

The nature and variety of living organisms revision notes

All living things share a set of characteristics, but they are not all alike. This topic describes the main groups of living organisms (plants, animals, fungi, protoctists and bacteria), the features that identify each group, and viruses, which are not living organisms but can cause disease.

For Pearson Edexcel International GCSE Biology 4BI1 and Science (Double Award) 4SD0. **Biology only** is not in the Double Award and is only examined on Paper 2.

1 Characteristics and variety of living organisms Spec 1.1-1.4

Characteristics of living organisms Spec 1.1

All living organisms share the eight characteristics below, although they show them in different ways.

The characteristics of living organisms	
Characteristic	What it means
Nutrition	Organisms require nutrition: they take in materials for energy, growth and repair.
Respiration	Organisms respire : they release energy from food in their living cells.
Excretion	Organisms excrete their waste: they remove the waste products of their chemical reactions.
Response	Organisms respond to their surroundings : they detect changes (stimuli) and react to them.
Movement	Organisms move: they change position or move parts of their body.
Control of internal conditions	Organisms control their internal conditions , keeping them steady (for example temperature and water content).
Reproduction	Organisms reproduce: they produce new individuals of the same kind.
Growth and development	Organisms grow and develop: they increase in size and change over time.

Plants and animals show all of these in different ways. A plant moves by growing towards light, rather than moving from place to place. An animal gets its nutrition by eating, but a plant makes its own food by photosynthesis.

Common mistake: Excretion is not the same as egestion. Excretion is removing waste made by the cells (for example carbon dioxide). Egestion is removing undigested food.

Exam tip: When asked why something is a living organism, link each characteristic to a real example, such as 'it respire to release energy'. Do not just list the words.

Plants and animals Spec 1.2

Plants and animals are both **eukaryotic** organisms: their cells have a nucleus. Both groups are **multicellular**, which means their bodies are made of many cells.

Plants and animals compared		
Feature	Plants	Animals
Number of cells	Multicellular	Multicellular
Chloroplasts	Cells contain chloroplasts	Cells do not contain chloroplasts
Photosynthesis	Able to carry out photosynthesis	Not able to carry out photosynthesis
Cell wall	Cellulose cell walls	No cell walls
Carbohydrate store	Starch or sucrose	Often glycogen
Co-ordination and movement	No nervous co-ordination	Usually have nervous co-ordination and can move from one place to another
Examples of plants	Flowering plants, such as a cereal (for example maize) and a herbaceous legume (for example peas or beans).	
Examples of animals	Mammals (for example humans) and insects (for example housefly and mosquito).	

Exam tip: A common 'compare' mark is the carbohydrate store: plants store starch or sucrose, animals store glycogen. Learn both.

