

Living Things

- Biology is the study of living things (organisms).

The seven characteristics of living things

- Movement
- Respiration
- Sensitivity
- Feeding
- Excretion
- Reproduction
- Growth
- For something to be alive it must possess all of these characteristics.

Animals can be divided into two main groups - Vertebrates and Invertebrates.

Vertebrates are animals that have a backbone

Invertebrates are animals that do not have a backbone

Vertebrates can be divided up into five groups - Fish, Amphibians, Reptiles, Birds and Mammals

A key is a set of questions used to identify a plant or animal.

The Cell

Structures found in plant and animal cells

- Nucleus - controls the activities of the cell. Contains chromosomes made of DNA.
- Cell membrane - controls what substances enter and leave the cell.
- Cytoplasm - watery fluid. All other structures of the cell are suspended in it.
- Vacuoles - store substances.

Structures found in plant cells only

- Chloroplasts - contain chlorophyll for photosynthesis.
- Vacuole - contains cell sap.
- Cell wall - Supports the cell. Made of cellulose.

Tissues, Organs, Systems

- A tissue is a group of similar cells, e.g. nerve tissue, muscle tissue.
- An organ is a group of tissues, e.g. heart, brain.
- A system is a group of organs, e.g. digestive system, nervous system.

The Microscope

- The eyepiece is the piece you look through
- The objective lens is just above the stage.
- The stage is where you put the slide.
- The focus knob moves the objective lens up or down to focus the object you are looking at.

Preparing a microscope slide

1. Place a drop of water on a glass slide.
2. Place the object to be viewed on top of the water.
3. Gently lower the cover-slip onto the slide. Avoid trapping air bubbles.
4. Apply some drops of stain to one side of the cover-slip and draw it across the sample by soaking some fluid from the other side with paper.

Growth

- Growth results from cell division.

Food

Food

- Food is needed for growth energy, repair and protection against disease.

The five major nutrients

Carbohydrates

- Sugars: a fast supply of energy (fruit, chocolate, soft drinks)
- Starch: a slower supply of energy (bread, potatoes, rice)
- Fibre: prevents constipation (brown bread, cereals, vegetables)

Fats

- Store energy (butter, cream, milk)

Proteins

- Growth & repair (lean meat, fish, cheese)

Minerals

- Iron: maintain a healthy blood supply (red meat, green vegetables)
- Calcium: maintain strong bones (milk, cheese)

Vitamins

- Vitamin C: prevents scurvy (oranges, cabbages, kiwis)
- Vitamin A: prevents night blindness (carrots, milk)

A Balanced Diet

- The six constituents of a balanced diet are carbohydrates, fats, proteins, minerals, vitamins and water.
- A balanced diet is a diet which contains the right amounts of each of the six constituents.

Tests

- To test for starch add iodine solution to the food sample. It will turn blue-black if starch is present.
- To test for protein add copper sulfate and sodium hydroxide. It will turn violet if protein is present.
- To test for glucose, add benedict's solution and heat. It will turn brick red if glucose is present.
- To test for fats rub the food sample on brown paper. A translucent spot will appear if fats are present.

Digestive System

Stages of Digestion

- The five stages of digestion are ingestion, digestion, absorption, assimilation and egestion.
- Ingestion is the taking of food into the mouth
- Digestion is the breaking down of food
- Absorption is the absorption of molecules of food into the blood in the small intestine
- Assimilation is the taking of food molecules from the blood into body cells.
- Egestion is the passing of undigested food out of the body.
- Physical digestion involves the chewing of food in the mouth and churning of food in the stomach.
- The four types of teeth are incisors, canines, premolars and molars.
- Chemical digestion is the breaking down of food by enzymes.

The Digestive System

- The digestive system is a group of organs working together to break down food and absorb the nutrients from it.
- The mouth chews food and mixes it with enzymes, eg. amylase in saliva.
- The oesophagus carries food to the stomach by muscular action (peristalsis).
- The stomach stores and churns food and mixes it with digestive juices. It also produces hydrochloric acid to kill bacteria.
- The liver produces bile to break down fats.
- The small intestine contains enzymes to break down food. Food molecules are absorbed into the blood in the small intestine.
- The pancreas produces enzymes.
- The large intestine passes water into the blood.

Enzymes

- An enzyme is a chemical which speeds up a chemical reaction in the body without being used up in the reaction.
- An enzyme acts on a substrate to produce the product.
- Amylase is an enzyme which breaks down starch (substrate) into maltose (product).

Respiration & The Breathing System

Respiration

- Respiration is the release of energy from food.
- Respiration produces energy, carbon dioxide and water vapour.
- Aerobic respiration requires oxygen.
- The word equation for aerobic respiration is:
Glucose + Oxygen = Energy + Carbon Dioxide + Water Vapour.

