

Carbon cycle

Carbon dioxide is taken out of the atmosphere by photosynthesis in plants and ocean uptake. The carbon is assimilated into plant compounds (e.g cellulose) which are ingested by animals. Respiration in plants and animals returns some carbon to the atmosphere. When plants and animals die, micro-organisms decompose the dead material. Bacteria and fungi respire to release the carbon as carbon dioxide. Combustion of fossil fuels also releases long term stores of carbon into the atmosphere.

Carbon cycle is CROP RAIDER

Carbon dioxide

Removed from the atmosphere by

Ocean uptake

Photosynthesis

Released into the

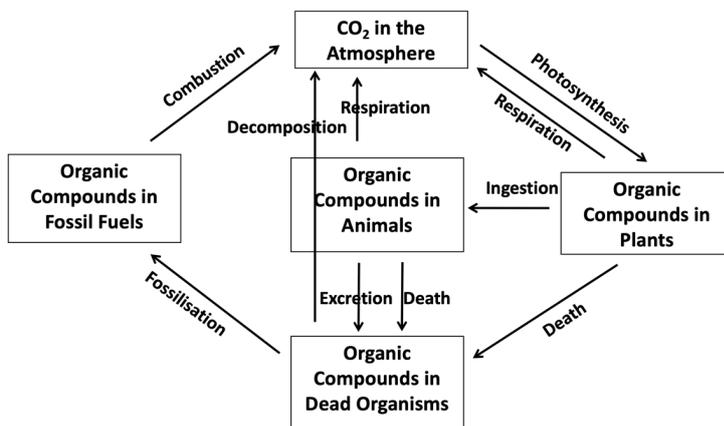
Atmosphere by

Igniting fossil fuels

Decomposition (by bacteria and fungi)

Egestion of waste

Respiration



Cloning

Remove a nucleus from an unfertilised egg cell. Take a nucleus from an adult body cell, e.g. skin cell, and insert it into the enucleated egg cell. Use an electric shock to cause the egg cell to divide into an embryo. These contain the same genetic information as the adult skin cell. Insert the embryo into a surrogate female to enable development.

Cloning is CRISP

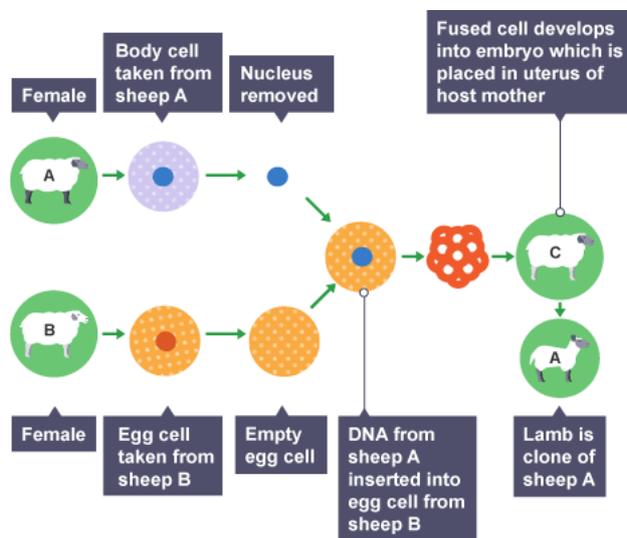
Cloning

Remove nucleus from egg cell

Insert adult nucleus

Shock

Put into surrogate female



Digestion

Digestion starts in the mouth and is used to break large molecules into small soluble molecules so that they can be absorbed into the blood.

Teeth break the food into smaller pieces. This is called mechanical digestion. Saliva containing amylase breaks down starch into sugar and makes the food easier to swallow.

