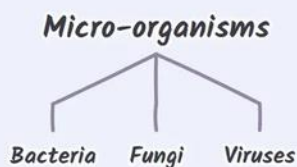


the organisms too small to see, and the industries built on making them work for us

What a microbe is *

- **micro-organisms** are living things too small to see with the unaided eye, needing a microscope
- the main groups are **bacteria**, **fungi**, **protozoa**, **algae** and **viruses**
- **bacteria** are **prokaryotic**, single celled, and shaped as rods, spheres, spirals or commas
- **fungi** are **eukaryotic** and include **yeast**, **moulds** and **mushrooms**
- **viruses** are on the **borderline of life**: they have no cell structure and can only reproduce inside a host cell
- so a virus is **inert outside a host** and behaves as living only inside one, which is why it sits awkwardly in any classification



the main groups branching from one heading: the first is prokaryotic and single celled, the second eukaryotic and often many celled, and the third has no cell at all and depends entirely on a host

Useful microbes

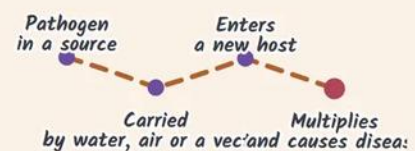
- **curd**: **Lactobacillus** turns the lactose of milk into lactic acid, which sets the milk and gives the sour taste
- **bread and alcohol**: **yeast** ferments sugar to ethanol and carbon dioxide. The gas raises the dough and the ethanol matters in brewing
- **antibiotics**: **penicillin** comes from the mould **Penicillium**, discovered by Fleming
- **nitrogen fixation**: **Rhizobium** in the root nodules of legumes converts atmospheric nitrogen into a form plants can use
- **decomposition**: microbes break down dead matter and return nutrients to the soil, without which the cycles would stop
- **industry**: vitamins, enzymes, vinegar, and the treatment of sewage all depend on micro-organisms

Harmful microbes

- a **pathogen** is a micro-organism that causes disease
- **bacterial diseases**: tuberculosis, typhoid, cholera and tetanus
- **viral diseases**: influenza, measles, polio, dengue and rabies
- **protozoan diseases**: malaria, spread by the **Anopheles** mosquito, and amoebic dysentery
- **fungus diseases**: ringworm and athlete's foot
- microbes also cause **food spoilage**, and some produce **toxins** that make food dangerous even after the organism is killed

Matching disease to cause and spread

Disease	Caused by	Spread by
Tuberculosis	bacterium	air, droplets
Cholera	bacterium	contaminated water
Malaria	protozoan	Anopheles mosquito
Dengue	virus	Aedes mosquito
Polio	virus	water, contact
Ringworm	fungus	contact



the chain a communicable disease follows from one host to the next: breaking any single link stops the spread, which is why clean water, mosquito control and isolation each work on their own

malaria and dengue are both mosquito borne but the causes differ, one protozoan and one viral, and so does the mosquito. That pair is asked about more than any other in the chapter