Animal and plant cells

4.1.1.2 · Cell biology · revision notes

The sub-cellular structures in animal and plant cells and the job of each one. Questions ask you to label cell diagrams, match structures to functions, compare animal and plant cells, and explain how a cell's structures suit what it does.

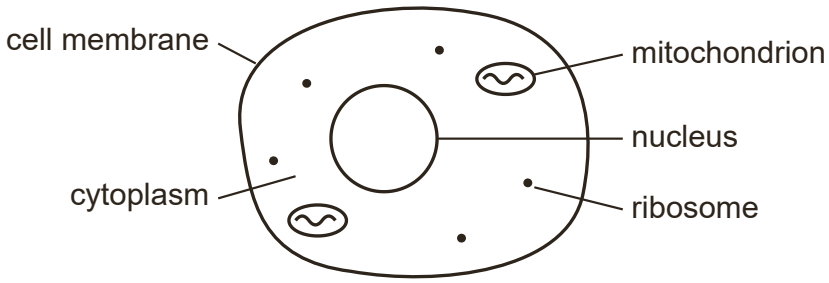
Key facts

- Nucleus: contains genetic material that controls the cell's activities
- Cell membrane: controls the movement of substances in and out
- Ribosomes: where protein synthesis happens
- Permanent vacuole: filled with cell sap (plant cells)
- Cytoplasm: where most chemical reactions happen; contains enzymes
- Mitochondria: where aerobic respiration happens
- Chloroplasts: where photosynthesis happens (plant cells)
- Cell wall: made of cellulose; strengthens the cell (plant and algal cells)

Notes

In animal and plant cells

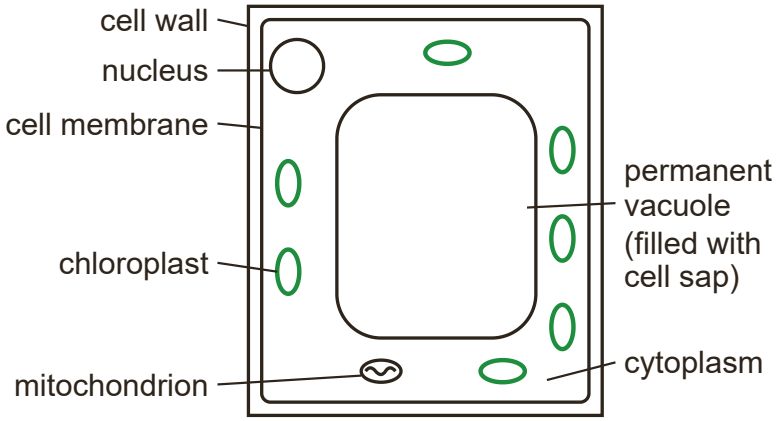
- **Nucleus**: contains the genetic material, which controls the activities of the cell.
- **Cytoplasm**: a gel-like substance where most of the cell's chemical reactions happen. It contains enzymes that control these reactions.
- **Cell membrane**: controls the movement of substances into and out of the cell.
- **Mitochondria**: where aerobic respiration happens, releasing energy for the cell.
- **Ribosomes**: where protein synthesis happens (proteins are made).



An animal cell, e.g. a cheek cell

Extra structures in plant cells

- **Chloroplasts**: where photosynthesis happens. They contain chlorophyll, which absorbs light.
- **Permanent vacuole**: filled with **cell sap**. It helps keep the cell firm.
- **Cell wall**: made of **cellulose**. It strengthens the cell. Algal cells also have a cellulose cell wall.
- Plant cells also have every structure that animal cells have, including mitochondria.



A plant cell, e.g. a palisade cell. The cell wall, chloroplasts and permanent vacuole are not found in animal cells.

- Not all plant cells have chloroplasts: root cells get no light, so they cannot photosynthesise.

Linking structure to function

- Many mitochondria: the cell needs a lot of energy, e.g. muscle cells and sperm cells.
- Many ribosomes: the cell makes a lot of protein, e.g. cells that make enzymes.
- Many chloroplasts: the cell carries out a lot of photosynthesis, e.g. palisade cells near the upper surface of a leaf.
- To estimate the size of a structure, compare it with the whole cell. If a nucleus is about a quarter of the width of a cell 20 µm wide, the nucleus is about 5 µm across.