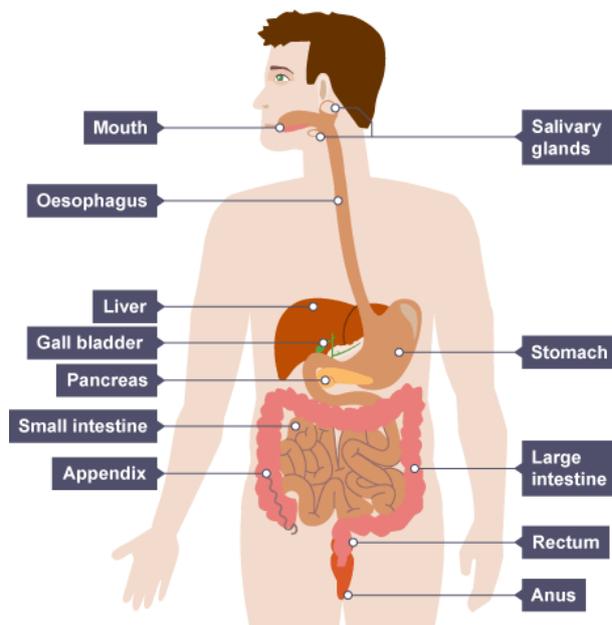
Food moves down the oesophagus by peristalsis (waves of muscular contraction) where it reaches the stomach.

The stomach churns the food with hydrochloric acid to kill bacteria and protease. This is the first site of protein digestion.

Bile is released in the small intestine. Bile is produced by the liver and stored in the gall bladder. It emulsifies fats – breaking large insoluble fat droplets, into smaller more soluble ones. This increases the surface area of the fat for lipase to act.

Enzymes, produced by the pancreas, break down food in the small intestine. Carbohydrase breaks carbohydrates down into sugars, protease breaks down proteins into amino acids and lipase breaks down fats into glycerol and fatty acids. These small molecules are absorbed into the blood.

Fibre does not get digested.

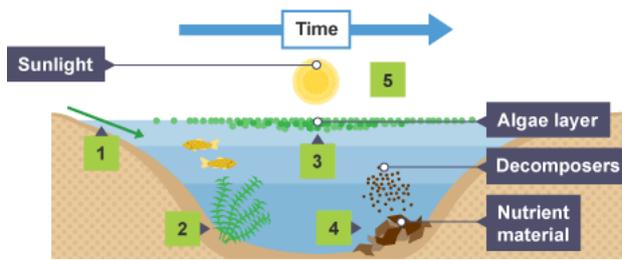


Eutrophication

Fertilisers contain nitrate ions. This causes algae to grow, which blocks sunlight into the lake. The plants below are unable to photosynthesise and die. Bacteria decompose the dead matter and respire, using up oxygen in the water. Aquatic life dies due to lack of oxygen. This is called eutrophication.

Eutrophication is FLABOBN

Fertilisers run into
Lakes, which cause
Algae to grow. This
Blocks sunlight
Obliterates (kills) plants
Bacteria decompose the dead plants and respire
No oxygen – kills fish and other aquatic life



- 1 Nutrient load up: excessive nutrients from fertilisers are flushed from the land into rivers or lakes by rainwater.
- 2 Plants flourish: these pollutants cause aquatic plant growth of algae, duckweed and other plants.
- 3 Algae blooms, oxygen is depleted: algae blooms prevent sunlight reaching other plants. The plants die and oxygen in the water is depleted.
- 4 Decomposition further depletes oxygen: dead plants are broken down by bacteria decomposers, using up even more oxygen in the water.
- 5 Death of the ecosystem: oxygen levels reach a point where no life is possible. Fish and other organisms die.

Evolution

There is variation in the population of organisms (e.g a range of colours). This is caused by mutations and leads to a range of alleles for one characteristic. One allele enables the organism to be better adapted to their environment. They are more likely to survive and reproduce, passing on the advantageous allele to the next generation. The frequency of this allele increases in the population.

