Exercise walk-through

2.1.1 The bacterial cell, specialised cells and levels of organisation

IGCSE Biology

You must be able to

- describe and compare the structure of a plant cell and an animal cell: **cell wall** 细胞壁, **cell membrane** 细胞膜, **nucleus** 细胞核, **cytoplasm** 细胞质, **chloroplasts** 叶绿体, **ribosomes** 核糖体, **mitochondria** 线粒体 and **vacuoles** 液泡
- describe the structure of a bacterial cell: cell wall, cell membrane, cytoplasm, ribosomes, **circular DNA** 环状 DNA and **plasmids** 质粒
- identify those structures in diagrams and images, and state the function of each
- state that new cells are produced by **division** 分裂 of existing cells
- state the specific functions of the specialised cells: **ciliated cells** 纤毛细胞, **root hair cells** 根毛细胞, **palisade mesophyll cells** 栅栏叶肉细胞, **neurones** 神经元, red blood cells and the **gametes** 配子
- describe the meaning of cell, **tissue** 组织, **organ** 器官, **organ system** 器官系统 and organism

1 The method

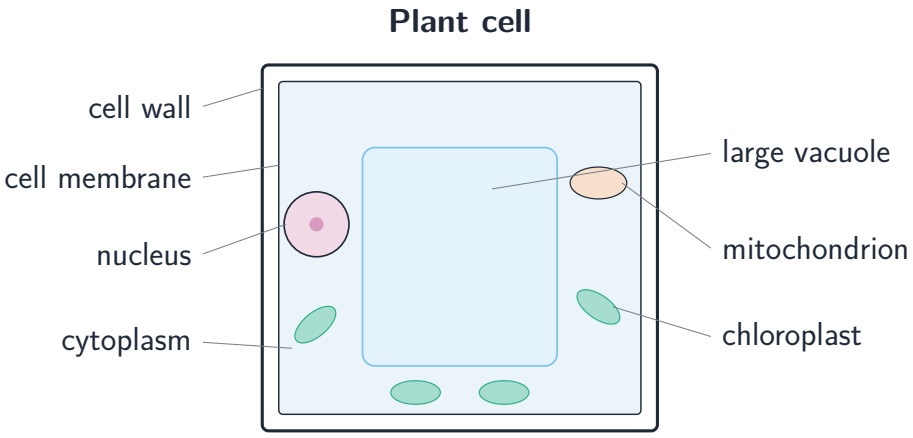
Method — Three kinds of cell, side by side

structure	plant	animal	bacterium	function
cell wall	✓ (cellulose)	×	✓	supports the cell and stops it bursting
cell membrane	✓	✓	✓	controls what enters and leaves
nucleus	✓	✓	×	contains the genetic material; controls the cell
cytoplasm	✓	✓	✓	where most chemical reactions happen
chloroplasts	✓	×	×	contain chlorophyll; where photosynthesis happens
large permanent vacuole	✓	×	×	filled with cell sap; keeps the cell firm
mitochondria	✓	✓	×	where **aerobic respiration** 有氧呼吸 happens
ribosomes	✓	✓	✓	where proteins are made
circular DNA	×	×	✓	the bacterium's genetic material, loose in the cytoplasm
plasmids	×	×	✓	small extra rings of DNA, carrying a few genes

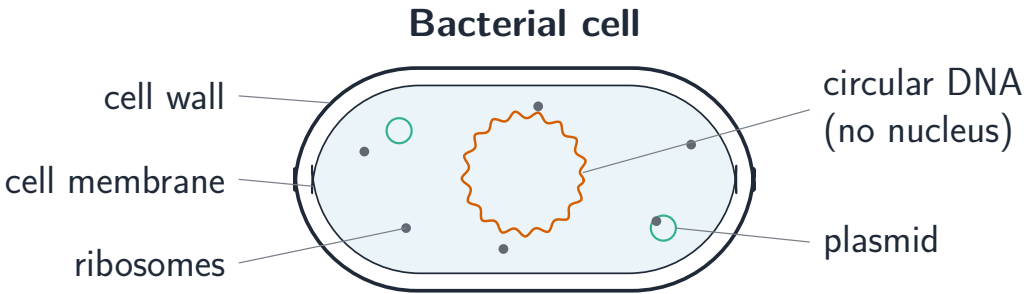
Method — Three kinds of cell, side by side

- A bacterium has **no nucleus**, **no mitochondria**, **no chloroplasts** and **no vacuole**. Its genetic material is a **loop of DNA** in the cytoplasm, plus **plasmids**.

