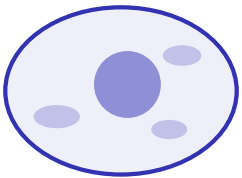
Cell Structure

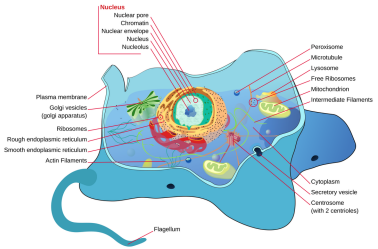
A-Level Biology ▪ Topic 1

A-Level Biology



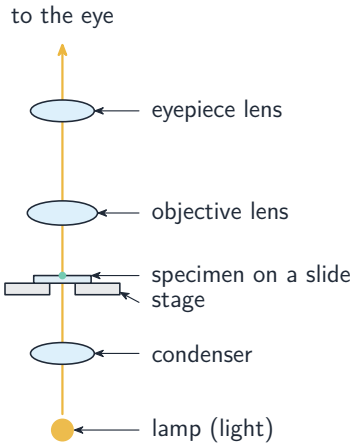
What we will cover

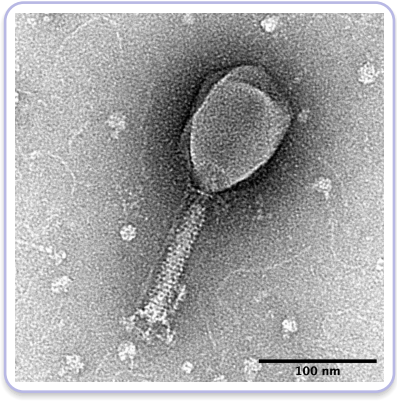
1. The light microscope
2. Magnification & resolution
3. Animal & plant cells
4. Organelles
5. Prokaryotic cells
6. Viruses



a eukaryotic cell

The light microscope



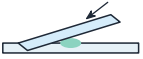


bacteriophage tem

Making a slide

1. specimen on a slide

2. add a drop of stain



3. lower the cover slip at an angle

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.

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 $25\,\text{mm}$ at $\times 5000 \Rightarrow$ 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

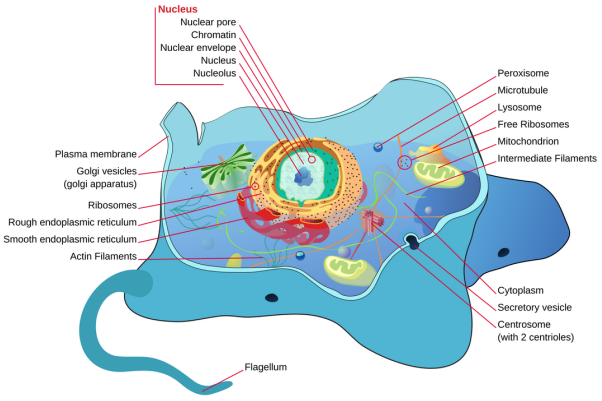
light microscope:
the two blur into **one**

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).

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

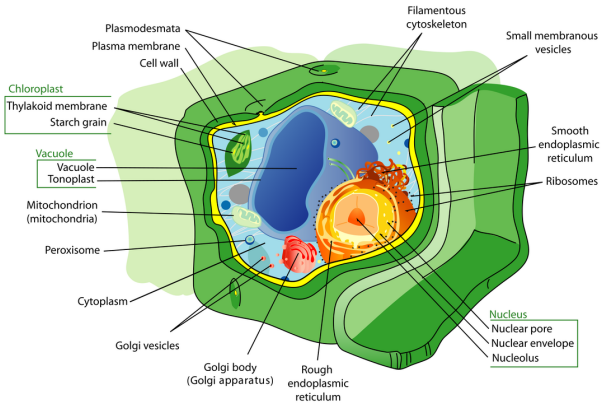
rough ER
粗面内质网
makes proteins

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

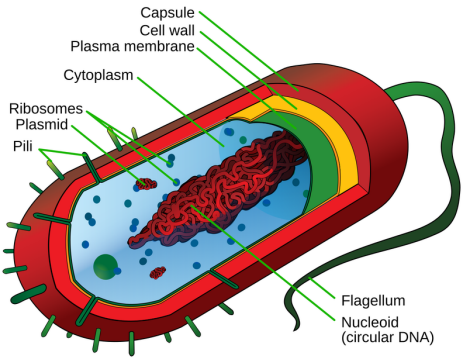


A plant cell also has:

- 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.

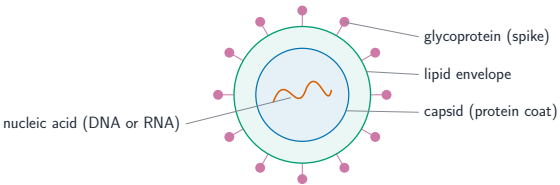
Prokaryotic cells



A **prokaryotic cell** 原核细胞 (a **bacterium** 细菌) is small (1–$5\,\mu\mathrm{m}$) & 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.

Topic 1 – key takeaways

1 Microscopy

magnification = image / actual size

2 Resolution

electron microscope resolves finer detail

3 Eukaryotes

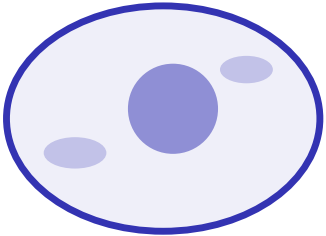
nucleus + membrane-bound organelles

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