Infectious Diseases

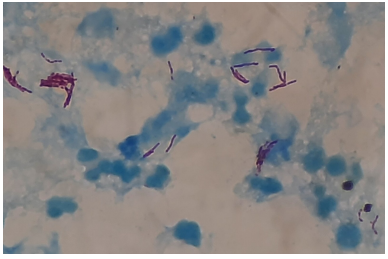
A-Level Biology ▪ Topic 10

A-Level Biology



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

The four diseases

cholera 霍乱

bacterium ▪ contaminated water

malaria 疟疾

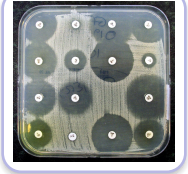
protoctist ▪ mosquito **vector** 媒介

TB 结核病

bacterium ▪ airborne droplets

HIV/AIDS

virus ▪ blood, sex, mother-to-baby



Clear zones round antibiotic discs: the bacteria cannot grow there

Four diseases: agent and route

Disease	Caused by	How it spreads
cholera 霍乱	the **bacterium** 细菌 *Vibrio cholerae*	water or food **contaminated** 污染 with **faeces** 粪便
malaria 疟疾	the protoctist *Plasmodium*	a mosquito **vector** 媒介 biting
tuberculosis 结核病	the bacterium *Mycobacterium*	airborne **droplets** 飞沫
HIV/**AIDS** 艾滋病	the **virus** 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.

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.

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.

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.

Controlling disease

biological
drugs, vaccines

social
behaviour, education

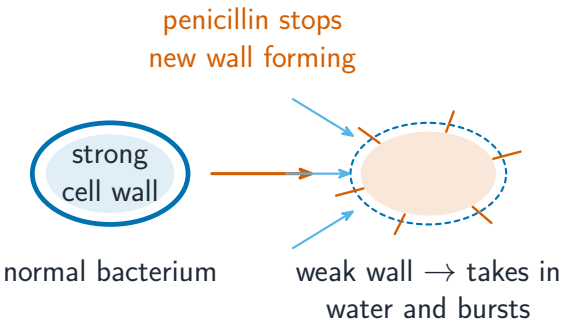
economic
cost, supply

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

Antibiotics



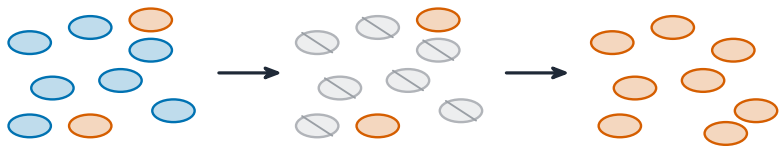
An **antibiotic** 抗生素 kills bacteria: **penicillin** 青霉素 stops them building a **cell wall** 细胞壁, so they take in water & burst.

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

Antibiotic resistance

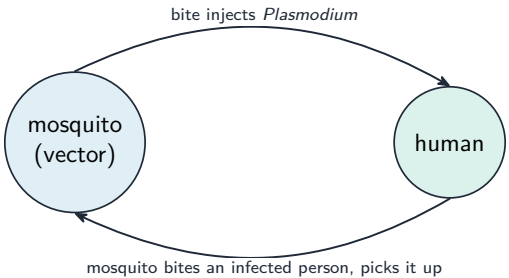
A **mutation** 突变 can make a bacterium **resistant** 耐药性; the antibiotic kills the rest, so survivors take over (natural selection). Slow it: use antibiotics only when they are needed – never for a viral illness such as a cold – pick the right one for the infection, finish the course, and cut farm use.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

1. a few are resistant **2. antibiotic kills non-resistant** **3. resistant multiply**



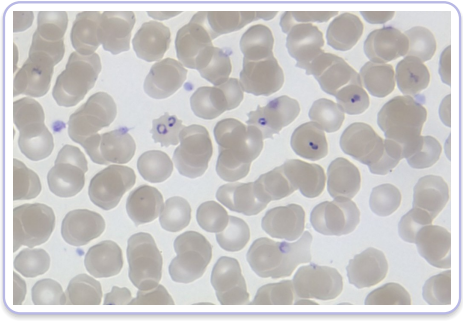
(red = resistant mutant)

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 protoctist 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 $\Rightarrow$ 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

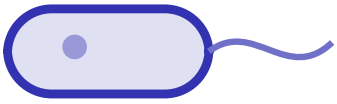
kill bacteria, not viruses

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