The nature and variety of living organisms

Pearson Edexcel · International GCSE · Biology

What counts as alive?

A housefly and a maize plant could not look more different, yet both are alive in the same eight ways, and both are built from the same kind of cell. This first section gives you the words for that shared life – the characteristics every organism shows – and a map of life's variety: five groups of organisms plus the viruses, which are not alive at all but still infect every living thing.

Edexcel International GCSE Biology 4BI1, Section 1 is assessed in both papers; expect direct recall and "compare" questions from 1.1–1.4, often one mark for a feature and one for the named example.

The characteristics of life

Every living organism does all eight: it takes in **nutrition** (material for energy or growth), it **respires** (releases energy from food), it **excretes** (removes waste), it **responds** to its surroundings, it **moves**, it **controls its internal conditions** (keeps itself steady inside), it **reproduces**, and it **grows and develops**. The memory hook MRS GREN lists movement, reproduction, sensitivity, growth, respiration, excretion, nutrition – the "control of internal conditions" is the eighth that the hook leaves out, so name it separately.

A virus does none of these by itself – that is why it is not living.

Variety: the five groups and their give-away features

Plants: multicellular; cells contain **chloroplasts** and carry out **photosynthesis**; walls of **cellulose**; carbohydrate stored as **starch** or sucrose. Examples: a cereal (maize) and a herbaceous legume (peas or beans).

Animals: multicellular; no chloroplasts, no photosynthesis; **no cell walls**; usually nervous coordination and movement from place to another; store carbohydrate as **glycogen**. Examples: mammals (humans) and insects (housefly, mosquito).

Fungi: no photosynthesis; body usually a **mycelium** of thread-like **hyphae** containing **many nuclei**; some single-celled (yeast); walls of **chitin**; feed by secreting digestive enzymes onto food outside the body and absorbing the products – **saprotrophic nutrition**; store glycogen. Examples: **Mucor** (typical hyphae) and **yeast** (single-celled).

Protoctists: microscopic **single-celled** organisms. *Amoeba* (pond water) is like an animal cell; *Chlorella* has chloroplasts and is like a plant. The pathogenic example is ***Plasmodium***, which causes **malaria**.

Bacteria: microscopic single-celled organisms with a cell wall, cell membrane, cytoplasm and **plasmids**; they **lack a nucleus** but have a **circular chromosome of DNA** DNA. Some photosynthesise; most feed off living or dead organisms. Examples: ***Lactobacillus bulgaricus*** (rod-shaped, used to make yoghurt) and ***Pneumococcus*** (spherical, causes pneumonia).

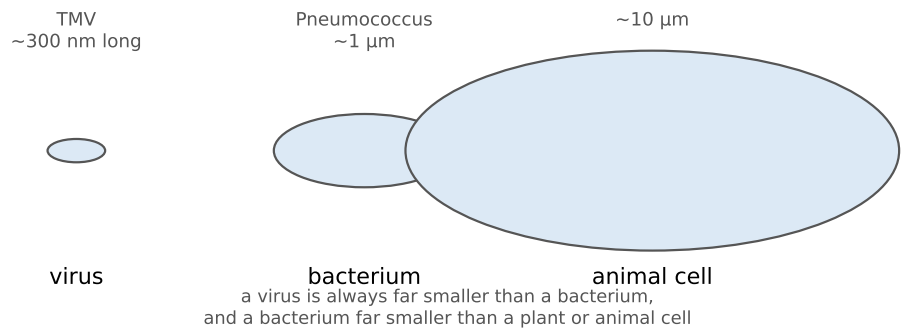
Plants	Animals	Fungi
multicellular; chloroplasts; cellulose walls; store starch (e.g. maize, peas)	multicellular; no chloroplasts; no cell walls; store glycogen (e.g. humans, housefly)	hyphae with many nuclei; chitin walls; saprotrophic feeding (e.g. Mucor, yeast)
Protoctists	**Bacteria**	**Viruses**
single-celled; some like animals (Amoeba), some like plants (Chlorella); Plasmodium	single-celled; no nucleus; circular DNA + plasmids (e.g. Lactobacillus, Pneumococcus)	not living; protein coat around DNA or RNA; reproduce only in cells (e.g. TMV, flu, HIV)

The four-way comparison the examiners like: **cell wall material** (cellulose / none / chitin / bacterial wall), **nucleus** (yes / yes / yes / no), **chloroplasts** (plants and some protoctists only), **storage carbohydrate** (starch / glycogen / glycogen / –).

Pathogens and the viruses

A **pathogen** is any organism or particle that causes disease – the specification allows fungi, bacteria, protoctists **or viruses**.

Viruses are **not living organisms**: they are small particles (smaller than bacteria), **parasitic**, and can **reproduce only inside living cells**; they have **no cellular structure** – just a **protein coat** containing **one type of nucleic acid, DNA or RNA** (never both). Learn the three named examples with their diseases: **tobacco mosaic virus** (discoloured tobacco leaves – it stops chloroplasts forming), **influenza virus** (flu) and **HIV** (AIDS).



Check yourself

1. List the eight characteristics shared by all living organisms.
2. Give two features of a plant cell that an animal cell lacks.
3. Which group stores carbohydrate as glycogen, and which as starch?
4. Describe saprotrophic nutrition in fungi, using the words hyphae, enzymes and absorb.
5. How does the genetic material of a bacterium differ from that of a plant cell?
6. Name the pathogenic protoctist and the disease it causes.
7. State three reasons why viruses are not classified as living organisms.
8. Which named virus prevents chloroplast formation, and what is the visible result?

Answers: 1 nutrition, respiration, excretion, response, movement, control of internal conditions, reproduction, growth; 2 chloroplasts and a cellulose cell wall; 3 animals and fungi store glycogen; plants store starch (or sucrose); 4 fungi secrete digestive enzymes from their hyphae onto dead food material, then absorb the soluble organic products; 5 a bacterium has no nucleus – circular DNA chromosome plus plasmids – while a plant cell keeps its DNA in a nucleus; 6 Plasmodium – malaria; 7 no cellular structure; reproduce only inside living cells; no life processes alone; 8 tobacco mosaic virus – discoloured, mosaic-patterned leaves.