The Breathing System

- Carbon dioxide is tested for by passing it through limewater. Limewater turns milky if carbon dioxide is present.
- Exhaled air contains more carbon dioxide than inhaled air.

Parts of the Breathing System

- Be able to draw a diagram with important parts!

Smoking

- Smoking for a long time can cause lung cancer, but it can also have other harmful effects.
- Particles of smoke irritate the lungs and produce mucus, leading to diseases such as bronchitis.
- Smoking during pregnancy can damage the baby.

Blood & The Circulatory System

Blood

- Plasma is the liquid part of the blood.
- Red blood cells are the most numerous blood cells. They are made in bone marrow and they contain haemoglobin to transport oxygen. They also give the blood its red colour.
- Iron is needed to make red blood cells.
- White blood cells fight disease.
- Platelets clot the blood to stop bleeding.
- Red blood cells have a biconcave shape and no nucleus.

The Circulatory System

- The circulatory system consists of the heart and the blood vessels.

Blood Vessels

- Veins bring blood to the heart. They have a wider lumen than arteries, and valves to prevent backflow of blood.
- Arteries carry blood away from the heart. They have a narrow lumen and have no valves.
- Capillaries are thin blood vessels (1 cell thick) that allow substances to pass into and out of the blood. They join veins to arteries.

The Heart

- Made of cardiac muscle - never tires
- Contracts to pump blood around the body
- Consists of 4 chambers - right & left atriums, right & left ventricles.
- Right side of the heart pumps deoxygenated blood to the lungs
- Left side of the heart pumps oxygenated blood to the rest of the body. The heart wall is therefore thicker/stronger on the left.
- Has 2 valves to control the direction of the flow of blood.

Exercise and the rate of heartbeat

- The normal heartbeat rate of a resting human is 70 beats per minute.
- Exercise increases the heartbeat rate. This is because during exercise the cells need to produce more energy, so they require more food and oxygen.

Body Temperature

- The normal body temperature in the human body is 37°C.
- Blood flow helps regulate body temperature.

Excretion

Excretion

- Excretion is the removal of wastes from the body.

Excretory Organs

- The human excretory organs are the lungs, the skin and the kidneys.
- The lungs excrete carbon dioxide and water.
- The skin excretes sweat (water and salts).
- The kidneys excrete urine (urea, water and salts) .

The Urinary System

- The kidneys filter the blood and remove urea and salts. They also remove water if the blood is too dilute.
- Blood is brought to the kidneys in the renal artery.
- Blood exits the kidneys in the renal vein.
- Urine passes from the kidneys through the ureters, bladder and urethra.

The Skeleton and Muscles

The Skeleton, Bone and Muscles

- The functions of the skeleton are support, protection and movement.
- Muscles are attached to bones. When they contract they allow us to move.
- All vertebrates have a spine made up of vertebrae.
- Bone is a living tissue so it can grow and repair.
- The presence of calcium in bones is what makes them hard.

Joints

- Fused joints do not allow movement, eg. the bones of the skull
- Ball and socket joints allow movement in any direction, eg the shoulder and the pelvis.
- Hinge joints allow movement in one direction only, e.g. the knee.

Ligaments and Tendons

- Ligaments join bone to bone.
- Cartilage acts as a shock absorber between bones.
- Synovial fluid acts as a lubricant.
- Tendons join muscle to bone.

Antagonistic Muscles

- Antagonistic muscles are pairs of muscles that pull in opposite directions, e.g. the biceps and triceps of the arm.
- To raise the arm, the biceps contracts and the triceps relaxes. To lower the arm, the triceps contracts and the biceps relaxes.

Bones in the skeleton that you need to know

- Skull
- Shoulder Blade
- Breast Bone
- Ribs
- Vertebrae
- Pelvis
- Collar Bone
- Humerus
- Ulna
- Radius
- Femur
- Tibia
- Fibula

The Nervous System

The Central Nervous System

- The central nervous system consists of the brain, the spinal chord and the nerves.
- Sensory nerves carry messages to the brain.
- Motor nerves carry messages from the brain.
- In certain cases there is no time to decide what to do, e.g. if you place your hand on something hot. The message goes from your hand to the spinal chord. From there a message is sent to your arm telling it to pull your arm away.

