One shared plan, key differences

Typical plant and animal cells are eukaryotic. Compare corresponding structures directly, then qualify statements where cell specialisation creates exceptions.

BOTH HAVE THE CORE EUKARYOTIC MACHINERY

A cell surface membrane, cytoplasm, a nucleus, mitochondria, ribosomes, endoplasmic reticulum and Golgi bodies are shared features of typical plant and animal cells. Cytoplasmic ribosomes are 80S. Chloroplasts do not replace mitochondria: photosynthetic plant cells also respire.

FEATURE	TYPICAL PLANT CELL	TYPICAL ANIMAL CELL
Cell wall	Cellulose wall outside the cell surface membrane.	No cell wall; a cell surface membrane is present.
Chloroplasts	Present in photosynthetic cells, not every plant cell.	Absent.
Vacuole	Usually a large permanent central vacuole.	No large permanent central vacuole; small vesicles may occur.
Tonoplast	Membrane around the vacuole.	No tonoplast around a plant-type central vacuole.
Plasmodesmata	Channels through walls connect adjacent cells.	Absent; cells can communicate through other junctions.
Centrioles	Usually absent in higher-plant cells.	Commonly present; associated with microtubule organisation.
Shape	Wall helps maintain shape, but plant cells are not all rectangular.	Often more flexible; shape varies with function.

COMPARE BOTH SIDES

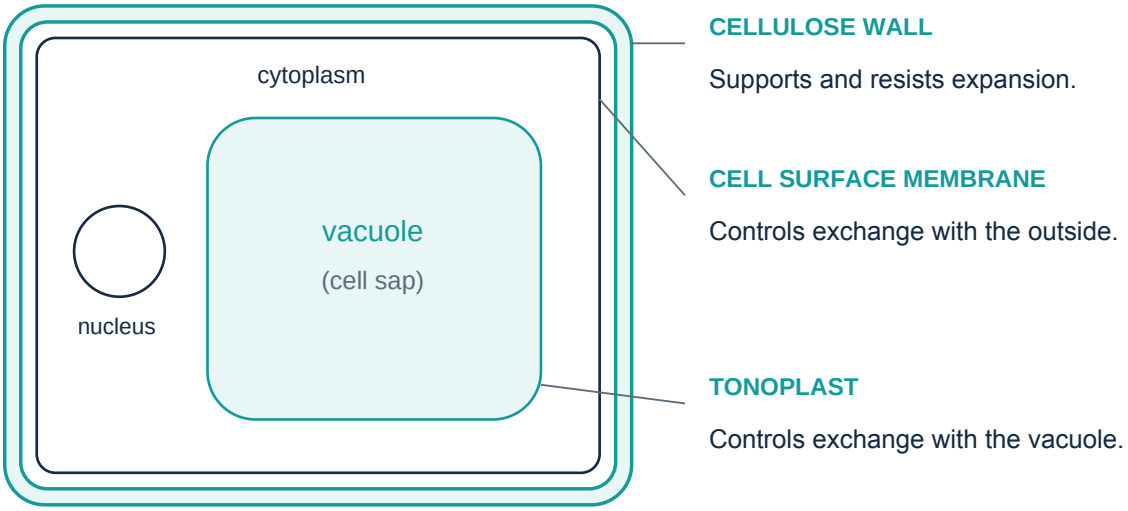
Both cell types have a cell surface membrane, whereas only the plant cell has a cellulose wall outside it.

Cambridge Biology 9700 syllabus: section 1.2, outcomes 1 and 3, pp. 15-16.

Three boundaries, different jobs

A plant cell wall is not a substitute for a cell surface membrane. The tonoplast is a separate membrane inside the cell, enclosing the vacuole.

SELECTED PLANT-CELL BOUNDARIES



Schematic, not to scale; other organelles are omitted.

1. SUPPORT: WALL + WATER-FILLED VACUOLE

Water entry can increase turgor pressure, pressing the cell contents against the wall. The wall resists further expansion and helps support tissues. The wall is freely permeable to many small dissolved substances; the membrane remains the selective boundary.

2. ENERGY: PLANTS NEED BOTH ORGANELLES

Chloroplasts carry out photosynthesis in photosynthetic cells. Mitochondria support aerobic respiration in both typical plant and animal cells. Plants still need ATP for processes such as active transport and synthesis.

3. COMMUNICATION: CHANNELS THROUGH WALLS

Plasmodesmata connect the cytoplasm of neighbouring plant cells through their walls. Animal cells lack plasmodesmata, but this does not mean that animal cells cannot communicate.

Further reading: OpenStax Biology 2e, 4.3 Eukaryotic cells.

Use evidence, not absolute rules

A typical cell diagram is a model, not a checklist that every specialised cell must match. Use several visible features and separate observation from inference.

1. NO CHLOROPLASTS DOES NOT MEAN ANIMAL

Most underground root cells do not receive light and lack chloroplasts. They are still plant cells, with features such as cellulose walls and vacuoles. A photosynthetic leaf cell and a root cell differ in function, not in whether they belong to a plant.

2. NO NUCLEUS DOES NOT MEAN PROKARYOTE

Mature mammalian red blood cells lose their nucleus and mitochondria during specialisation. They remain animal cells. In a microscope image, a nucleus can also be absent from the section or unresolved; an unseen nucleus alone does not establish cell type.

3. ABUNDANCE TELLS YOU ABOUT FUNCTION

Many mitochondria suggest a high demand for ATP. Extensive rough ER and Golgi suggest active protein secretion. These clues concern a cell’s work and are not, by themselves, plant-versus-animal markers.

A PRECISE PAIRED COMPARISON

Cell A shows a wall outside its membrane and chloroplasts. Cell B shows a nucleus and mitochondria, but no wall or chloroplasts in a clear, complete view.

SHARED FEATURE

Typical cells of both types have mitochondria for aerobic respiration; both also have a cell surface membrane.

DIFFERENCE + CONCLUSION

A has a wall and chloroplasts whereas B lacks them. A is consistent with a photosynthetic plant cell; B is consistent with an animal cell. Shape or colour alone would be weaker evidence.

Cambridge Biology 9700 syllabus: comparison and interpretation, section 1.2, outcomes 2-3.