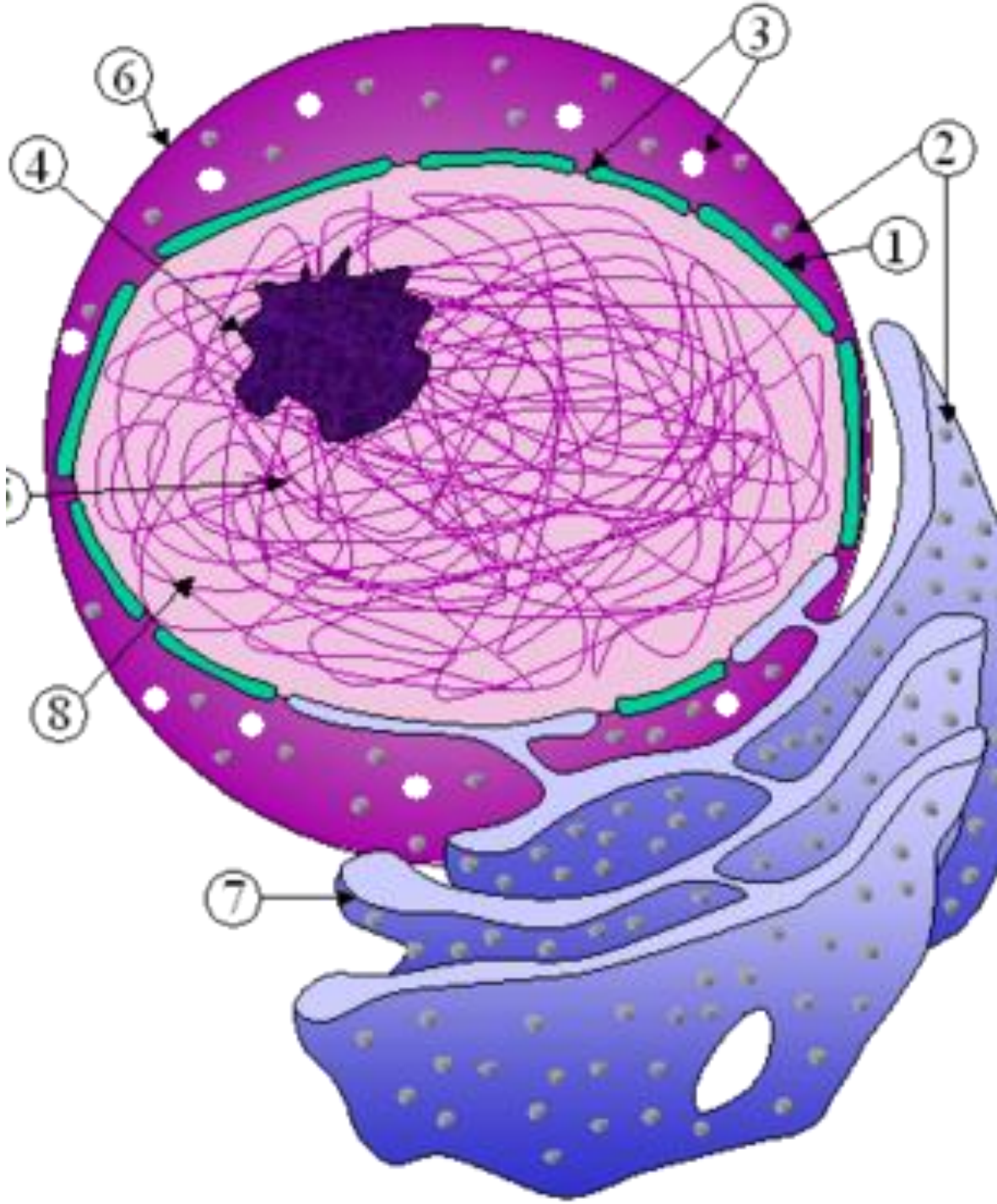
DP Biology – B2.2

Organelles

- How does the structure of each organelle suit its function?
- Why is it useful for cells to have separate compartments?



