Infectious diseases

A-Level Biology

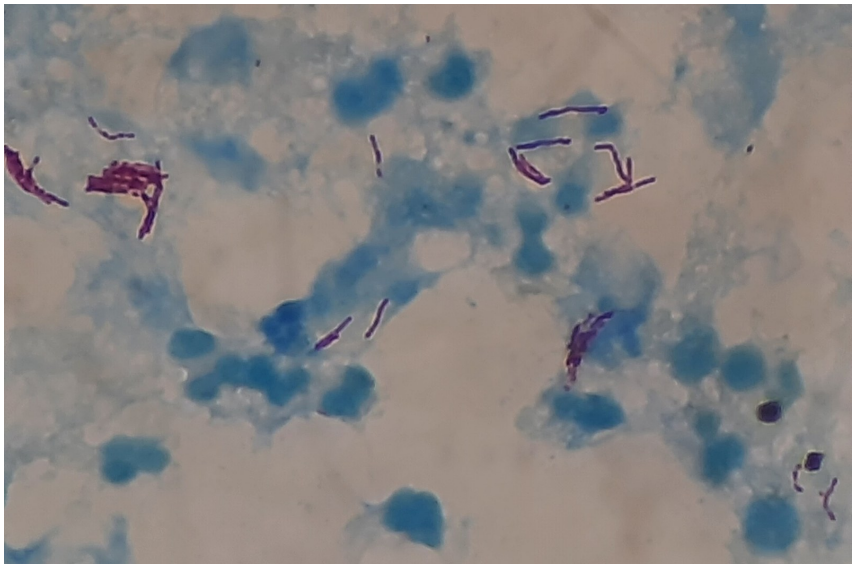
What causes infectious disease

An **infectious disease** 传染病 is caused by a **pathogen** 病原体—an organism that lives in or on a host and causes harm. Infectious diseases are **transmissible**: the pathogen can be **transmitted** 传播 (passed) from one person to another.

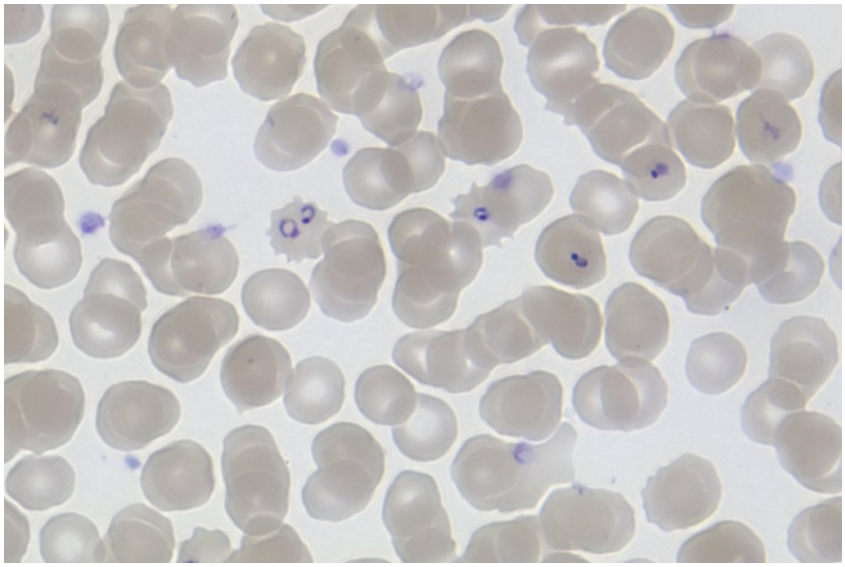
You need to know four diseases, the pathogen that causes each, and how each spreads.

Disease	Pathogen and type	How it spreads
cholera 霍乱	the **bacterium** 细菌 *Vibrio cholerae*	drinking water or food **contaminated** 污染 with **faeces** 粪便 (human waste)
malaria 疟疾	the **protoctist** 原生生物 *Plasmodium*	the bite of an infected **mosquito** 蚊子, which acts as a **vector** 媒介 (a carrier of the pathogen); also through infected blood
tuberculosis (TB) 结核病	the bacterium *Mycobacterium*	tiny airborne **droplets** 飞沫 from coughs and sneezes; spreads fast where people are crowded
HIV/AIDS	the **virus** 病毒 HIV (which leads to **AIDS** 艾滋病)	unprotected sex, infected blood (for example shared needles), and from mother to baby

HIV infects and destroys certain white blood cells, so it slowly weakens the body's **immune system** 免疫系统.



