

Infectious Diseases

A-Level Biology ▪ Topic 10

A-Level Biology



Infectious Diseases

What we will cover

1

The four diseases

2

Malaria & vectors

3

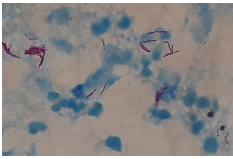
Controlling disease

4

Antibiotics

5

Antibiotic resistance



TB bacteria in sputum

1

The diseases

Infectious Diseases

The diseases

The four diseases

cholera 霍乱

bacterium ▪ contaminated water

malaria 疟疾

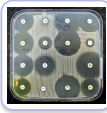
protocist ▪ mosquito **vector** 媒介

TB 结核病

bacterium ▪ airborne droplets

HIV/AIDS

virus ▪ blood, sex, mother-to-baby



Antibiotic zones

Infectious Diseases

The diseases

Four diseases: agent and route

| Disease          | Caused by                                      | How it spreads                                             |
|------------------|------------------------------------------------|------------------------------------------------------------|
| cholera 霍乱       | the <b>bacterium</b> 细菌 <i>Vibrio cholerae</i> | water or food <b>contaminated</b> 污染 with <b>faeces</b> 粪便 |
| malaria 疟疾       | the <b>protocist</b> <i>Plasmodium</i>         | a mosquito <b>vector</b> 媒介 biting                         |
| tuberculosis 结核病 | the <b>bacterium</b> <i>Mycobacterium</i>      | airborne <b>droplets</b> 飞沫                                |
| HIV/AIDS 艾滋病     | the <b>virus</b> 病毒 HIV                        | unprotected sex, infected blood, mother to baby            |

HIV destroys certain white blood cells, so it slowly weakens the **immune system** 免疫系统 itself – which is why an infection that a healthy person shrugs off becomes fatal.

Infectious Diseases

The diseases

Tuberculosis, and what “infectious” means

Tuberculosis

Tuberculosis (TB) 肺结核 is caused by the bacterium *Mycobacterium* and spreads in tiny airborne **droplets** 飞沫 from coughs and sneezes – fast, where people are crowded.

Transmissible

Infectious diseases are **transmissible** 可传播的: the pathogen can be **transmitted** 传播 from one person to another.

Why TB persists

It can lie latent for years, treatment takes months, and stopping early is what breeds resistance.

For each disease name the pathogen, the route and the control measure. Those three columns answer almost every question in this topic.

Infectious Diseases  
└ The diseases

Preventing each one

cholera

clean water and proper sewage treatment; good hygiene; vaccines 疫苗 in some areas

malaria

sleep under nets; drain still water where mosquitoes breed; insecticides 杀虫剂; anti-malarial drugs

TB and HIV

find and treat cases early; contact tracing; for HIV, protected sex and screened blood

Every one of these needs the biological, the social and the economic answer together – a net nobody sleeps under prevents nothing.

Infectious Diseases  
└ The diseases

Malaria needs a vector

**Plasmodium** 疟原虫 is the pathogen; the female *Anopheles* mosquito is the **vector** 媒介. The parasite's sexual stage happens in the mosquito, the asexual stage in the human liver then red cells – that is why you cannot catch malaria from another person directly.

Control the vector (nets, drain standing water) and you break the cycle even if the pathogen is still in people.

Infectious Diseases  
└ The diseases

Controlling disease

biological  
drugs, vaccines

social  
behaviour, education

economic  
cost, supply

Each disease needs all three: e.g. malaria – nets & insecticide (bio), removing still water (social), funding (economic). HIV has no cure or vaccine yet.

2 Antibiotics

Infectious Diseases  
└ Antibiotics

Antibiotics

penicillin stops new wall forming

strong cell wall

normal bacterium

weak wall → takes in water and bursts

An **antibiotic** 抗生素 kills bacteria: **penicillin** 青霉素 stops them building a **cell wall** 细胞壁, so they take in water & burst.

Antibiotics do **not** work on **viruses** 病毒 – a virus has no wall or reactions to attack.

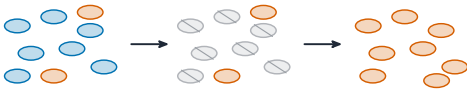
Infectious Diseases  
└ Antibiotics

Antibiotic resistance

A **mutation** 突变 can make a bacterium **resistant** 耐药性: the antibiotic kills the rest, so survivors take over (natural selection). Slow it: use antibiotics **only when they are needed** – never for a viral illness such as a cold – pick the **right** one for the infection, finish the course, and cut farm use. Otherwise some infections become very hard, or impossible, to treat.

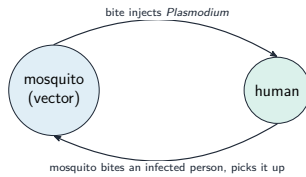
**2. antibiotic kills**

**1. a few are resistant** **non-resistant** **3. resistant multiply**



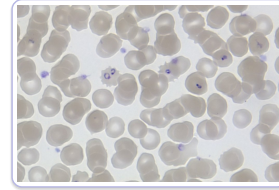
(red = resistant mutant)

## Malaria needs a vector, drawn



Malaria needs a mosquito vector: the parasite passes from human to mosquito to human with each bite – which is why control targets the mosquito

## The parasite itself



The protist Plasmodium (small dark rings) that causes malaria, living inside red blood cells

## Exam tips

- For each named disease give the **pathogen and route** (cholera – bacterium, water; malaria – Plasmodium, mosquito vector; also TB, HIV/AIDS).
- Explain why **antibiotics** work on bacteria only (they target cell walls/enzymes, not viruses).
- Explain **antibiotic resistance** as natural selection: a resistant mutant survives and reproduces; reduce it by finishing courses and avoiding overuse.

# 3 Recap

## Worked example – why antibiotics fail

A patient takes antibiotics for flu and does not improve. Explain, and say how resistance spreads.

- Flu is a **virus**. Antibiotics target **bacterial** structures (cell walls, 70S ribosomes).
- A virus has none of these and replicates inside host cells ⇒ **no effect**.
- Meanwhile the antibiotic **selects** for resistant bacteria already present by chance mutation.
- Resistance genes also spread **horizontally** on **plasmids**, even between species.

Antibiotics **select**, they do not cause resistance. Plasmid transfer is why resistance spreads so much faster in bacteria than by inheritance alone.

## Topic 10 – key takeaways

### 1 Pathogens

cholera, malaria, TB, HIV – know the spread

### 2 Vectors

malaria needs a mosquito vector

### 3 Antibiotics

kill bacteria, not viruses

### 4 Resistance

spreads by natural selection – use wisely

## Check yourself

- 1 Which pathogen type causes malaria?
- 2 What is the mosquito called in malaria spread?
- 3 Why don't antibiotics work on viruses?
- 4 How does antibiotic resistance spread?



**Answers** 1. a protist (Plasmodium) 2. a vector 3. no cell wall or reactions to target 4. natural selection