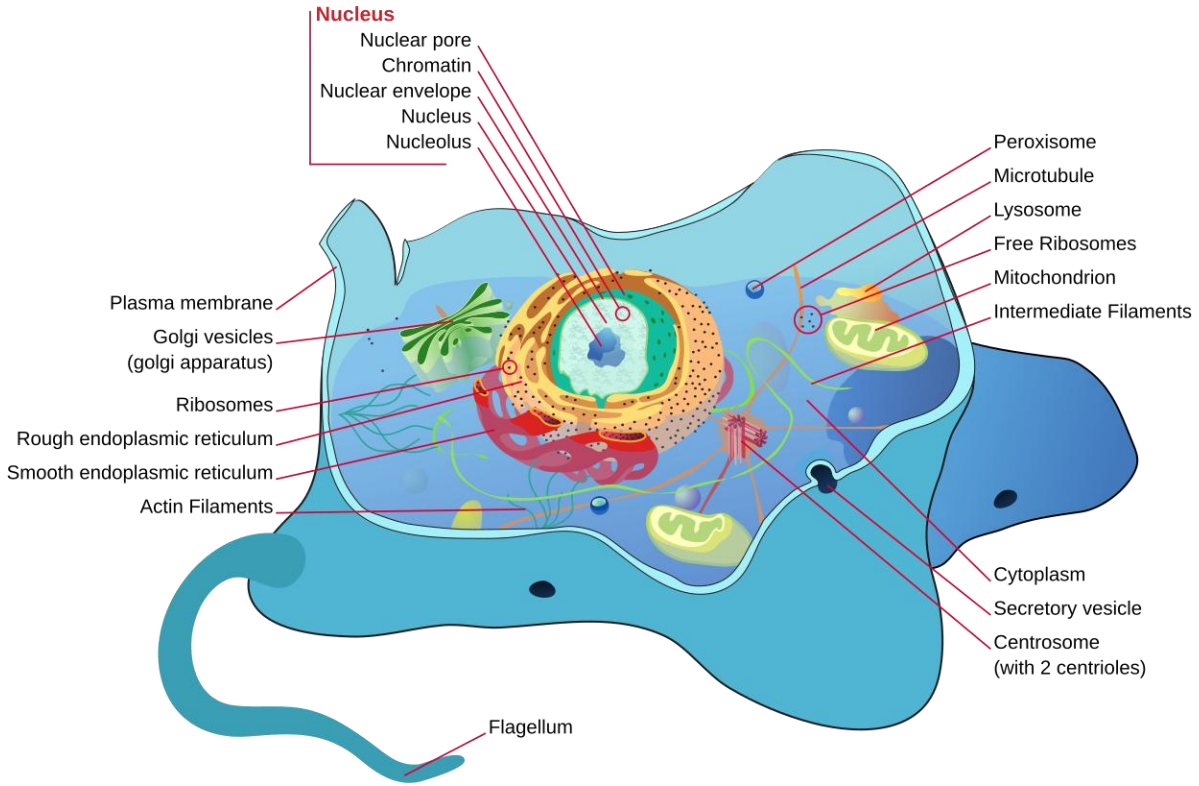
SL statements B2.2.1–3. Textbook pp. 244–247. The structure of each organelle in detail is at HL.
Image: the nucleus and endoplasmic reticulum. Magnus Manske, public domain.

Objectives for each class

Class	Statements	By the end of the class, you can…
1	B2.2.1	Explain what counts as an organelle, and sort cell structures by the number of membranes they have
2	B2.2.2–3	Explain the advantages of separating the nucleus from the cytoplasm, and of compartments in the cytoplasm

What is an organelle?

B2.2.1



An animal cell. LadyofHats, public domain.

- An **organelle** is a discrete subunit of a cell
- Each is adapted to carry out one or more particular functions
- Together they divide up the work of the cell

Key idea

Structure suits function: this is the first guiding question.

Common mistake

Not everything in a cell is an organelle. The cell wall, cytoskeleton and cytoplasm are not. The nucleus, vesicles, ribosomes and plasma membrane are.

Sorting structures by membranes

B2.2.1

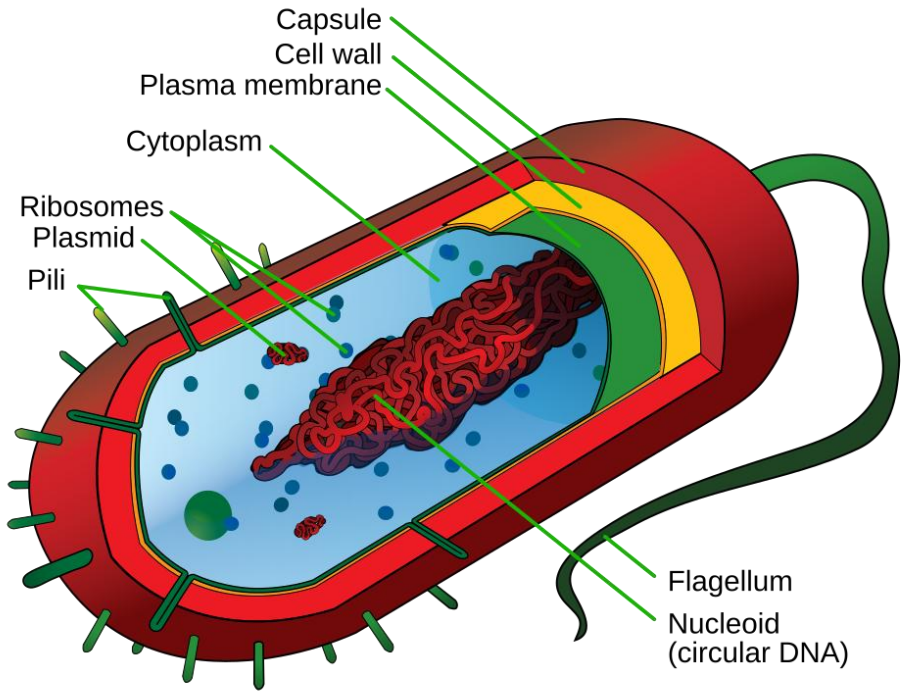
Number of membranes	Examples
Two	Nucleus, mitochondrion, chloroplast
One	Vesicle, vacuole, lysosome, rough and smooth ER, Golgi apparatus
None	Ribosome
Not organelles	Cell wall, cytoskeleton, cytoplasm

Activity

Close the table. Sort these from memory: nucleus, vacuole, ribosome, cytoplasm, chloroplast, cell wall, Golgi apparatus, cytoskeleton, mitochondrion and rough ER.