Evolution is VIP MASP

Variation

In the

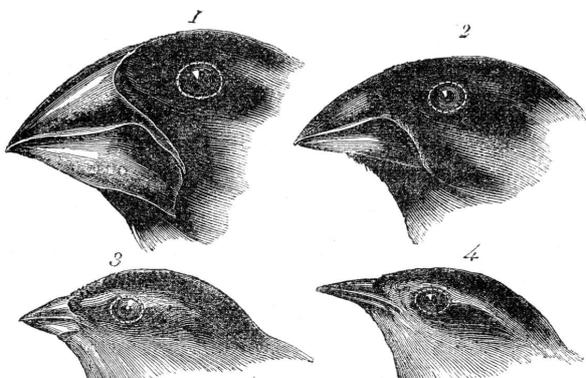
Population, is caused by

Mutation

Allows some organisms to

Survive and reproduce

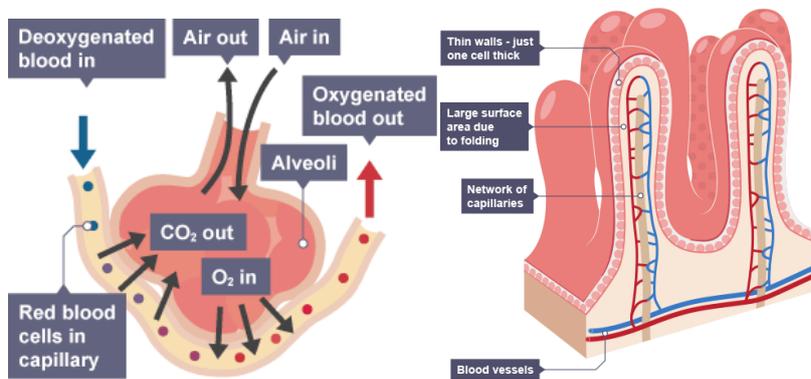
Passing on allele to offspring



Exchange surfaces

Small molecules (e.g. glucose and oxygen) are absorbed into the blood stream by diffusion. The substances move down their concentration gradient, passing through the wall of the alveoli or small intestine. These surfaces are adapted to maximise diffusion by having:

1. A large surface area, for example, villi and microvilli or alveoli folds
2. A good blood supply to maintain the concentration gradient
3. Thin permeable walls so there is a short diffusion distance



Homeostasis

Homeostasis is the maintenance of constant internal body conditions. This is important to maintain optimum conditions for enzymes to function. The conditions that the body controls include blood glucose levels, body temperature and water levels.

For example:

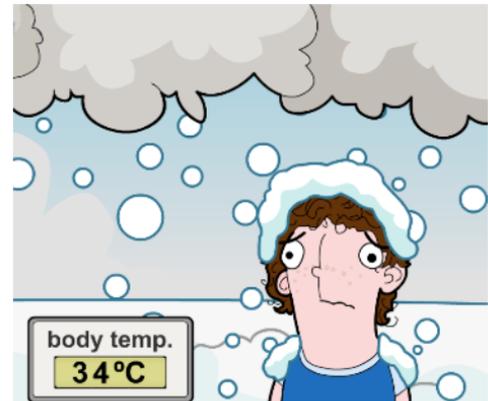
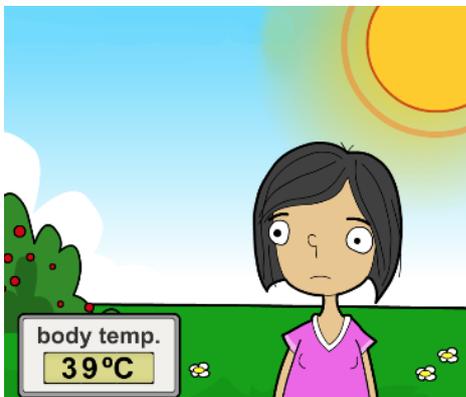
A temperature increase is detected by receptors in the skin. A signal is sent via the sensory neurone to the hypothalamus which causes responses to decrease body temperature:

1. Sweating - which takes away heat from the skin when the water evaporates
2. Hairs lie flat
3. Vasodilation occurs – arterioles dilate to direct more blood to the surface of the skin

A temperature decrease is detected by receptors in the skin. A signal is sent via the sensory neurone to the hypothalamus which causes responses to increase body temperature:

1. Shivering – muscle contraction and respiration produce heat
2. Hairs stand up – to trap an insulating layer of air
3. Vasoconstriction occurs – arterioles constrict to direct less blood to the surface of the skin

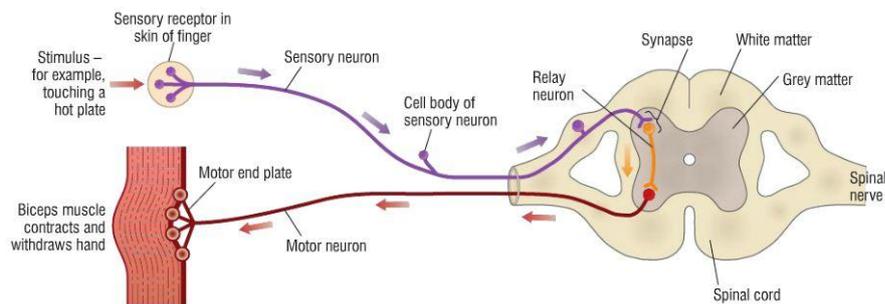
These are both examples of negative feedback loops.