Method — Three kinds of cell, side by side



Method — Three kinds of cell, side by side



Method — Where new cells come from

All new cells are produced by the division of existing cells. That one sentence answers a surprising number of questions: how an organism grows, how a wound heals, how a bacterial population increases.

Method — The six specialised cells

A **specialised cell** has a structure that suits one particular job. Answer in two halves every time – **the feature**, then **what it lets the cell do**:

cell	feature	so that it can
ciliated cell	**cilia** on its surface	sweep mucus along the trachea and bronchi
root hair cell	a long, thin **hair**	absorb water and mineral ions over a large surface area
palisade mesophyll cell	packed with **chloroplasts**, and tall	absorb as much light as possible for photosynthesis
neurone	very **long**, with fine branches	carry an electrical impulse a long way in one cell
red blood cell	**no nucleus**, dented disc shape	hold more haemoglobin, so it carries more oxygen
egg cell / sperm cell	food **stores** / a **flagellum** and mitochondria	feed the embryo / swim to the egg cell

Method — The six specialised cells

A specialised cell has a structure that suits one particular job.

ciliated cell

cilia beat and sweep mucus along the trachea and bronchi

root hair cell

a long **hair** gives a large surface area, to absorb water and mineral ions

palisade mesophyll cell

packed with **chloroplasts**, and tall, so it absorbs as much light as possible

neurone

very **long**, so one cell carries an electrical impulse a long way

red blood cell

no **nucleus** and a dented disc shape, so it carries more oxygen

egg cell and sperm cell

the egg carries **food stores**; the sperm has a **flagellum** and swims

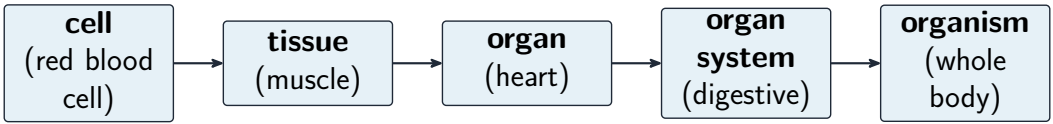
A mark is never given for naming the cell. It is given for the **feature** and for **what that feature lets the cell do**.

Method — Cell to organism

level	meaning	example
cell	the basic unit of all living things	a palisade mesophyll cell
tissue	a group of cells of **similar structure** working together to do one job	palisade tissue in a leaf; muscle tissue
organ	**several tissues** working together to do one job	a leaf; the heart; the stomach
organ system	**several organs** working together	the transport system of a plant; the digestive system
organism	a complete living thing	a maize plant; a human

- A leaf is an **organ**, not a tissue, because it contains **more than one tissue** – palisade tissue, xylem, phloem and epidermis – all working together for photosynthesis.

Method — Cell to organism



2 Practice

Practice 2.1 ▪ 3 marks

State **three** structures found in a plant cell but not in an animal cell.

Solution 2.1

Method: Three kinds of cell, side by side — p.4

Worked steps

- a **cell wall** B1
- **chloroplasts** B1
- a **large permanent vacuole** B1

Practice 2.2 ▪ 3 marks

State **two** structures found in a bacterial cell that are found in neither a plant nor an animal cell, and **one** structure a bacterial cell does not have.

Solution 2.2

Method: Three kinds of cell, side by side — p.4

Worked steps

- found only in the bacterium: **circular DNA** and **plasmids** B1 B1
- a bacterium has **no nucleus** – also acceptable: no mitochondria, no chloroplasts, no large permanent vacuole B1

Practice 2.3 ▪ 2 marks

Explain how a neurone is adapted to its function.

Solution 2.3

Worked steps

- a neurone is very **long**, and has fine branches at its ends B1
- so a single cell can carry an **electrical impulse** a long way, for example from the foot to the spinal cord B1

Practice 2.4 ▪ 2 marks

Explain how an egg cell is adapted to its function.

