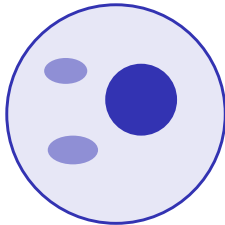


Organisation of the Organism

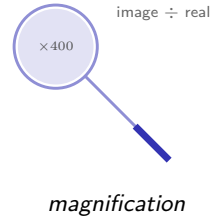
IGCSE Biology ■ Topic 2

IGCSE Biology



What we will cover

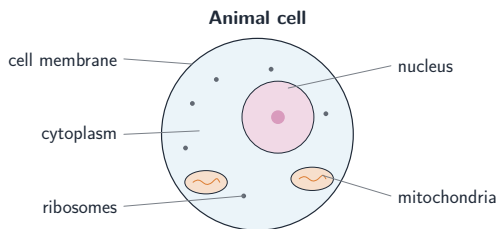
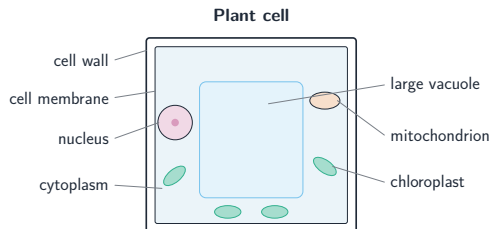
- 1 Animal & plant cells
- 2 Bacterial cells
- 3 What each part does
- 4 Specialised cells
- 5 Levels of organisation
- 6 Magnification



1

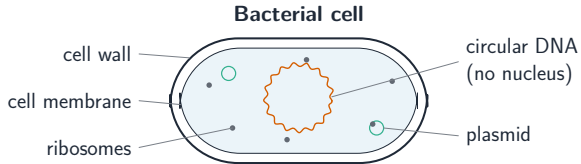
Cells

Animal and plant cells



Both share membrane, **cytoplasm** 细胞质, **nucleus** 细胞核, **mitochondria** 线粒体 & ribosomes. A plant cell adds a **cell wall** 细胞壁, a large **vacuole** 液泡 & **chloroplasts** 叶绿体.

Bacterial cells



- **No nucleus:** the DNA is one circular loop, loose in the cytoplasm.
- Small extra rings of DNA, the **plasmids** 质粒, sit beside it.
- It still has a cell wall, a cell membrane, cytoplasm and ribosomes.
- It has **no** mitochondria and **no** chloroplasts.

What makes a bacterium different

A prokaryote

A bacterium is a **prokaryote** 原核生物: its cell has **no** nucleus. The DNA sits free in the cytoplasm as a circular loop.

What it still has

Cell wall, cell membrane, cytoplasm and ribosomes – and often **plasmids** 质粒, small extra rings of DNA.

What it lacks

No mitochondria, no chloroplasts, no nucleus – so all its chemistry happens in the cytoplasm or at the membrane.

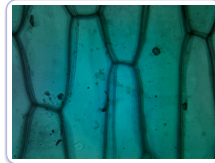
Where cells come from

All new cells are made by the **division** 分裂 of cells that already exist – which is as true of a bacterium as of you.

Plasmids are why bacteria are the workhorse of genetic engineering: a gene can be carried in on a ring of DNA.

The parts every cell has

- **membrane** – controls what enters/leaves
- **cytoplasm** – a jelly-like liquid where many reactions happen
- **nucleus** – controls the cell; holds DNA
- **ribosomes** – make **proteins** 蛋白质
- **mitochondria** – where **respiration** 呼吸作用 releases **energy** 能量



*Plant cells show walls
and vacuoles*

What each cell structure does

chloroplasts 叶绿体	contain chlorophyll 叶绿素, the green substance that traps light for photosynthesis 光合作用
cell wall 细胞壁	cellulose; supports the plant cell and stops it bursting
vacuole 液泡	filled with cell sap 细胞液; keeps the cell firm
nucleus 细胞核	holds the genetic material 遗传物质 and controls the cell's activities
mitochondria 线粒体	where aerobic respiration releases energy
cell membrane 细胞膜	controls what enters and leaves the cell

The three a plant cell has and an animal cell does not are **cell wall**, **chloroplasts** and a **permanent vacuole**. That comparison is asked almost every year.

Specialised cells

A **specialised cell** 特化细胞's shape suits its job:

- **red blood cell** 红细胞 – no nucleus, holds more O_2
- **root hair cell** 根毛细胞 – long, big surface
- **neurone** 神经元 – very long, carries impulses



red blood cell
(carries oxygen)



root hair cell
(absorbs water)



nerve cell
(carries impulses)

Specialised cells, and the feature that fits each job

ciliated cells 纤毛细胞	move mucus 黏液 along the trachea 气管 and bronchi 支气管 – tiny hairs (cilia) sweep it upward
palisade mesophyll 栅栏叶肉	photosynthesis – packed with chloroplasts, near the top of the leaf where the light is
root hair cells	absorb water and ions – a long extension gives a large surface area
neurones 神经元	carry electrical impulses 电脉冲 – very long , to reach far across the body
red blood cells	carry oxygen – no nucleus, so there is more room for haemoglobin
sperm 精子 and egg cells 卵细胞	reproduction – the sperm can swim, the egg stores food. Both are gametes 配子

Always answer in two halves: the **job**, then the **feature that suits it**. Naming the cell alone earns nothing.