Prokaryotes have few organelles

B2.2.1



A prokaryotic cell. LadyofHats, public domain.

- Ribosomes and the plasma membrane are found in both prokaryotes and eukaryotes
- Prokaryotes have no membrane-bound organelles
- Eukaryotes are **compartmentalized**: they have separate membrane-bound regions

Practical skill

Biologists separate organelles by spinning broken cells in a centrifuge. Heavier parts settle first, so each fraction can be studied on its own.

Separating the nucleus and cytoplasm

B2.2.2

	Eukaryote	Prokaryote
DNA	Inside a nucleus	In the cytoplasm, as a nucleoid
Transcription and translation	Separate in place and time	Can happen together
mRNA	Modified before it meets ribosomes	Ribosomes may attach straight away

Key idea

The nuclear membrane keeps transcription away from translation. Eukaryotic mRNA can therefore be modified after transcription, before it reaches any ribosome. In prokaryotes this is not possible, because ribosomes can start on the mRNA while it is still being made.

Compartments in the cytoplasm

B2.2.3

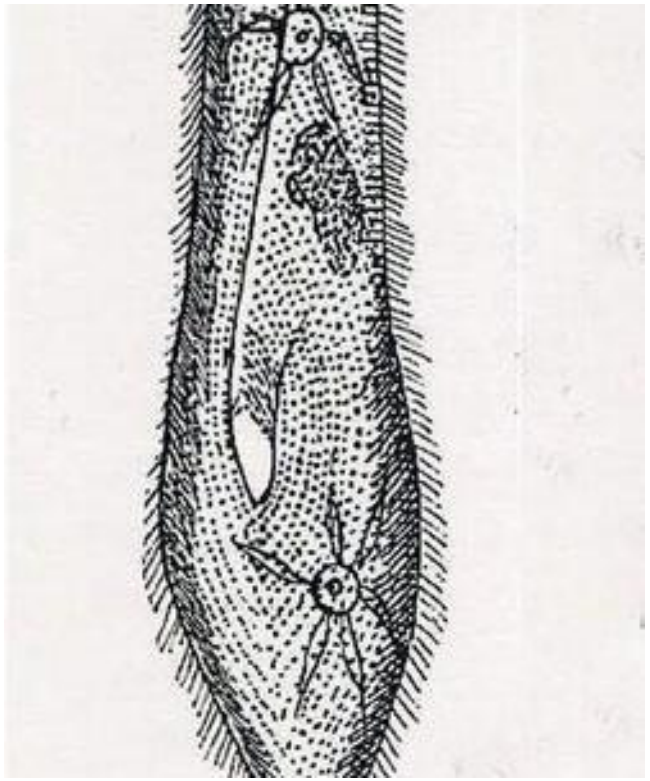
Advantage	What it means
Enzymes and substrates are concentrated	Reactions happen faster than if they were spread through the cytoplasm
Harmful substances are kept apart	Other parts of the cell are protected from them
Conditions can be different	Each compartment can have its own pH, for example
Incompatible processes are separated	Reactions that would interfere do not meet

Discussion

Use the example of a lysosome: why would releasing its enzymes into the cytoplasm be damaging to the cell?

Two examples: lysosomes and vacuoles

B2.2.3



Paramecium. A. Kahl, public domain.

- **Lysosomes** hold digestive enzymes at a high concentration, with an acid pH inside
- The enzymes do not attack the rest of the cell, as they are kept behind a membrane
- **Phagocytic vacuoles** form when a cell engulfs food or bacteria

Example

In Paramecium, food enters a vacuole by endocytosis. Conditions inside change as digestion goes on: first the pH drops, then it rises again.

Link

Phagocytes use the same route to take in and digest pathogens (C3.2).

Check that you can explain

1. What an organelle is, with structures that are and are not organelles
2. How many membranes each organelle has
3. Why eukaryotes can modify mRNA before translation
4. Four advantages of compartments in the cytoplasm
5. How lysosomes and phagocytic vacuoles show these advantages

Exit activity: 5 minutes

On your own and without notes. Hand this in as you leave.

1. State one structure that is an organelle and one that is not.
2. Explain the advantage of keeping transcription and translation apart.
3. Explain how lysosomes show an advantage of compartmentalization.

Image credits

Nucleus ER.png – Magnus Manske (talk) – Public domain
Animal cell structure en.svg – LadyofHats (Mariana Ruiz) – Public domain
Average prokaryote cell- en.svg – Mariana Ruiz Villarreal, LadyofHats – Public domain
Paramecium caudatum.jpg – Alfred Kahl – Public domain

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