Compare how cells are organised

Compare a typical bacterium with typical plant and animal cells. The central distinction is the presence or absence of a nucleus and other membrane-bound compartments.

START WITH THE SIMILARITIES

Both cell types have a cell surface membrane, cytoplasm, DNA and ribosomes. Both carry out metabolism and protein synthesis. A prokaryotic cell is a complete cell, not an empty bag or a virus.

FEATURE	TYPICAL BACTERIUM	PLANT / ANIMAL CELL
Nucleus	No nuclear envelope; DNA lies in a nucleoid region.	A nucleus encloses the nuclear DNA.
Chromosomes	Main chromosome usually a circular DNA molecule.	Nuclear chromosomes are linear DNA molecules associated with histones.
Ribosomes	70S ribosomes in the cytoplasm.	80S ribosomes in the cytoplasm, free or attached to rough ER.
Compartments	No mitochondria, chloroplasts, ER or Golgi bodies.	Membrane-bound organelles are present; chloroplasts occur in photosynthetic plant cells.
Cell wall	Usually present; contains peptidoglycan.	Plant: cellulose wall. Animal: no cell wall.
Typical size	Generally 1-5 μm in diameter in the syllabus model.	Generally larger, often around 10-100 μm; cell size varies widely.

PAIR THE SAME FEATURE

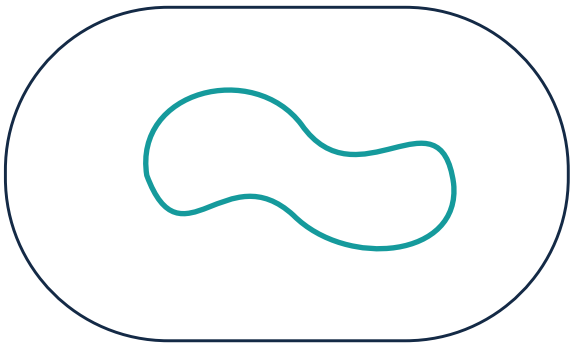
Bacterial DNA is not enclosed by a nuclear envelope, whereas eukaryotic nuclear DNA is enclosed in a nucleus. Both cells still contain genetic information.

Cambridge Biology 9700 syllabus: section 1.2, learning outcomes 5-6, p. 16.

DNA location is a strong clue

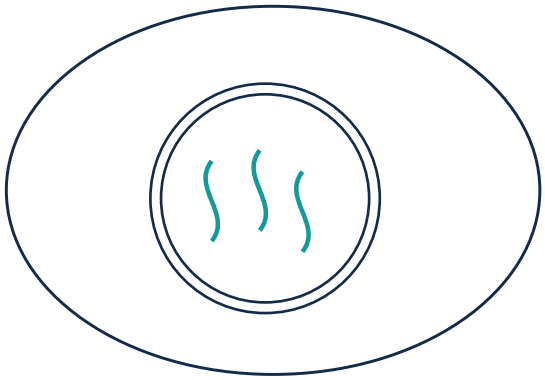
A nucleoid is a region without a surrounding membrane. A nucleus is a membrane-bound organelle. Both contain DNA, but their boundaries and organisation differ.

BACTERIUM



DNA in a nucleoid region

EUKARYOTIC CELL



DNA enclosed in a nucleus

Schematic comparison, not to scale. Teal paths represent DNA; other cell structures are omitted. Nuclear chromosomes are not always condensed into visible rods.

1. COMPARTMENTS ORGANISE REACTIONS

Eukaryotic membranes separate processes into regions with specialised conditions. For example, the nucleus houses nuclear DNA and the ER supports synthesis and transport. Bacteria perform essential cellular reactions without these organelles.

2. CYTOPLASMIC RIBOSOMES ARE THE COMPARISON

Compare bacterial 70S with eukaryotic cytoplasmic 80S ribosomes. Ribosomes are not membrane-bound. Do not write that prokaryotes lack ribosomes or that every ribosome in a eukaryotic cell is 80S.

3. CLASSIFY THE WHOLE CELL

Mitochondria and chloroplasts have their own DNA and ribosomes; 70S ribosomes occur in chloroplasts and many mitochondria. These organelles inside a eukaryotic cell do not make the whole cell prokaryotic.

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

Build a comparison from evidence

Use several features together. Size, wall presence or a single missing structure is weaker evidence than the combined pattern of DNA location, organelles and cell-wall composition.

ILLUSTRATIVE CELL PROFILES: THE FEATURES ARE GIVEN

A: BACTERIAL CELL

2 µm across; DNA in a nucleoid; 70S ribosomes; peptidoglycan wall.

The nucleoid and wall chemistry support a bacterial identification. Small size is supporting evidence, not proof by itself.

B: PLANT CELL

30 µm across; nucleus; chloroplasts; cellulose wall; 80S cytoplasmic ribosomes.

A nucleus establishes eukaryotic organisation. The chloroplasts and cellulose wall support a photosynthetic plant-cell identification.

C: ANIMAL CELL

20 µm across; nucleus; mitochondria; 80S cytoplasmic ribosomes; no wall.

The nucleus and organelles support a eukaryotic identification. In this plant-versus-animal comparison, lack of a wall supports animal.

CHECK WHAT AN IMAGE CAN ACTUALLY TELL YOU

A light micrograph cannot directly establish ribosome type or wall chemistry. A nucleus may be outside a thin section, and some specialised eukaryotic cells lose it. A plant root cell may lack chloroplasts. Report what is observed, what is supplied by other evidence, and what you infer.

Cambridge Biology 9700 syllabus: compare typical bacterial, plant and animal cells, 1.2.6.