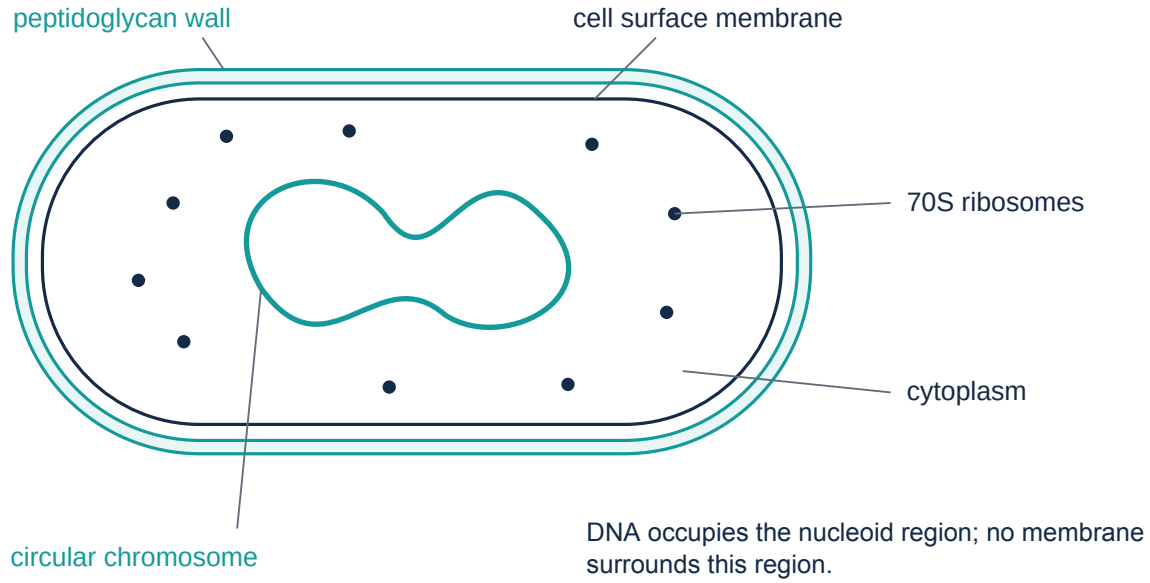
A bacterium is a complete cell

A typical bacterium is unicellular and prokaryotic: its DNA is not enclosed by a nuclear envelope. It has a membrane, cytoplasm and ribosomes, even though it lacks a nucleus.

TYPICAL BACTERIAL CELL: SELECTED CORE FEATURES



Schematic, not to scale. Optional structures are discussed on page 2.

1. SMALL AND UNICELLULAR

The syllabus describes a typical bacterium as generally 1-5 μm in diameter. This is a guide, not a size limit applying to every species. A bacterial colony is many cells together, not one large cell.

2. GENETIC INFORMATION + PROTEIN SYNTHESIS

The main chromosome is usually one circular DNA molecule in the nucleoid region. Ribosomes in the cytoplasm are 70S and make proteins. A nucleoid is a region of the cell, not a nucleus.

3. NO MITOCHONDRIA DOES NOT MEAN NO ATP

A typical bacterium lacks mitochondria, chloroplasts, ER and Golgi bodies. Reactions in its cytoplasm and at its cell membrane can support metabolism and ATP production.

Cambridge Biology 9700 syllabus: section 1.2, learning outcome 5, p. 16.

Some features are optional

Plasmids, capsules, pili and flagella occur in some bacteria, not all. These adaptations add functions but are not required to identify every bacterial cell.

PLASMID

A small additional DNA molecule, usually circular, separate from the main chromosome. It can replicate independently and may carry useful genes, such as genes for antibiotic resistance. Not every plasmid carries resistance genes.

CAPSULE

An outer layer beyond the wall in some bacteria. It can aid attachment and protect against drying or host defences. It is not the cell surface membrane and does not replace the wall.

PILI / FIMBRIAE

Short surface appendages can help attachment. Specialised pili in some bacteria help establish contact for DNA transfer between cells. Do not assume every short projection has the same function.

FLAGELLUM

A long protein appendage used for movement in some bacteria. Rotation propels the cell. It is not built like a eukaryotic cilium or flagellum, and a bacterium without one can still be alive.

KEEP THE CORE AND THE EXTRAS SEPARATE

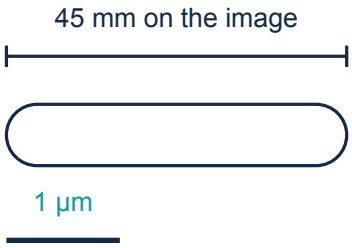
A cell surface membrane, cytoplasm, ribosomes and chromosomal DNA are core cellular components. A peptidoglycan wall is typical of bacteria; some bacteria lack a wall. The absence of a capsule, plasmid, pilus or flagellum does not rule out a bacterium.

Further reading: OpenStax Biology 2e, 4.2 Prokaryotic cells.

Read the structure and the scale

Identify a bacterium from a combination of evidence. Small size alone is not decisive, and a diagram can show features that an actual microscope image does not resolve.

SCALE-BAR EXAMPLE: MEASURE THE SAME COPY



The scale bar is 15 mm long on this copy and represents 1 µm. The cell image is three times as long as the bar.

$$\text{Actual length} = \frac{45\ \text{mm}}{15\ \text{mm}} \times 1\ \mu\text{m} = 3\ \mu\text{m}$$

Illustrative rod, not a micrograph. Length is not necessarily diameter.

1. SEPARATE THE WALL FROM THE MEMBRANE

The bacterial wall typically contains peptidoglycan, not plant cellulose. It supports shape and resists osmotic bursting. The membrane controls exchange. Wall chemistry cannot be established from an ordinary outline image alone.

2. USE POSITIVE EVIDENCE, NOT JUST ABSENCE

A small cell with 70S ribosomes and DNA not enclosed in a nucleus fits a prokaryotic interpretation. Failure to see a nucleus in one section is weaker evidence: a eukaryotic nucleus may be outside the section or unresolved.

3. A BACTERIUM IS NOT A VIRUS

A bacterium has cellular organisation, ribosomes and its own metabolic reactions. A virus is non-cellular and depends on a host cell to reproduce. Also, not all prokaryotes are bacteria: archaea are prokaryotic but do not have bacterial peptidoglycan walls.

Cambridge Biology 9700 syllabus: core bacterial features, section 1.2.5; scale skills, 1.1.