

## Nutrition – bacteria and fungi

### Extracellular digestion

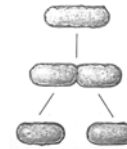
1. secrete enzymes
2. digest the food
3. reabsorb the digested food

Fungi are saprophytes feeding on dead organic material. They feed by extracellular digestion. This means they **secrete enzymes** through the walls of their fine feeding hyphae, which **break down** the food into nutrients. The digested nutrients are then **reabsorbed** through the hyphae wall. The nutrients are used for growth or used in respiration to release energy.

Bacteria and fungi thrive in warm, moist conditions, rich in nutrients.

## Reproduction – bacteria

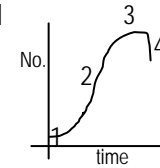
Occurs by **binary fission** – asexual (mitosis) as often as every 20 minutes under favourable\* conditions. The DNA copies itself, the cell membrane pinches the cytoplasm in half, and two bacteria form (identical).



\*enough food, oxygen (if aerobic), moisture, warmth, space.

1. lag phase
2. log or exponential growth (population doubling in each reproductive period)
3. stationary
4. death phase

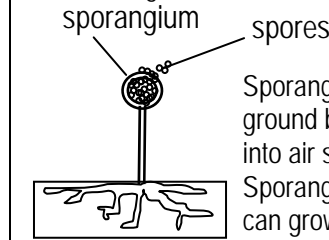
Exponential growth doesn't keep occurring as bacteria run out of nutrients and space and become poisoned by their excretory products.



## Reproduction – fungi

**Spores:** small, tough coated reproductive cells.

**Sporangium:** swellings at the tips of hyphae that produce/contain/release spores for reproduction which are dispersed in the air and grow into new fungi (role of spread).



Sporangia (plural of sporangium) above ground burst to release the light spores into air so they are easily spread.

Sporangia disperse spores so new fungi can grow further away. Yeast reproduces by budding.

## Growth – bacteria and fungi

Grow bigger by using nutrients gained by digestion of food, and energy released from the digested food by RESPIRATION.

Once cells reach a certain size they become too big to be efficient and will divide to make more cells.

Viruses don't grow - they have no chemical processes of their own.

Be careful in use of the word "growth" as it can refer to the individual organism or to the growth of a population.

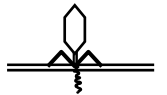
## Describe biological ideas relating to how humans use and are affected by micro-organisms Level 1 2 credits

*How humans use and are affected by micro-organisms could include: nutrient cycling, food production, sewage treatment, food poisoning, disease in living things, microbial attack on everyday materials (helpful and harmful), antibiotics, and resistance to antibiotics.*

## Reproduction – viruses

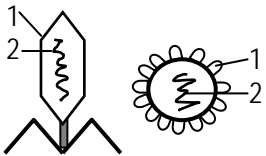
Virus attaches to cell (via protein coat), penetrates cell membrane and injects viral genetic material. Viral genetic material is replicated using host cellular machinery. New protein coats are made and assembled with the new genetic info. into new viruses. Cell bursts releasing the new viruses the cell usually dies in the process. If host cell is a bacterium the virus is called a bacteriophage.

Viruses need a host/living cell to reproduce / replicate because they have no other life functions – they have no chemical processes of their own e.g. raw materials, energy and enzymes are supplied by host cell. Viruses are always PATHOGENS.



## Structure – virus

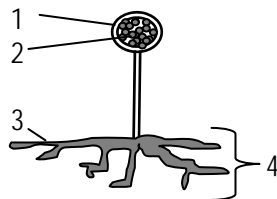
1. protein (coat) = capsid
2. genetic material = nucleic acid / DNA / RNA (NOT chromosome)



Viruses are NOT alive – exist only to reproduce.

## Structure – fungi

1. sporangium
2. spores
3. hyphae
4. mycelium (mass of hyphae)

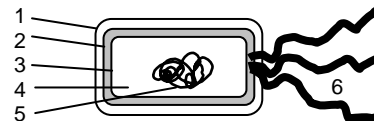


## Structure – bacteria

4 main different shapes – rod (bacillus), spherical (coccus), comma shaped (vibrio) or spiral (spirillum).



1. slime capsule (protection & prevents dehydration)
2. cell wall (shape)
3. cell membrane (controls entry/exit of substances)
4. cytoplasm (cell reactions occur here)
5. genetic material (genes control bacterium processes)
6. flagellum/a (movement)



## Nutrition – fungi

**Hyphae:** threads used for feeding / growth / spreading.

Their function is: secretion of enzymes / **extracellular digestion** / securing fungus to substrate / absorb water and/or nutrients and/or food. Absorbing nutrients allows further growth of the hyphae into new food. Hyphae branch out, and form a mycelium and spread to cover a large area. As the hyphae grow, new sporangia are produced (reproduction).

Yeasts – are single celled fungi.

Mushrooms - are large fungi.