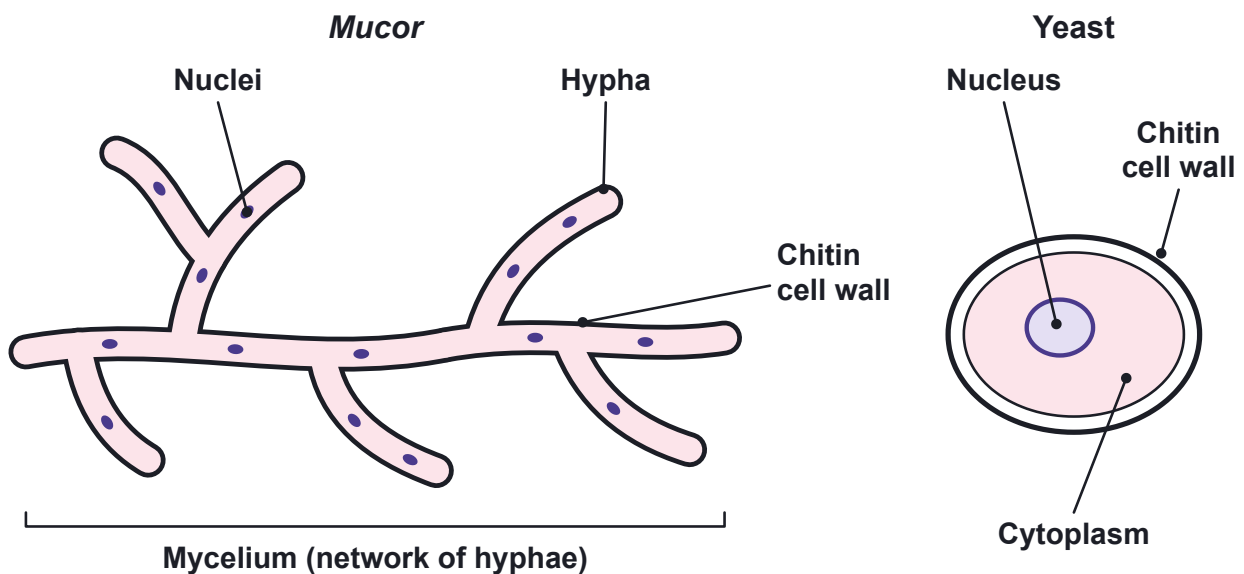
Fungi and protists Spec 1.2

Fungi

Fungi are eukaryotic organisms that are not able to carry out photosynthesis. Most have a body organised into a **mycelium**, made from thread-like structures called **hyphae**, which contain many nuclei. Some fungi are single-celled.

- Their cell walls are made of **chitin**.
- They feed by secreting digestive enzymes onto food material outside the body (extracellular secretion), then absorbing the organic products. This is called **saprotrophic nutrition**.
- They may store carbohydrate as glycogen.

Mucor shows the typical fungal hyphal structure. Yeast is a single-celled fungus.

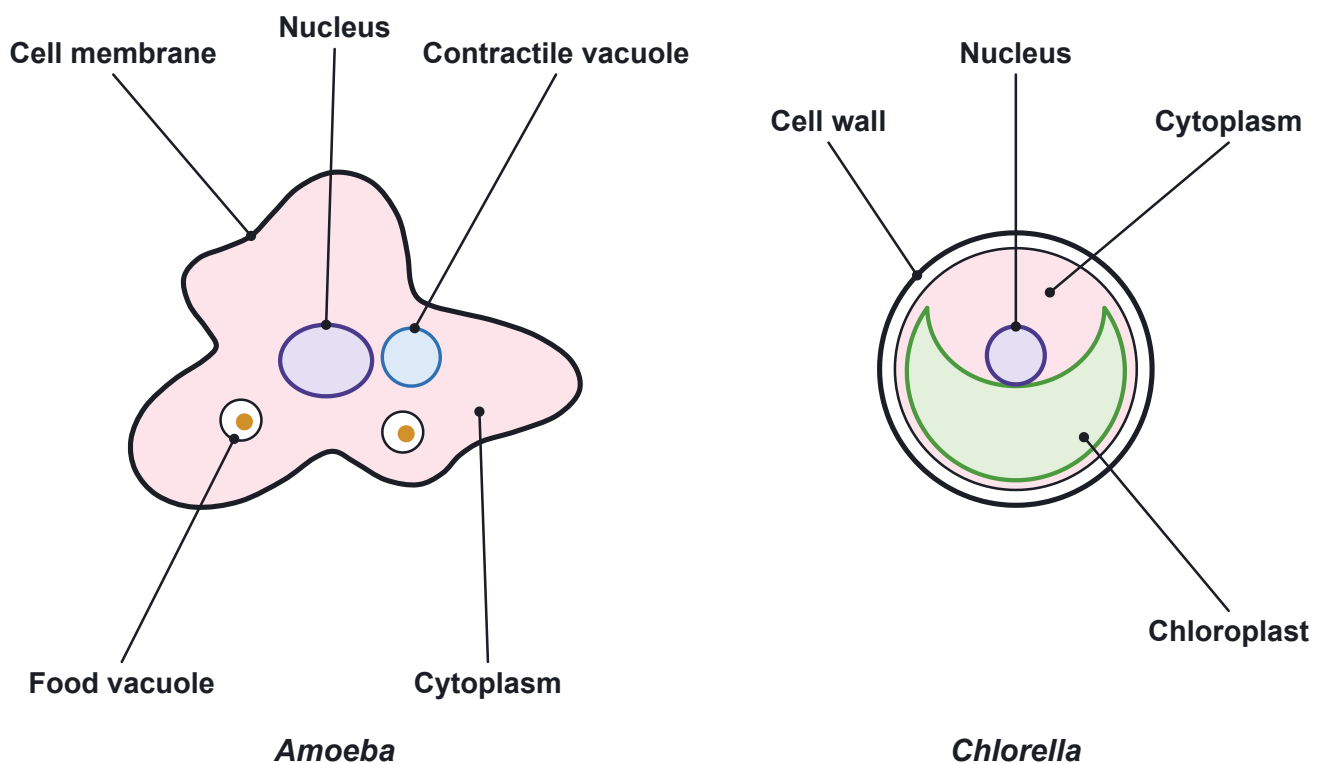


Two fungi: *Mucor* is made of **hyphae** forming a **mycelium**; yeast is single-celled. Both have cell walls made of **chitin**.

