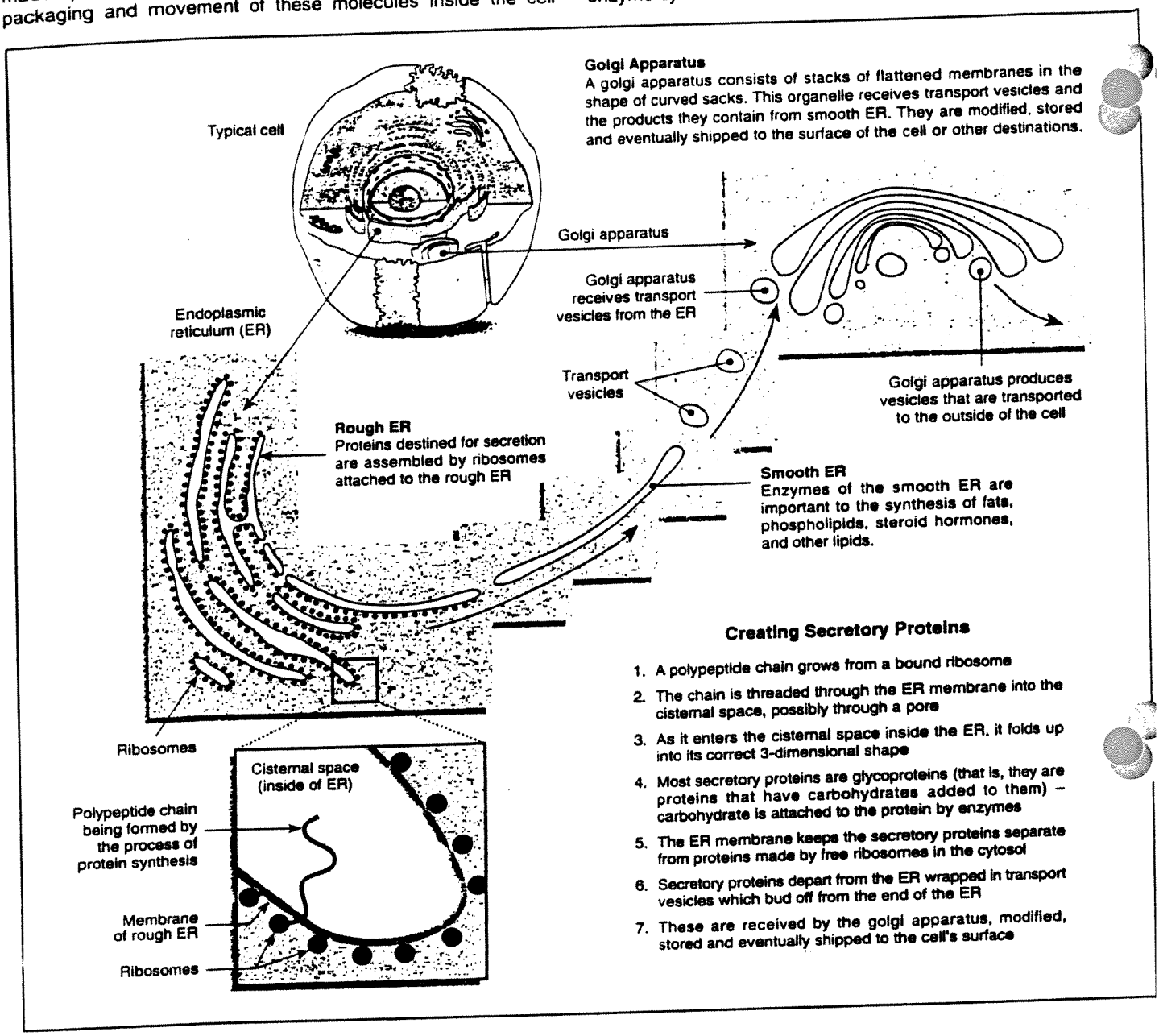
   _____

   (b) Channel proteins and carrier proteins: _____

   _____

3. Explain how cholesterol can play a role in membrane transport: _____

Cells produce a range of **macromolecules** – organic polymers made up of repeating units of smaller molecules. The synthesis, packaging and movement of these molecules inside the cell involves a number of membrane bound organelles, as indicated below. These organelles provide compartments where the enzyme systems involved can be isolated.



4. Define the term macromolecule: _____

_____

5. Suggest why polypeptides produced for transport are synthesised by membrane-bound (rather than free) ribosomes:

_____

_____

_____

6. Suggest why most secretory proteins are glycoproteins: _____

_____

_____

7. Briefly describe the roles of the following organelles in the production of macromolecules:

(a) Rough ER: _____

(b) Smooth ER: _____

(c) Golgi apparatus: _____