

## Diseases & Immunity

IGCSE Biology ■ Topic 10

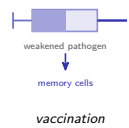
IGCSE Biology



Diseases & Immunity

### What we will cover

- 1 Pathogens & transmission
- 2 The body's defences
- 3 Antigens & antibodies
- 4 Vaccination
- 5 Active vs passive immunity
- 6 Cholera



# 1 Disease and defence

Diseases & Immunity  
└ Disease and defence

### Pathogens and transmission

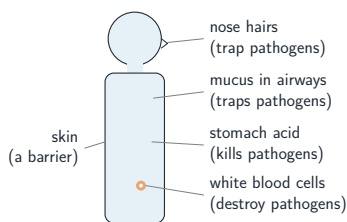


indirect: through food, water or air

- by **direct contact** 直接接触 – for example through blood and other **body fluids** 体液.
- indirectly – for example from **contaminated** 污染 surfaces, food, animals, or the air.

Diseases & Immunity  
└ Disease and defence

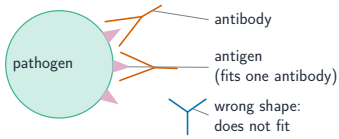
### The body's defences



- **skin** – a barrier that covers and protects the body.
- **hairs in the nose** – trap dust and pathogens in the air you breathe in.
- **mucus** 黏液 – sticky liquid in the airways that traps pathogens.
- **stomach acid** 胃酸 – kills most pathogens in your food.

# 2 Immunity

## Antigens and antibodies



Each pathogen carries **antigens** 抗原.  
**Lymphocytes** 淋巴细胞 make **antibodies** 抗体 (proteins).

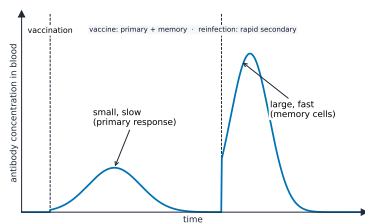
An antibody's shape is **complementary** 互补 to one antigen – it fits only that pathogen.

## Vaccination

**Vaccination** 疫苗接种 puts in weakened pathogens/antigens.

- lymphocytes make antibodies
- **memory cells** 记忆细胞 stay for years
- next time: a fast, large response

## Vaccination, in detail



After vaccination, memory cells give a fast, large response if the real pathogen arrives

## Active vs passive immunity

### active immunity 主动免疫

your own antibodies (infection/vaccine); memory cells → long-term

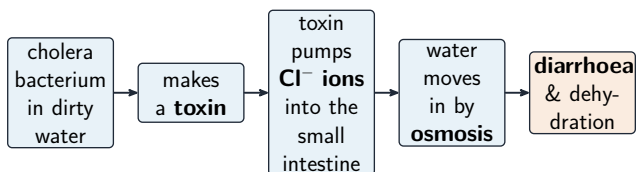
### passive immunity 被动免疫

antibodies from another (placenta, breast milk); no memory → short-term

## Cholera

**Cholera** 霍乱 spreads in dirty water. Its **toxin** 毒素:

- pumps chloride ions into the gut
- water follows by **osmosis** 渗透
- → **diarrhoea** 腹泻 & **dehydration** 脱水



## How pathogens spread



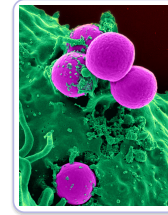
A mosquito can spread pathogens from person to person when it bites.

## How a pathogen is transmitted, and how to stop it

|                                 |                                                                                 |
|---------------------------------|---------------------------------------------------------------------------------|
| direct contact                  | blood or other body fluids passing from one person to another                   |
| indirect contact                | contaminated food or water, an object, an animal vector, or droplets in the air |
| a transmissible disease 传染病     | one in which a pathogen 病原体 can be passed from one host to another              |
| clean water                     | a safe supply, so drinking water is not contaminated                            |
| hygienic 卫生 preparation         | of food, and good personal hygiene – washing your hands                         |
| waste and sewage treatment 污水处理 | proper disposal, so waste never reaches water or food                           |

Cholera is the standard example: a **bacterium** 细菌 spread by contaminated water, and stopped by **sewage treatment** and a **clean supply** rather than by medicine.

## The body's defences, continued



A white blood cell (green) engulfing round bacteria (purple), a key body defence

## The body's own defences, and how public health helps

|                     |                                                                                              |
|---------------------|----------------------------------------------------------------------------------------------|
| skin                | a physical barrier, and it produces oil and sweat that inhibit bacteria                      |
| mucus and cilia     | trap and sweep out pathogens in the airways                                                  |
| stomach acid        | kills most pathogens swallowed with food, before they reach the small intestine 小肠           |
| phagocytes 吞噬细胞     | white blood cells that engulf and digest pathogens                                           |
| lymphocytes         | make antibodies specific to one antigen                                                      |
| breast-feeding 母乳喂养 | passes antibodies to infants 婴儿 – natural passive immunity, before their own system is ready |

Public health works upstream: clean water, hygienic food, safe waste disposal and vaccination stop the pathogen **reaching** anyone.

## Exam tips

- Pathogen = organism that causes disease. Transmissible = can pass between hosts, by direct contact or indirectly.
- Learn the five body defences: skin, nose hairs, mucus, stomach acid, white blood cells.
- An antibody's shape is **complementary** to one antigen (like an enzyme and its substrate).
- Active immunity (from infection or vaccination) makes **memory cells** → long-term. Passive immunity (placenta, breast milk) makes **no** memory cells → short-term.
- Cholera: toxin → chloride ions into the gut → water in by osmosis → diarrhoea and dehydration.

# 3

## Recap

## Worked example – active or passive immunity?

A traveller is given an injection of ready-made antibodies. Is this active or passive immunity, and how long does it last?

- The antibodies were **not made by the traveller** – they were given.
- So it is **passive immunity** 被动免疫: protection starts **immediately**.
- But no **memory cells** are made.
- When the antibodies break down the protection is gone ⇒ **short-lived**.

**Active:** you make your own antibodies (vaccine or infection) – slow to start, **long-lasting** (memory cells). **Passive:** given to you – instant, **short**.

## Topic 10 – key takeaways

### 1 Defences

skin, mucus, stomach acid, white cells

### 2 Antibodies

complementary shape to one antigen

### 3 Immunity

active makes memory cells;  
passive does not

### 4 Cholera

toxin → osmosis → diarrhoea

## Check yourself

- 1 Name two of the body's defences.
- 2 What cell makes antibodies?
- 3 Which immunity makes memory cells?
- 4 Why does cholera cause water loss?



**Answers** 1. e.g. skin & stomach acid 2. a lymphocyte 3. active immunity 4. water moves into the gut by osmosis