Two specialised cells, read as shape-for-job

Root hair cells

For the **absorption** 吸收 of water and minerals from the soil: a long thin “hair” gives a large surface area.

Palisade mesophyll cells

Palisade mesophyll cells 栅栏叶肉细胞 do the photosynthesis: packed with chloroplasts and placed near the **top** of the leaf, where the light is.

The rule

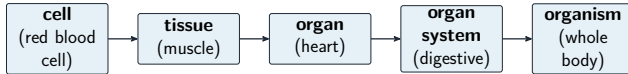
Every specialised cell is a shape that answers a job. Name the feature, then the job, then why the feature helps.

“It has a large surface area” is half an answer. Finish it: *so more water is absorbed per second.*

2

Scale

Levels of organisation



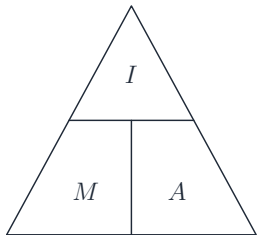
cell 细胞 → **tissue** 组织 →
organ 器官 → **organ**
system 器官系统 →
organism 生物体. e.g. muscle
(tissue), heart (organ),
digestive system.

From cell to organism

cell	the smallest part that can carry out the life processes
tissue 组织	a group of cells with similar structure working together – muscle tissue, xylem
organ 器官	several different tissues working together to do a job – the heart, or a leaf
organ system 器官系统	several organs working together – the digestive system 消化系统, which breaks down food
organism	all the organ systems together

The word that separates tissue from organ is **different**: one tissue is one kind of cell, an organ is several kinds of tissue.

Magnification



I = image size

M = magnification

A = actual size

$$M = \frac{I}{A}$$

cover a letter to get its formula

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}}$$

Example ($\times 250$)

$$\begin{aligned} \text{image } 5.00 \text{ mm} &\rightarrow \text{actual} \\ &= 5.00 / 250 = 0.02 \text{ mm} \\ &= 20 \mu\text{m} \end{aligned}$$

image = size in the drawing; actual = real size of the **specimen** 标本. 1 mm = 1000 μm .

Cover the quantity you want in the triangle to read off its formula

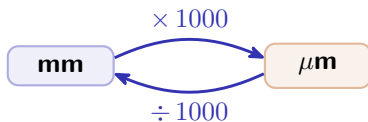
The size of cells: magnification



A light microscope makes cells look larger. How many times larger is the **magnification**:
image size $\div$ actual size.

Changing units (Supplement)

Cells are measured in **micrometres** 微米 (μm):



$$\text{magnification} = \frac{\text{image size}}{\text{actual size}}$$

A cell is drawn 60 mm wide; its real width is 30 μm . Find the magnification.

Make the units match first:

$$60 \text{ mm} = 60 \times 1000 = 60\,000 \mu\text{m}$$

$$\text{magnification} = \frac{\text{image}}{\text{actual}}$$

$$\text{magnification} = \frac{60\,000}{30} = \times 2000$$

✗ Forget to convert: $60 \div 30 = \times 2$ – a thousand times too small.

Exam tips

- A plant cell has a cell wall, a large vacuole and chloroplasts; an animal cell has none of these. Both have a nucleus, cytoplasm, cell membrane, mitochondria and ribosomes.
- A cell with **no nucleus** but with plasmids and a loop of DNA is a bacterium.
- For magnification, cover the quantity you want: $\text{magnification} = \text{image} \div \text{actual}$; $\text{actual} = \text{image} \div \text{magnification}$.
- Always convert to the same unit before you calculate. Remember $1 \text{ mm} = 1000 \mu\text{m}$.
- For a specialised cell, link its job to the one feature that suits it (for example a red blood cell has no nucleus, so it can hold more oxygen).

3

Recap

Topic 2 – key takeaways

1

Plant extras

cell wall, vacuole & chloroplasts

2

Bacteria

no nucleus; a DNA loop & plasmids

3

Organisation

cell to tissue to organ to organism

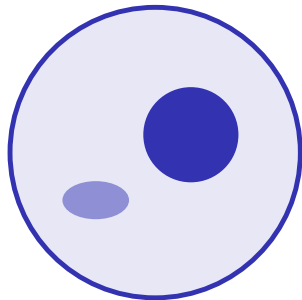
4

Magnification

image / actual; same unit first

Check yourself

- 1 Which three parts does a plant cell have but an animal cell not?
- 2 What holds a bacterium's DNA?
- 3 Where in a cell does respiration happen?
- 4 A $\times 100$ image is 4 mm – what is the actual size?



Answers 1. cell wall, vacuole, chloroplasts 2. a single loop of DNA (no nucleus)
3. the mitochondria 4. 0.04 mm