The bacterium 细菌 *Mycobacterium (red rods) that causes tuberculosis, stained in a sputum sample*



The protoctist 原生生物 Plasmodium (small dark rings) that causes malaria, living inside red blood cells

Image: MichaelZahniser, Public domain (commons.wikimedia.org)

Preventing and controlling these diseases

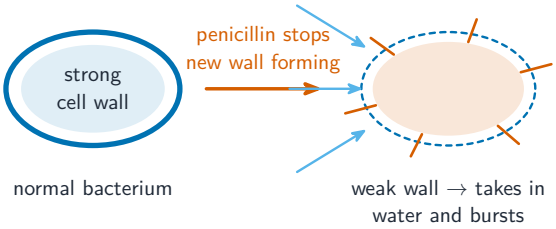
Control has **biological**, **social** and **economic** sides —the science of the pathogen, people's behaviour and education, and the money and resources available. Examples:

- **cholera**: provide clean water and proper sewage treatment; good hygiene; **vaccines** 疫苗 in some areas.
- **malaria**: sleep under nets; remove pools of still water where mosquitoes breed; spray **insecticides** 杀虫剂; take anti-malarial drugs.
- **TB**: find and treat infected people with a long course of antibiotics; give the BCG vaccine; reduce overcrowding; trace contacts of patients.
- **HIV**: use condoms; use clean needles; test donated blood; educate people. There is no cure and no vaccine yet, but drugs can slow the virus down.

In every case, cost (economic), people's willingness to change behaviour (social) and the supply of drugs or vaccines (biological) all affect how well a disease can be controlled.

Antibiotics

An **antibiotic** 抗生素 is a drug that kills bacteria or stops them growing. For example, **penicillin** 青霉素 stops bacteria from building their **cell walls** 细胞壁. As the bacterium grows, its weak wall cannot hold it, so the cell takes in water and bursts.



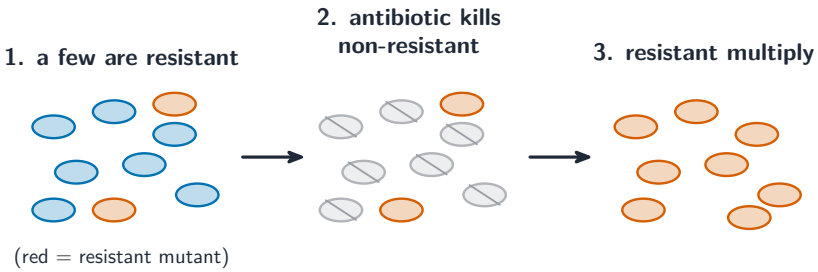
Penicillin 青霉素 *stops new cell wall* 细胞壁 *forming, so the bacterium takes in water and bursts*

Antibiotics do **not** work against **viruses**. A virus has no cell wall and no chemical reactions of its own to attack —it simply uses the machinery of the host cell. So there is no antibiotic target in a virus.

Antibiotic resistance

Sometimes a **mutation** 突变 makes a bacterium **resistant** to an antibiotic, which means the antibiotic no longer kills it. This **resistance** 耐药性 is a serious problem:

- when an antibiotic is used, the non-resistant bacteria die, but any resistant ones survive and multiply. Over time, more and more bacteria carry the resistance.
- some infections then become very hard, or impossible, to treat.



Antibiotic resistance 耐药性 *spreads by natural selection: the antibiotic kills the rest, so the resistant survivors take over*

Steps to slow resistance down:

- only use antibiotics when they are really needed (not for viral illnesses such as colds).
- always finish the full course, so no bacteria are left alive.
- use the correct antibiotic for the infection.
- reduce the heavy use of antibiotics in farming.