**Fungi cause diseases** that include thrush, ringworm, and athlete's foot.



<p><b>Why we get sick with viruses</b>  <b>Reproduction</b> Large numbers produced quickly  <b>Structure</b> Unable to recognise protein coat / new protein coat formed / new antigen formed  <b>Mutation</b> DNA / RNA alters frequently / virus mutates quickly requiring new antibody / host cannot produce new antibodies quickly enough.</p> <p><b>Why we catch colds more than once?</b>  Proteins/antigens form the part of the virus that is recognised by the immune system. Frequent mutations lead to different strains with different protein coats/antigens. These are not recognised by the immune system.</p>	<p><b>How viruses make us sick</b>  Viruses reproduce in a living cell, and because they can make many hundreds of viruses inside each cell before it dies this causes many more cells to die and organs to malfunction which leads to illness.  <b>Viral diseases</b> - measles, mumps, flu, AIDS</p> <p><b>How bacteria make us sick</b>  Bacterial reproduction doesn't destroy living cells, but instead increases the number of bacteria so that the amount of toxin they excrete increases. It is the toxin which then causes inflammation in parts of the body.  <b>Bacterial diseases</b> – meningitis, salmonella, TB</p>	<p><b>Antibiotics</b>  We take antibiotics to fight bacterial infections. Antibiotics are based on natural compounds the fungi produce to compete against bacteria for nutrients and space.  <b>Antibiotic resistance</b> has occurred because of <b>overuse</b> or <b>inappropriate</b> use of antibiotics.  <b>Variation / mutations</b> can occur in bacterial populations which may lead to antibiotic resistance, and may allow them to survive. The resistance is passed on to subsequent generations, so the antibiotics will no longer work. By finishing the course of antibiotics more bacteria will be killed / less will survive.  <b>Viruses cannot be killed by antibiotics.</b></p>
<p><b>Vaccines</b>  Vaccines cause the body to produce <u>specific</u> antibodies.  A vaccine is a dead or weakened form, or even a fragment of a microbe, that induces the person's body to make antibodies in advance, so it will respond quickly and destroy the microbes if they infect the body. Inactivated toxic compounds are used where these, rather than the micro-organism itself, cause illness eg tetanus.  *Specific: The vaccine only works if the microorganism strain is the same as the immunity that has been built up. If a different strain or a new mutated form of the strain infects the individual, the antibodies will not recognise the microorganism, and the patient is likely to become ill.</p>	<p><b>Culturing bacteria, fungi &amp; viruses</b>  Inoculate a sterile nutrient agar plate. Incubate sealed and labelled, upside down in a warm place. Avoid sealing it air tight &amp; incubating near body temperatures as this encourages the more harmful anaerobes and microbes that thrive in humans. Store upside down to avoid condensation falling on the microbes.  Fungi appear as fuzzy / furry / fluffy patches. Bacteria grow in colonies, and appear as shiny or greasy spots in a variety of colours. Plates should later be destroyed by burning them or soaking in strong disinfectants.  Viruses can only be cultured (grown) in living cells eg fertilized hens eggs.</p>	<p><b>How bacteria can cause food poisoning</b>  Bacteria reproduce on food if conditions allow growth. The bacteria <b>release toxins</b> into the food which can be a poison to humans making them sick.</p> <p><b>How disinfectants work</b>  Disinfectants kill / eliminate / destroy / inhibit growth of <b>harmful / pathogenic</b> microorganisms / bacteria, reducing the chance of infection through food contamination / wounds / or items / areas that present a high risk of infection (eg plates, chopping boards, kitchen areas, door handles etc).  <b>Antiseptics</b> kill the microbes without killing our cells.</p>
<p><b>Nutrient cycles – decomposers</b>  Without decomposition, nutrients would not be available / would run out / be all locked up in living animals and plants. Fungi <i>and</i> bacteria make nutrients available in usable form.  <b>Nitrogen fixing bacteria</b> in root nodules and soil turn N<sub>2</sub> from the air into usable nitrates (used by plants to make proteins)  <b>Fungi</b> break down dead organic material containing carbon / nitrogen and use it to build their structures / release energy for respiration. The nutrients are recycled through the food chain and used as food by other organisms. The fungi excrete useable nutrients that plants can absorb from the soil and store. Microbe respiration also releases CO<sub>2</sub> necessary for photosynthesis.</p>	<p><b>Uses of Fungi - yeast</b>  Yeast cells make CO<sub>2</sub> and alcohol (ethanol) when they carry out feeding or respiration (fermentation) - anaerobic respiration of glucose. glucose → ethanol + carbon dioxide + energy  CO<sub>2</sub> makes the dough rise / beer &amp; wine bubble <b>and</b> ethanol makes the beer or wine alcoholic. The release of CO<sub>2</sub> and ethanol is excretion as these are waste products to the yeast.</p> <p><b>Uses of bacteria</b>  Yoghurt / cheese is produced by the fermentation / respiration of bacteria added to milk. Respiration of the milk sugar lactose by bacteria produces lactic acid. The lactic acid lowers the pH of the milk allowing the milk (proteins) to curdle / precipitate as solid curds.</p>	<p><b>Terms</b>  <b>saprophytic</b> - feeds on dead/decomposing/decaying matter (saprophyte); no harm done –beneficial in a decomposing role  <b>decomposer</b> - are organisms that consume dead organisms, and, in doing so, carry out the process of decomposition  <b>parasitic</b> - feeds on living organic matter / material / host (parasite): harmful  <b>pathogen/pathogenic</b>- disease causing microorganism  <b>aerobic bacteria</b> – require oxygen for respiration  <b>anaerobic bacteria</b> – do not require oxygen for respiration</p>