Protoctists

Protoctists are **microscopic single-celled** eukaryotic organisms. They are a varied group.

- *Amoeba* lives in pond water and has features like an animal cell.
- *Chlorella* has chloroplasts and is more like a plant cell.
- *Plasmodium* is a pathogen. It causes malaria.



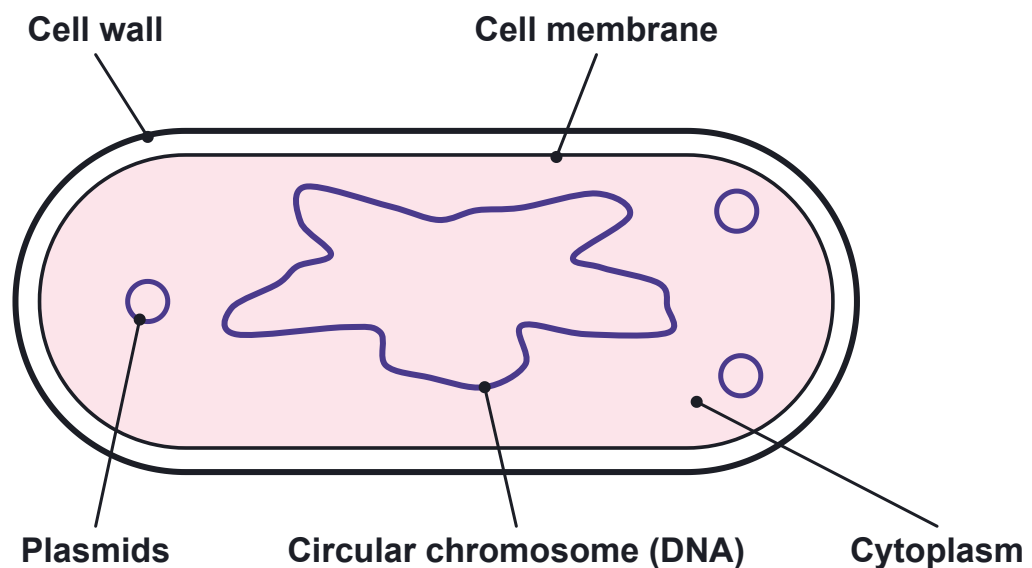
Two protoctists: *Amoeba* is like an animal cell, while *Chlorella* has a **cell wall** and a **chloroplast**, like a plant cell.

Common mistake: Write 'protoctists', the word used in this specification. A protoctist is single-celled, but not every single-celled organism is a protoctist: bacteria and yeast are not.

Bacteria Spec 1.3

Bacteria are **prokaryotic** organisms. They are **microscopic and single-celled**, and they do not have a nucleus.

Cell wall	Surrounds the cell and supports it.
Cell membrane	Controls the movement of substances into and out of the cell.
Cytoplasm	Where the chemical reactions of the cell happen.
Circular chromosome	A single loop of DNA found free in the cytoplasm, not enclosed in a nucleus.
Plasmids	Small rings of extra DNA, separate from the circular chromosome.



A bacterial cell has a **circular chromosome** and **plasmids** free in the cytoplasm. There is **no nucleus**.

Most bacteria feed off other living or dead organisms. Some bacteria can carry out photosynthesis.

Two examples of bacteria		
Bacterium	Shape	Importance
<i>Lactobacillus bulgaricus</i>	Rod-shaped	Used in the production of yoghurt from milk
<i>Pneumococcus</i>	Spherical	A pathogen that causes pneumonia

Common mistake: Bacteria do have DNA. Write that it is not in a nucleus, never that bacteria have no DNA.

