

Organisation of the Organism

IGCSE Biology ■ Topic 2

IGCSE Biology



Organisation of the Organism

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

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└ Cells

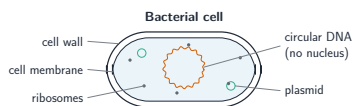
Animal and plant cells



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.

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Bacterial cells



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

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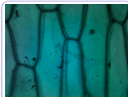
What makes a bacterium different

- 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.

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The parts every cell has



Plant cells show walls and vacuoles

- **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

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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.

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Specialised cells

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

- **red blood cell** 红细胞 – no nucleus, holds more O₂
- **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)

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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 cellsabsorb 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 cellscarry oxygen – no nucleus, so there is more room for haemoglobin

sperm 精子和 **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.

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Two specialised cells, read as shape-for-job

Root hair cellsFor 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 ruleEvery 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.*

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Scale

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└─ Scale

Levels of organisation

cell
(red blood cell)

tissue
(muscle)

organ
(heart)

organ system
(digestive)

organism
(whole body)

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.

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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

organismall 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.

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Magnification

I

M

A

I = image size
 M = magnification
 A = actual size
 $M = \frac{I}{A}$
cover a letter to get its formula

magnification = $\frac{\text{image size}}{\text{actual size}}$
Example (×250)
image 5.00 mm → 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

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The size of cells: magnification



A light microscope, used to look at cells

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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 .

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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: magnification = image ÷ actual; actual = image ÷ magnification.
- Always convert to the same unit before you calculate. Remember 1 mm = 1000 μm .
- 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).

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Recap

Topic 2 – key takeaways

1 Plant extras

cell wall, vacuole & chloroplasts

2 Bacteria

no nucleus; a DNA loop & plasmids

3 Organisation

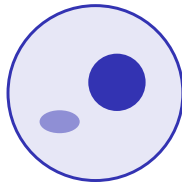
cell to tissue to organ to organism

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