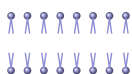


Cell Structure and Function

AP Biology • Unit 2

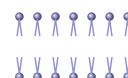
AP Biology



Cell Structure and Function

What we will cover

- 1 Organelles and the endomembrane system
- 2 Surface area-to-volume ratio
- 3 The fluid mosaic membrane
- 4 What crosses the membrane
- 5 Passive and active transport
- 6 Tonicity and endosymbiosis



1 Organelles

Cell Structure and Function

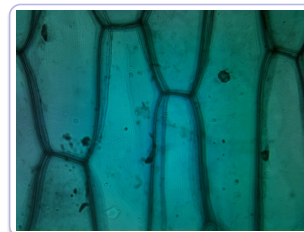
↳ Organelles

Organelles and the endomembrane system

A **eukaryotic** 真核的 cell divides work among **organelles** 细胞器:

- **nucleus** 细胞核 – stores DNA
- **mitochondria** 线粒体 – make ATP
- **ribosomes** 核糖体 – build proteins
- **ER** 内质网 + **Golgi** 高尔基体 – pack and ship

The endomembrane team traces a protein: nucleus → rough ER → Golgi → vesicle → membrane.



Organelles divide labour inside the cell

2 SA:V

Cell Structure and Function

↳ SA:V

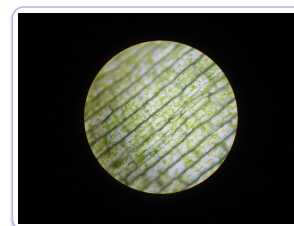
Surface area-to-volume ratio

Materials cross the **surface** 表面积; the **volume** 体积 must be served. As a cell grows, volume outpaces surface:

A cube of side s

$$\frac{\text{area}}{\text{volume}} = \frac{6s^2}{s^3} = \frac{6}{s}$$

The ratio **shrinks** as s grows – so cells stay small (or add **folds** 褶皱).



Leaf cells micrograph

3 Membrane

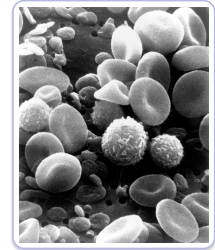
Cell Structure and Function
└ Membrane

The fluid mosaic membrane

The **fluid mosaic model** 流动镶嵌模型: a **phospholipid bilayer** 磷脂双分子层 (hydrophilic heads out, hydrophobic tails in) with drifting proteins.

- **membrane proteins** 膜蛋白 – channels, pumps, receptors
- **cholesterol** 胆固醇 – steadies the fluidity

Selectively permeable 选择性通透的 – it maintains **homeostasis** 稳态.



Rbc SEM

4 Crossing

Cell Structure and Function
└ Crossing

What crosses, and how

The hydrophobic core decides what crosses directly:

- cross easily – small **nonpolar** (O_2 , CO_2), and water
- blocked – large or charged (**glucose** 葡萄糖, Na^+)

Facilitated diffusion 易化扩散:

channel 通道蛋白/**carrier** 载体蛋白 proteins – passive, but **saturates**.

Passive: down the gradient, no ATP

Active: against the gradient, uses ATP

Osmosis 渗透 = diffusion of water. Endo/exocytosis move bulk cargo.

5 Tonicity

Cell Structure and Function
└ Tonicity

Tonicity and endosymbiosis

Water moves toward the **saltier** side. **Water potential** 水势 $\Psi = \Psi_S + \Psi_P$.

- **hypertonic:** cell shrinks
- **hypotonic:** cell swells
- **isotonic:** steady volume

Endosymbiotic theory 内共生学说: mitochondria & chloroplasts were once bacteria – own circular DNA, double membranes, own ribosomes.



Water leaves cells in a hypertonic solution

6

Recap

Unit 2 – key takeaways

1 Organelles

compartments for parallel reactions; endomembrane ships proteins

2 SA:V

ratio $\downarrow$ / $\uparrow$ shrinks with size – cells stay small

3 Membrane

fluid mosaic bilayer; selectively permeable

4 Transport

passive down / active up the gradient; osmosis

Check yourself

- 1 As a cell grows, does its surface-to-volume ratio rise or fall?
- 2 Why can O_2 cross the membrane but Na^+ cannot?
- 3 Does active transport use ATP?
- 4 Name one piece of evidence for endosymbiosis.



Answers 1. it falls 2. Na^+ is charged; O_2 is nonpolar 3. yes 4. own circular DNA (or double membrane)