Viruses and pathogens Spec 1.4

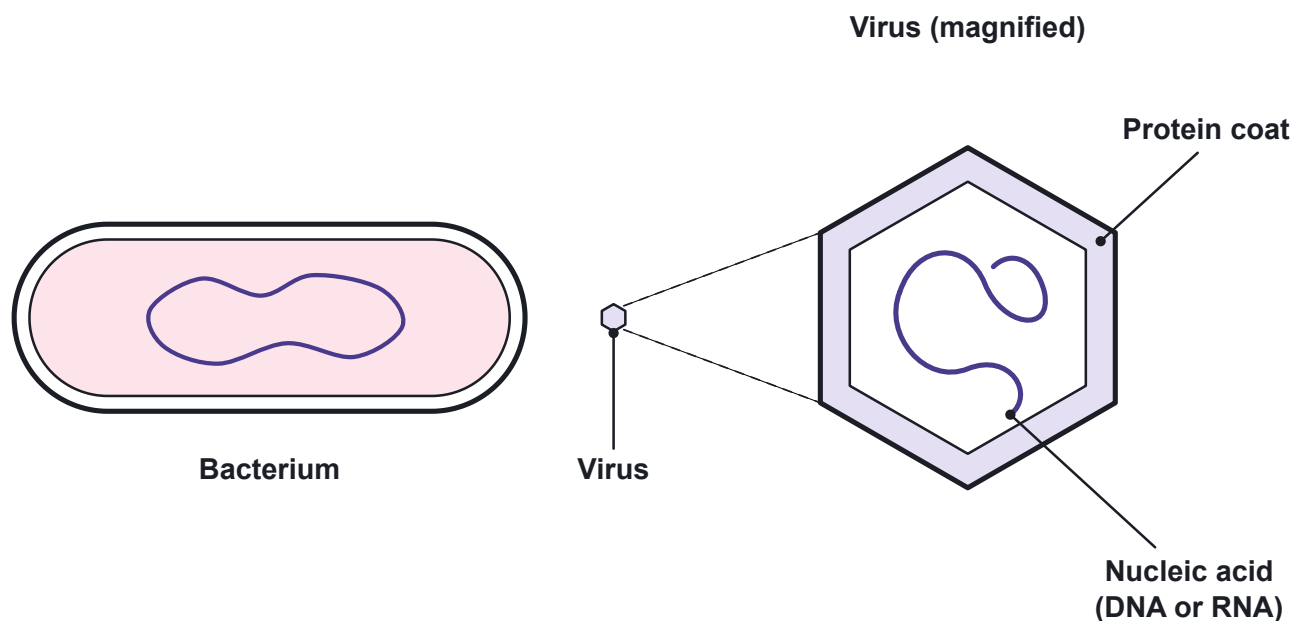
A **pathogen** is an organism or particle that causes disease. Pathogens may include fungi, bacteria, protoctists or viruses.

Viruses

Viruses are **not living organisms**. They are small particles, smaller than bacteria, and they have a wide variety of shapes and sizes.

- They have **no cellular structure**.

- They have a **protein coat** and contain one type of nucleic acid, either DNA or RNA.
- They are parasitic: they can **reproduce only inside living cells**.
- They infect every type of living organism.



A virus is much smaller than a bacterium. It has a **protein coat** around one type of **nucleic acid** (DNA or RNA) and no cellular structure.

Examples of viruses	
Virus	Disease or effect
Tobacco mosaic virus	Discolours the leaves of tobacco plants by preventing the formation of chloroplasts
Influenza virus	Causes flu
HIV	Causes AIDS

Examples of pathogens from this topic		
Type of pathogen	Example	Disease
Virus	HIV	AIDS
Bacterium	<i>Pneumococcus</i>	Pneumonia
Protoctist	<i>Plasmodium</i>	Malaria

Exam tip: Say that viruses 'reproduce only inside living cells' and that they have 'no cellular structure'. These are the usual mark-scheme points for why a virus is not a living organism.

Quick check

1. Give any four characteristics shared by all living organisms.
2. What are fungal cell walls made of?
3. What is the name for the thread-like structures that make up a fungal mycelium?
4. Give two features of a bacterial cell.
5. Why are viruses not classed as living organisms?

Quick check answers

Characteristics and variety of living organisms

1. Any four from: nutrition, respiration, excretion, response to surroundings, movement, control of internal conditions, reproduction, growth and development.
2. Chitin.
3. Hyphae.
4. Any two from: cell wall, cell membrane, cytoplasm, plasmids, circular chromosome of DNA, no nucleus.
5. They have no cellular structure and can reproduce only inside living cells.