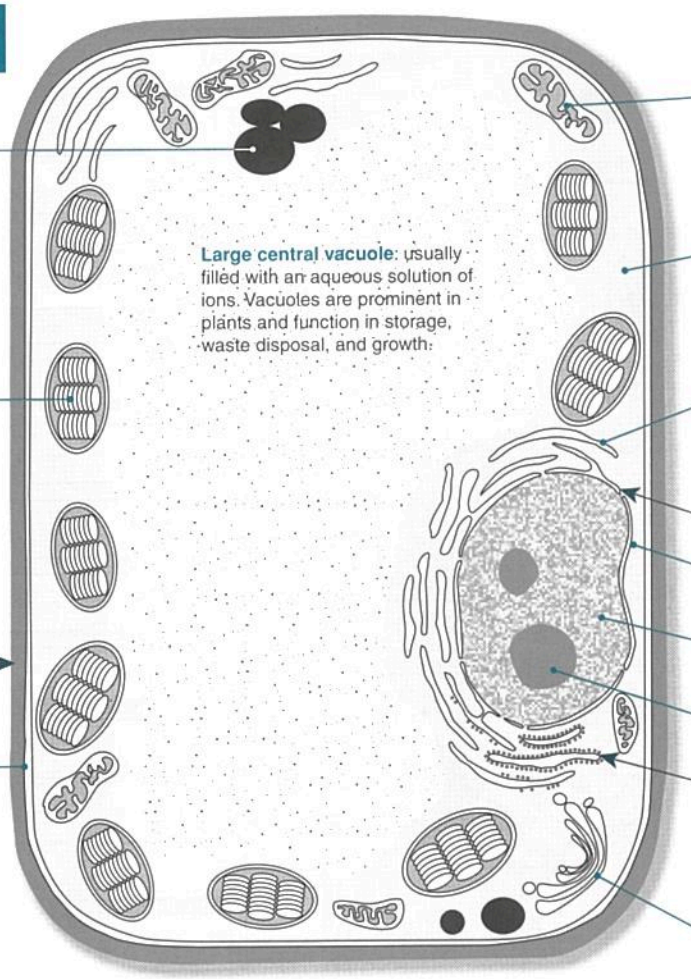
42 Plant Cells

Key Idea: Plant cells are eukaryotic cells. They have many features in common with animal cells, but they also have several unique features.

Plant cells are enclosed in a cellulose cell wall which protects the cell, maintains its shape, and prevents excessive water uptake. It does not interfere with the passage of materials into and out of the cell. The diagram below shows the structure and function of a typical plant cell and its organelles. The animal cells activity provides further information on the organelles listed here but not described.

Generalised Plant Cell



Starch granule: Carbohydrate stored in amyloplasts (plastids specialised for storage). Plastids are unique to plants. Non-photosynthetic plastids usually store materials.

Chloroplast: Specialised plastids, 2 µm x 5 µm, containing the green pigment chlorophyll. They contain dense stacks of membranes (grana) within a colourless stroma. They are the sites for photosynthesis and occur mainly in leaves.

Cell wall: A semi-rigid structure outside the plasma membrane, 0.1 µm to several µm thick. It is composed mainly of cellulose. It supports the cell and limits its volume.

Plasma membrane: Located inside the cell wall in plants, 3 to 10 nm thick.

Large central vacuole: usually filled with an aqueous solution of ions. Vacuoles are prominent in plants and function in storage, waste disposal, and growth.

Mitochondrion: 1.5 µm X 2–8 µm. Mitochondria are ovoid structures bounded by a double membrane. They are the cell energy transformers, converting chemical energy into ATP.

Cytoplasm: A watery solution containing dissolved substances, enzymes, and the cell organelles and structures. The site of translation in the cell.

Endoplasmic reticulum (ER): Comprises a network of tubes and flattened sacs. ER is continuous with the plasma membrane and the nuclear membrane and may be smooth or have attached ribosomes (rough ER).

Nuclear pore: 100 nm diameter.

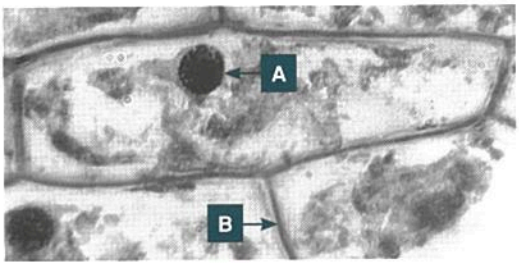
Nuclear membrane: A double layered structure penetrated by holes (nuclear pores).

Nucleus: A conspicuous organelle containing most of the cell's DNA, 5 µm diameter.

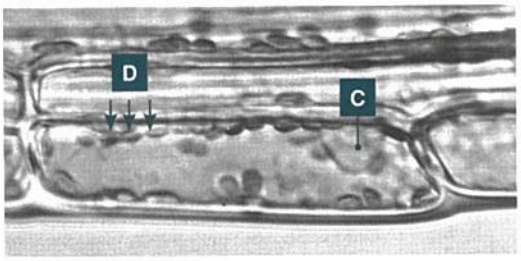
Nucleolus

Ribosomes: These small (20 nm) structures manufacture proteins. Ribosomes are made of ribosomal RNA and protein. They may be free in the cytoplasm or associated with the surface of the endoplasmic reticulum.

