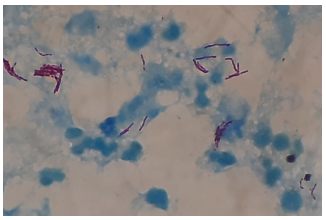
Infectious Diseases

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

Antibiotic zones

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

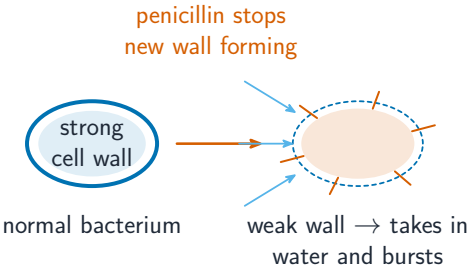
social
behaviour, education

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



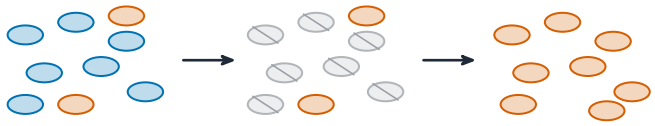
An **antibiotic** 抗生素 kills bacteria: **penicillin** 青霉素 stops them building a **cell wall** 细胞壁, so they take in water & burst.

> 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 needed, finish the course, cut farm use.

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



(red = resistant mutant)

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.

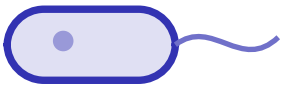
> Antibiotics select, they do not cause resistance. Plasmid transfer is why resistance spreads so much faster in bacteria than by inheritance alone.

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