Solution 2.4

Method: Three kinds of cell, side by side — p.4

Worked steps

- the egg cell contains **food stores** in its cytoplasm B1
- which feed the **embryo** until it implants and the placenta can supply it B1
- also acceptable: the **jelly coat**, which changes after one sperm enters so that no second sperm can get in

Practice 2.5 ▪ 1 mark

State where all new cells come from.

Solution 2.5

Method: Where new cells come from — p.8

Worked steps

- from the **division of existing cells** B1

Practice 2.6 ▪ 4 marks

Describe what is meant by a tissue and by an organ, and give one example of each.

Solution 2.6

Method: Cell to organism — p.11

Worked steps

- a **tissue** is a group of cells of similar structure working together to do one job B1
- for example **muscle tissue**, or **palisade tissue** in a leaf B1
- an **organ** is several tissues working together to do one job B1
- for example the **heart**, the **stomach** or a **leaf** B1

3 Exam-style

Exam-style 3.1 ▪ 1 mark

Which structure is found in a plant cell **and** in a bacterial cell, but **not** in an animal cell?

A a chloroplast

B a cell wall

C a nucleus

D a ribosome

Solution 3.1

Method: Three kinds of cell, side by side — p.4

A a chloroplast

B a cell wall ✓

C a nucleus

D a ribosome

Worked steps

B

- a **cell wall** is present in plant cells and bacterial cells, and absent from animal cells B1

Exam-style 3.2 ▪ 6 marks

The table lists three specialised cells and their functions.

cell	**function**
ciliated cell	moving mucus in the trachea
palisade mesophyll cell	photosynthesis
sperm cell	reproduction

For **each** cell, state one feature that adapts it to its function, and explain how that feature helps.

Solution 3.2

Method: The six specialised cells — p.9

Worked steps

- **ciliated cell:** it has **cilia** on its surface B1, which beat and sweep the mucus, with its trapped particles, along the trachea B1
- **palisade mesophyll cell:** it is packed with **chloroplasts** and is tall B1, so it absorbs as much light as possible for photosynthesis B1
- **sperm cell:** it has a **flagellum** B1, which beats so the sperm can swim to the egg cell; the **acrosome** and the **mitochondria** are equally acceptable, each with its own reason B1

Exam-style 3.3 ▪ 11 marks

A leaf and a heart are both organs.

Exam-style 3.3 (a) ▪ 3 marks

Describe what is meant by a tissue, an organ and an organ system.

Solution 3.3 (a)

Worked steps

- a **tissue** is a group of cells of similar structure working together to do one job B1
- an **organ** is several tissues working together to do one job B1
- an **organ system** is several organs working together B1

Exam-style 3.3 (b) ▪ 2 marks

Name one tissue found in a leaf, and state its function.

Solution 3.3 (b)

Worked steps

- any one of: **palisade tissue**, **xylem**, **phloem**, **epidermis** B1
- with its function: palisade tissue carries out photosynthesis; xylem carries water; phloem carries sucrose; the epidermis covers and protects the leaf B1

Exam-style 3.3 (c) ▪ 2 marks

Explain why a leaf is described as an organ rather than as a tissue.

Solution 3.3 (c)

Worked steps

- a leaf contains **more than one tissue** – palisade tissue, xylem, phloem and epidermis B1
- a tissue is only **one** kind of cell working together, so a structure built from several tissues is an organ B1

Exam-style 3.3 (d) ▪ 2 marks

A bacterial cell has no nucleus. State where its genetic material is found, and name the other structure in a bacterium that carries genes.

Solution 3.3 (d)

Worked steps

- its genetic material is a **loop of DNA**, loose in the **cytoplasm** B1
- genes are also carried on **plasmids** B1

Exam-style 3.3 (e) ▪ 2 marks

A cut in the skin heals over several days. Use your knowledge of where new cells come from to explain how this happens.

Solution 3.3 (e)

Worked steps

- all new cells are produced by the **division of existing cells** B1
- the cells at the edge of the cut divide, producing new cells that fill the gap and close the wound B1