Golgi apparatus



Onion epidermal cells



Elodea cells

1. The two photographs (left) show plant cells as seen by a light microscope. Identify the basic features labelled **A-D**:

   A: _____

   B: _____

   C: _____

   D: _____

2. Identify four structures or organelles present in generalised plant cells but absent from animal cells:

   _____

   _____

   _____

   _____

3. Identify four membrane-bound organelles that plant cells have in common with animal cells:

   (a) _____ (c) _____

   (b) _____ (d) _____

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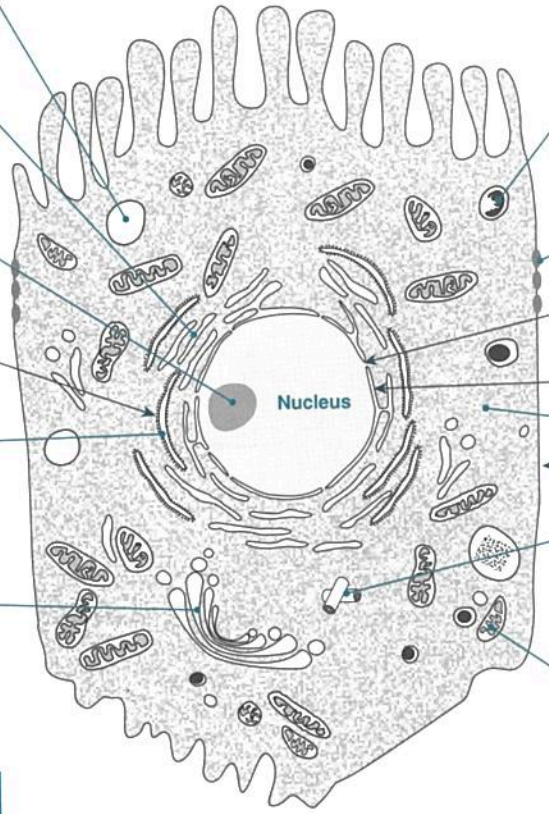
40 Animal Cells

Key Idea: Animal cells are eukaryotic cells. They have many features in common with plant cells, but also have a number of unique features.

Animal cells, unlike plant cells, do not have a regular shape. In fact, some animal cells (such as phagocytes) are able to alter their shape for various purposes (e.g. engulfing foreign material). The diagram below shows the structure and organelles of a liver cell. It contains organelles common to most relatively unspecialised human cells. Note the differences between this cell and the generalised plant cell. The plant cells activity provides further information on the organelles listed here but not described.



Vacuoles: Smaller than those found in plant cells.

Smooth endoplasmic reticulum: ER without ribosomes. It is a site for lipid and carbohydrate metabolism, including hormone synthesis.

Nucleolus: A dense, solid structure composed of crystalline protein and nucleic acid. They are involved in ribosome synthesis.

Ribosomes: These small structures may be free in the cytoplasm or associated with the endoplasmic reticulum (ER).

Rough endoplasmic reticulum: A site of protein synthesis. The rough ER also synthesises new membranes, growing in place by adding proteins and phospholipids.

Golgi apparatus: A series of flattened, disc-shaped sacs, stacked one on top of the other and connected with the ER. The Golgi stores, modifies, and packages proteins. It 'tags' proteins so that they go to their correct destination.

Lysosome: A sac bounded by a single membrane. They are pinched off from the Golgi apparatus and contain and transport enzymes that break down food and foreign matter. Lysosomes show little internal structure but often contain fragments of material being broken down. Specialised lysosomes are generally absent from plant cells.

Tight junctions: Join cells together in the formation of tissues.

Nuclear pore: A hole in the nuclear membrane allowing the nucleus to communicate with the rest of the cell.

Nuclear membrane: Double layered

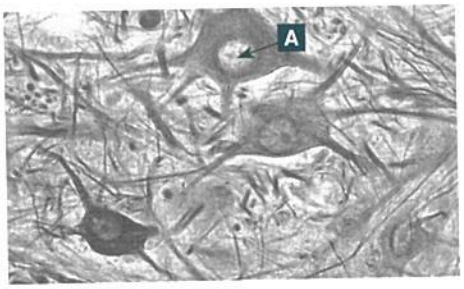
Cytoplasm

Plasma membrane

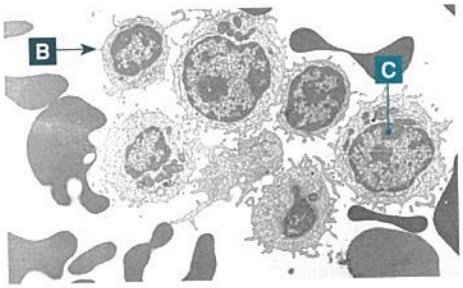
Centrioles: Structures associated with nuclear division. They are composed of microtubules, but appear as small, featureless particles, 0.25 µm diameter, under a light microscope. They are absent in higher plant cells and some protists.

Mitochondrion (*pl.* mitochondria): An organelle bounded by a double membrane system. The number in a cell depends on its metabolic activity.

Generalised Animal Cell



Neurones (nerve cells) in the spinal cord



White blood cells and red blood cells (blood smear)

Photos: EII

1. The two photomicrographs (left) show several types of animal cells. Identify the features indicated by the letters **A-C**:

   A: _____

   B: _____

   C: _____

2. White blood cells are mobile, phagocytic cells, whereas red blood cells are smaller than white blood cells and, in humans, lack a nucleus.

   (a) In the photomicrograph (lower, left), circle a white blood cell and a red blood cell:

   (b) With respect to the features that you can see, explain how you made your decision.

   _____

   _____

   _____

   _____

3. Name and describe one structure or organelle present in generalised animal cells but absent from plant cells:

   _____

   _____