Required practical 1: observe, draw and label cells

- Aim: use a light microscope to observe, draw and label plant and animal cells, e.g. onion epidermis cells and cheek cells.
- Microscope parts: the stage holds the slide; the lamp or mirror directs light through the slide; the eyepiece and objective lenses magnify; the focusing knobs focus the image.
- Draw with a sharp pencil: clear continuous lines, no shading or colouring, the correct cell shapes and relative sizes, and no overlapping cells.
- Label the structures you can see (e.g. cell wall, cytoplasm, nucleus) with ruled lines, and write the magnification (e.g. ×400) or draw a scale bar.
- The nucleus, cell wall and chloroplasts can be seen with a light microscope. Ribosomes are too small to see.

How to answer each type of question

Name a structure from its function

1 mark each | Grade 3

1. Read the function, then match it to one structure.
2. Spell the name clearly: mitochondria, ribosome, chloroplast, vacuole.
3. Give one answer only: a second, wrong answer can cancel the mark.

Example. Name the part of a cell:
(a) where proteins are made
(b) that is filled with cell sap
(c) where aerobic respiration happens.

Model answer.

(a) ribosome (1)
(b) (permanent) vacuole (1)
(c) mitochondrion / mitochondria (1)

Compare animal and plant cells

2 to 3 marks | Grade 4

1. The plant-only structures are the cell wall, chloroplasts and permanent vacuole.
2. Remember plant cells also have a nucleus, cytoplasm, cell membrane, mitochondria and ribosomes.
3. Check the specific cell in the question: a root cell has no chloroplasts.

Example. Give **three** structures found in a palisade cell from a leaf that are **not** found in a human cheek cell.

Model answer.

cell wall (1)
chloroplast(s) (1)
permanent vacuole (1)

Explain why a plant cell has no chloroplasts

2 marks | Grade 5

1. State what chloroplasts do: photosynthesis.
2. Say why this cell cannot photosynthesise: it gets no light.
3. Link the two ideas with 'so'.

Example. Cells from a carrot root do not contain chloroplasts.
Explain why.

Model answer. Chloroplasts are where photosynthesis happens (1). Root cells are underground and receive no light, so they cannot photosynthesise (1).

Explain how a cell's structures relate to its function

2 to 3 marks | Grade 6

1. Pick out the structure named or shown in the question.
2. State what that structure does.
3. Link it to what this cell needs to do, using 'so' or 'which means'.

Example. Some cells in the pancreas make large amounts of digestive enzymes. Enzymes are proteins.
Suggest why these cells contain many ribosomes.

Model answer. Ribosomes are where proteins are made / where protein synthesis happens (1). Many ribosomes mean the cells can make large amounts of enzyme (1).

Don’t lose marks

- Saying mitochondria 'make' or 'produce' energy. Respiration in mitochondria **releases** energy.
- Saying plant cells have no mitochondria. Plant cells respire all the time, so they have mitochondria.
- Mixing up the cell wall and the cell membrane. The membrane controls what enters and leaves; the wall strengthens the cell.
- Saying all plant cells have chloroplasts. Cells that get no light, such as root cells, do not.
- Giving a permanent vacuole as a structure of animal cells. It is a plant cell feature.

More tips

Memory tricks

- Plant extras are the '3 Cs': Cellulose cell wall, Cell sap vacuole, Chloroplasts.
- Learn the pairs both ways round: ribosome and protein, mitochondria and respiration, chloroplast and photosynthesis, nucleus and genetic material, membrane and 'in and out'.
- Quick check: chloroplasts or a cellulose cell wall mean a plant (or algal) cell, never an animal cell.

Exam technique

- Use the exact function phrases: 'controls the movement of substances in and out', 'protein synthesis', 'aerobic respiration'.
- In 'explain' questions about a named cell, link the structure to that cell's job, not just its general function.
- When you label a diagram, draw label lines with a ruler so they touch the structure and do not cross each other.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 **Name the parts of an animal cell**
Nucleus, cytoplasm, cell membrane, mitochondria and ribosomes.

Grade 3 **Name the extra structures in plant cells**
Chloroplasts, a permanent vacuole filled with cell sap, and a cell wall made of cellulose.

Grade 4

State the function of each structure

e.g. mitochondria are where aerobic respiration happens; ribosomes are where proteins are made.

Grade 5

Explain why some plant cells lack chloroplasts

Cells that receive no light, such as root cells, cannot photosynthesise, so they have no chloroplasts.

Grade 5

Link a cell's structures to its function

e.g. a cell that needs a lot of energy has many mitochondria for respiration.

Grade 7

Estimate sizes of sub-cellular structures

Compare the structure with the whole cell, e.g. a nucleus a quarter of the width of a 20 µm cell is about 5 µm across.

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