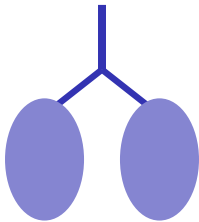


# Gas Exchange in Humans

IGCSE Biology ■ Topic 11

IGCSE Biology



# What we will cover

1 A good gas-exchange surface

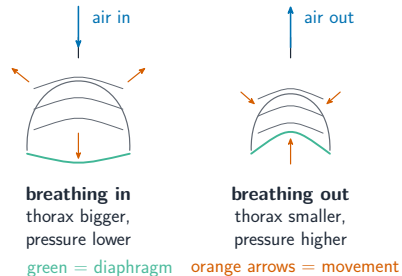
2 The breathing system

3 The alveolus

4 How you breathe

5 Inspired vs expired air

6 Exercise & clean airways



*how you breathe*

# A good gas-exchange surface

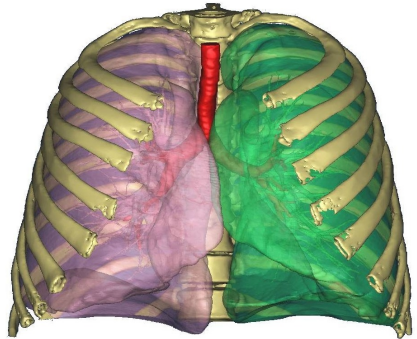
large **surface area**

**thin** – a short dis

good **blood supply**

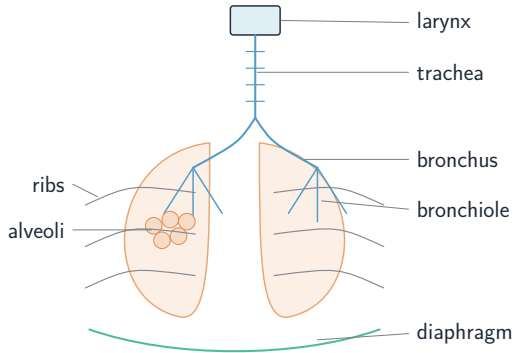
good **ventilation**

**Gas exchange** 气体交换:  $O_2$  in,  $CO_2$  out, by  
**diffusion** 扩散. A steep concentration difference  
keeps it fast.



*Gas exchange needs a large surface area*

# The breathing system

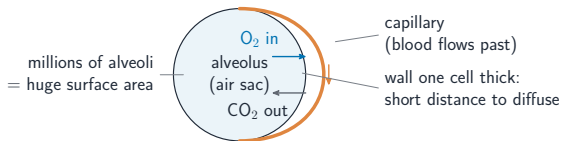


The air path:

**trachea** 气管 → **bronchi** 支气管 → **bronchiol**

The **ribs** 肋骨, **intercostal muscles** 肋间肌 & **diaphragm** 膈肌 move the air.

# The alveolus

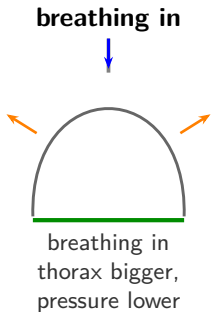


Millions of **alveoli** 肺泡 are perfect surfaces:

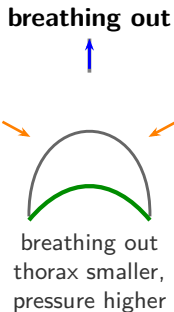
- huge surface area
- wall one cell thick
- wrapped in **capillaries** 毛细血管

O<sub>2</sub> diffuses in; CO<sub>2</sub> diffuses out.

# How you breathe



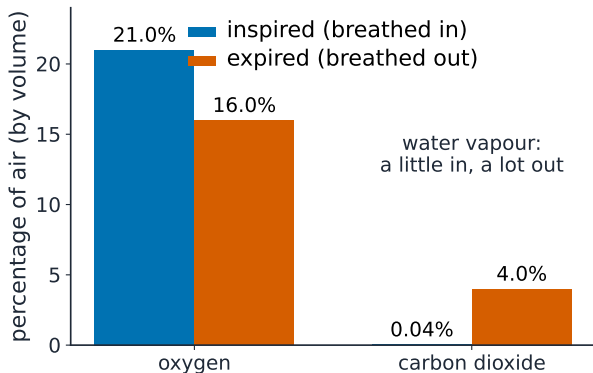
green = diaphragm



orange = rib movement

**Breathing in** 吸气: intercostals & diaphragm **contract** →  
**thorax** 胸腔 bigger → pressure drops → air in. Breathing out is the reverse.

## Inspired vs expired air



Expired air has **less**  $O_2$  (21%→16%), **more**  $CO_2$  (0.04%→4%) & more water vapour.

**Limewater** 石灰水 turns cloudy faster with expired air – it has more  $CO_2$ .

## Exercise and clean airways

### exercise

more CO<sub>2</sub> in blood → brain  
→ faster, deeper breathing

### clean airways

**goblet cells** 杯状细胞  
make **mucus** 黏液; **ciliated**  
**cells** 纤毛细胞 sweep it up



## Worked example – inspired vs expired air

**Expired air has more CO<sub>2</sub> and water vapour, and is warmer. Explain each.**

- Body cells **respire**, making CO<sub>2</sub>; blood carries it to the alveoli and it **diffuses out**.
- So expired CO<sub>2</sub> ( $\approx 4\%$ ) > inspired ( $\approx 0.04\%$ ).
- The alveoli are **moist**; water **evaporates** from that film into the air.
- The air is warmed to **body temperature** inside the lungs.
- Oxygen falls ( $21\% \rightarrow 16\%$ ) – but **not to zero**: only some diffuses out.

Expired air still holds plenty of oxygen – that is exactly why **rescue breathing works**. Nitrogen is unchanged; the body does not use it.

## Topic 11 – key takeaways

### 1 Surface

large, thin, blood supply,  
ventilation

### 2 Alveoli

millions; one-cell wall; capillaries

### 3 Breathing

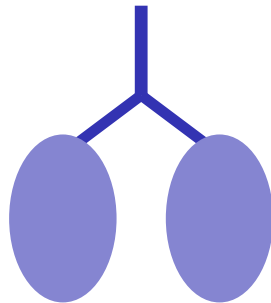
contract → bigger thorax → air  
in

### 4 Expired air

less O<sub>2</sub>, more CO<sub>2</sub> & water

## Check yourself

- 1 Name two features of a good gas-exchange surface.
- 2 Where does gas exchange happen in the lungs?
- 3 What happens to the diaphragm when you breathe in?
- 4 Which gas is higher in expired air?



**Answers** 1. e.g. large surface area & thin 2. the alveoli 3. it contracts and flattens  
4. carbon dioxide