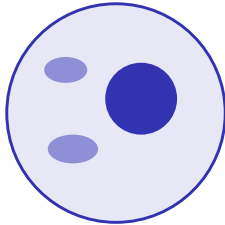


Organisation of the Organism

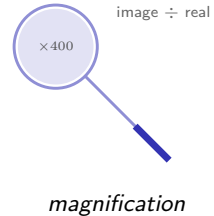
IGCSE Biology ■ Topic 2

IGCSE Biology



What we will cover

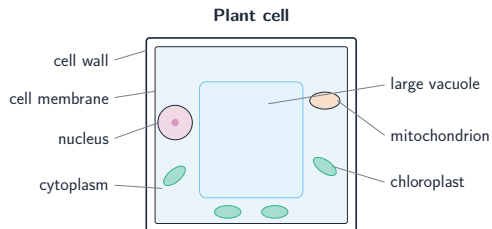
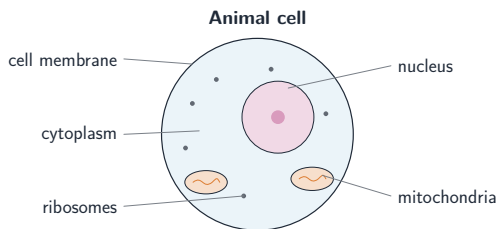
- 1 Animal & plant cells
- 2 Bacterial cells
- 3 What each part does
- 4 Specialised cells
- 5 Levels of organisation
- 6 Magnification



1

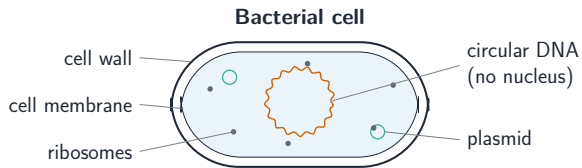
Cells

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



- **image size** = the size in the drawing or photo.
- **actual size** = the real size of the **specimen** 标本.

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.

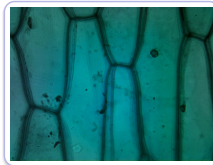
Where cells come from

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 栅栏叶肉细胞

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**

neurons 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 cells 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

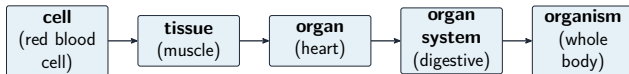
Every specialised cell is a shape that answers a job. Name the feature, then the job, then why the feature helps.

“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.

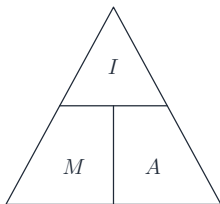
From cell to organism

cellthe 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 ($\times 250$)

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

1 mm = 1000 μm ; convert to one unit first.

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

The size of cells: magnification



A light microscope, used to look at cells

Changing units (Supplement)

Cells are often measured in **micrometres** 微米 (μm), which are smaller than millimetres (mm):

Worked example. A cell is drawn 60 mm wide, and its real width is 30 μm .

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 $1 \text{ mm} = 1000 \text{ }\mu\text{m}$.
- 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

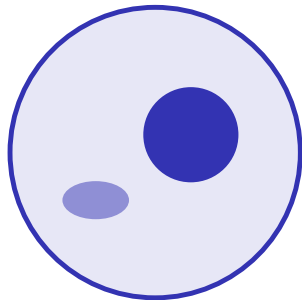
4

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