Nervous system

Receptors in the skin detect stimuli (changes in the environment), for example temperature or pressure receptors. This information is sent to the brain or spinal cord via the sensory neurone. Gaps between two neurones are called synapses. The information is processed and sent to an effector via the motor neurone, which brings about a response. Effectors are always muscles or glands.

Note: Reflex reactions are not processed by the brain to save time and instead use a relay neurone in the spine to connect the sensory and motor neurone.



Test yourself

1. Fish use their gills as a gas exchange surface. Suggest three ways in which fish gills are adapted for efficient gas exchange.
2. White blood cells are part of the immune system. White blood cells help the body to defend itself against pathogens. Describe how pathogens cause infections and describe how the immune system defends the body against these pathogens (6)
3. Panama is a narrow strip of land which today joins North America and South America. It was formed by land moving up from beneath the sea. Panama has separated the Pacific Ocean and the Caribbean Sea for the past 3 million years.
4. Explain how two different species of pistol shrimp could have developed from an ancestral species of shrimp (6)

5. A dairy farmer washes out his cow shed each day. The waste water contains urine and faeces. The waste water overflows into a stream by mistake. The waste water will have an effect on the plants and invertebrates living in the stream. Explain why (6)
6. The doctors were worried that the man might also have injured his spine. They touched different areas of his skin with a sharp point. They asked him to tell them each time if he could feel the sharp point. Explain how the information about the sharp point touching the skin reaches the man's brain (6)
7. Describe and explain how the structure of the small intestine is adapted for absorbing digested food. (5)

Mark scheme

Answer 1

- Large surface area
- Good blood supply/ capillaries
- Permeable walls

Answer 2

- bacteria and viruses are pathogens credit any ref to bacteria and viruses
- they reproduce rapidly inside the body
- bacteria may produce poisons / toxins (that make us feel ill)
- viruses live (and reproduce) inside cells (causing damage).
- white blood cells help to defend against pathogens by:
- ingesting pathogens / bacteria / (cells containing) viruses credit engulf / digest / phagocytosis
- to destroy (particular) pathogen / bacteria / viruses
- producing antibodies
- to destroy particular / specific pathogens
- producing antitoxins
- to counteract toxins (released by pathogens) credit memory cells / correct description

Answer 3

- (two ancestral populations) separated (by geographical barrier / by land) / were isolated
- genetic variation (in each population) or different / new alleles or mutations occur

- different environment / conditions (allow abiotic or biotic example)
- natural selection occurs or some phenotypes survived or some genotypes survived
- (favourable) alleles / genes / mutations passed on (in each population)
- eventually two types cannot interbreed successfully

Answer 4

- this contains mineral ions (and organic matter)
- this increases growth of algae / water plants
- the plants / algae (underneath) die
- due to lack of light / photosynthesis / space
- decomposers / microorganisms feed on decaying matter or multiply rapidly
- the respiration of decomposers uses up all the oxygen
- so invertebrates die due to lack of oxygen • this is called eutrophication

Answer 5 - sharp point stimulates (pain) receptor (in the skin) must be in correct order 1 to send (nerve) impulse ignore information and messages 1 via sensory neurone 1 to spinal cord do not accept spine, ignore CNS 1 crosses synapse allow synapse in any correct context 1 to other (relay) neurones / to brain do not accept motor neurone allow explanation in a flow diagram

Answer 6 - long; 2. villi / villus / microvilli; 3. increase surface area / eq; 4. diffusion / active transport / osmosis; 5. capillaries; 6. (blood flow) maintains concentration gradient / maintains diffusion gradient; 7. thin walls / one cell thick / short distance; (applies to villi or capillaries)