

Cell Structure

A-Level Biology ■ Topic 1

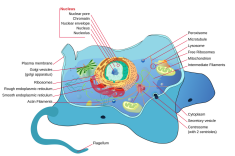
A-Level Biology



Cell Structure

What we will cover

- 1 The light microscope
- 2 Magnification & resolution
- 3 Animal & plant cells
- 4 Organelles
- 5 Prokaryotic cells
- 6 Viruses



a eukaryotic cell

1 Microscopy

Cell Structure

↳ Microscopy

The light microscope

A **light microscope** 光学显微镜 uses visible light and glass lenses. Typical max magnification $\times 1500$; **resolution** 分辨率 about 200 nm. An electron microscope uses a beam of electrons: far higher resolution (TEM for internal detail, SEM for surfaces) but the specimen must be dead and in vacuum.

Magnification is how much larger the image is. Resolution is the smallest distance at which two points still look separate.

Cell Structure

↳ Microscopy

Making a slide

A **temporary wet mount** 临时装片: specimen on a **slide** 载玻片, a drop of stain, then lower the **cover slip** 盖玻片 at an angle (no bubbles). Drawings: sharp single lines, no shading, correct sizes, labels that don't cross.



1. specimen on a slide

2. add a drop of stain

3. lower the cover slip at an angle

Cell Structure

↳ Microscopy

Magnification and actual size

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

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

$$1 \mu\text{m} = 1000 \text{ nm}$$

same unit top & bottom

Worked example

a chloroplast is 25 mm at $\times 5000 \Rightarrow \text{actual size} = 25/5000 = 0.005 \text{ mm} = 5 \mu\text{m}$

Measure real cells with a calibrated **eyepiece graticule** 目镜测微尺.

Resolution and the electron microscope

light microscope:
the two blur into **one**

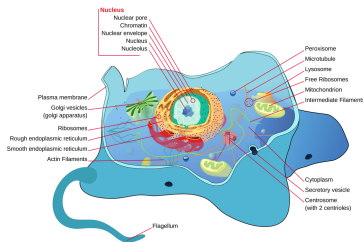
electron microscope:
resolved as **two**

Resolution 分辨率 is the smallest gap at which two points still look separate.

An **electron microscope** 电子显微镜 uses a shorter **wavelength** 波长, so it resolves far finer detail
– **SEM** 扫描 (surface) and **TEM** 透射 (inside).

2 Eukaryotic cells

The animal cell



A **eukaryotic cell** 真核细胞 keeps its DNA in a **nucleus** 细胞核; **organelles** 细胞器 float in the **cytoplasm** 细胞质. Every job that needs energy uses **ATP** ATP made in respiration.

Organelles and their jobs

nucleus

细胞核
holds DNA, controls the cell

mitochondria

线粒体
respiration → ATP

rough ER

粗面内质网
makes proteins

Golgi body

高尔基体
packs into vesicles

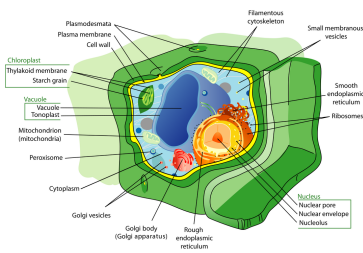
ribosomes

核糖体
join amino acids

lysosomes

溶酶体
break down waste

The plant cell



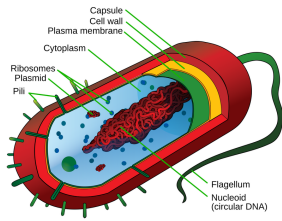
A plant cell also has:

- a **cell wall** 细胞壁 of **cellulose** 纤维素
- **chloroplasts** 叶绿体 for **photosynthesis** 光合作用
- a large permanent **vacuole** 液泡

Animal cells have none of these.

3 Prokaryotes and viruses

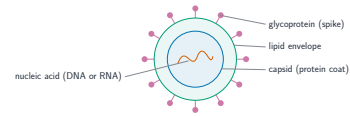
Prokaryotic cells



A **prokaryotic cell** 原核细胞 (a **bacterium** 细菌) is small ($1-5\ \mu\text{m}$) & simple:

- circular DNA free in the cytoplasm – **no nucleus**
- 70S ribosomes; **peptidoglycan** 肽聚糖 wall
- no double-membrane organelles

Viruses



A **virus** 病毒 is **non-cellular** 非细胞:

- a core of **nucleic acid** 核酸 – DNA or RNA
- a protein **capsid** 衣壳; some have a lipid **envelope** 包膜

It can only copy itself inside a living **host** 宿主 cell.

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Recap

Topic 1 – key takeaways

1 Microscopy

magnification = image / actual size

2 Resolution

electron microscope resolves finer detail

3 Eukaryotes

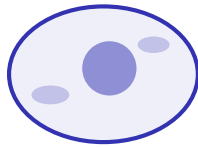
nucleus + membrane-bound organelles

4 Prokaryotes

no nucleus; viruses are non-cellular

Check yourself

- 1 Write the magnification equation.
- 2 Which microscope has higher resolution, and why?
- 3 Name the organelle where respiration makes ATP.
- 4 Does a prokaryote have a nucleus?



Answers 1. magnification = image size / actual size 2. electron (shorter wavelength)
3. mitochondria 4. no