The Eye

- Sclera: a white protective layer (3rd layer from the inside).
- Choroid Layer: a dark layer rich in blood vessels (2nd layer from the inside).
- Retina: the light sensitive layer (1st layer from the inside).
- Cornea: this allows light into the eye.
- Aqueous Humour: liquid that helps focus light onto the retina (in the area between the cornea and the lens).
- Iris: a muscle that controls the amount of light entering the eye.
- Lens: this focuses light onto the retina.
- Ciliary Muscles: hold the lens in place and controls its shape to allow us to see objects near and far away.
- Optic Nerve: brings images to the brain in the form of electric pulses.
- Fovea/Yellow Spot: the most sensitive part of the retina.
- Blind Spot: the point where the retina joins the optic nerve.
- Vitreous Humour: jelly-like fluid that gives the eye shape (in the main part of the eye).

Reproduction

Reproduction

- A gamete is a sex cell.
- Sexual reproduction is the fusion of a male and female gamete.
- The male gamete is the sperm.
- The female gamete is the egg.

The Male Reproductive System.

- Testes: produce sperm
- Sperm is mixed with seminal fluid to form semen.
- Seminal vesicle: produces the seminal fluid.

The Female Reproductive System

- The egg is made in the ovary
- Eggs are released every month until the menopause.

The Menstrual Cycle

- An egg is released from the ovary every 28 days.
- the release of an egg from the ovary is called ovulation.
- In days 1-5 of the menstrual cycle the lining of the uterus breaks down (menstruation).
- In days 6-12 the womb lining builds up again.
- In days 13-15 ovulation occurs.
- In days 16-28 the lining of the uterus stays built up.
- The fertile period is the time in the menstrual cycle when the woman is most likely to become pregnant if she has intercourse. The fertile period lasts from day 11 to day 18.

Fertilisation

- Fertilisation is the fusion of a male and female gamete.
- The fusion of the male and female gametes forms a zygote.
- After an egg has been fertilised it attaches itself to the lining of the uterus. This is called implantation.

Pregnancy

- The average length of human pregnancy is 40 weeks.
- During pregnancy the placenta allows food and oxygen to pass into the baby's blood, and wastes to pass into the mother's blood.
- The embryo is protected by amniotic fluid.
- Contraception is a means by which fertilisation is prevented.

Genetics

Inheritable Characteristics

- These are passed from parent to child.
- Examples: eye colour, facial shape, blood group.

Non-Inheritable Characteristics

- These are acquired during life and are not controlled by genes.
- Examples: scars, accent, muscle strength.

Chromosomes

- These are strips of DNA wrapped around a protein.
- Every human cell contains 23 pairs of chromosomes except for the egg and sperm cells which contain 23 single chromosome.
- Genes are sections of chromosomes which determine the chemical make up of the body.
- When a cell divides exact copies of its chromosomes are formed.
- At fertilisation the sperm cell and the egg cell combine to create 23 pairs of chromosomes.

Plant Structure, Transport & Transpiration

Plant Structure

- All flowering plants consist of a shoot and a root.
- The root anchors the plant and absorbs water. It also absorbs minerals that are dissolved in the water.
- The stem holds the plant towards the sunlight, supports the flower, transports water and minerals up to the leaves and transports food down from the leaves.
- The leaf makes food by photosynthesis, loses water by transpiration, and exchanges carbon dioxide with oxygen.
- The flower forms the seeds for reproduction.
- Xylem Cells transport water and dissolved minerals up through the plant (Hint for remembering: **X**ylem = **W**ater).
- Phloem Cells transport food down from the leaves to all the other parts of the plant (Hint for remembering: **Ph**loem = **F**ood)

Plant Transport

- Water is absorbed through the roots of a plant.
- Water and minerals move through the plant in xylem vessels.
- Food travels through the plant in phloem vessels.

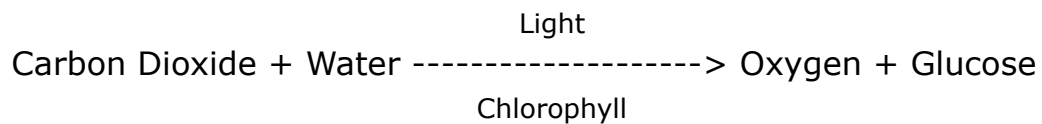
Transpiration

- Transpiration is the movement of water from the roots to the surface of the plant and the loss of water from the surface of the plant.
- Water is lost through stomata - tiny pores between cells on the undersurface of a leaf.
- Transpiration provides water for photosynthesis.
- Transpiration carries dissolved minerals up the plant.
- Transpiration also cools the plant.
- Transpiration is highest with bright sunlight, availability of soil water, and a low humidity.

Photosynthesis & Tropisms

Photosynthesis

- Photosynthesis is the process by which plants make their food.
- Photosynthesis occurs in the leaves of a plant.
- The green chemical chlorophyll is needed for photosynthesis. It is found in the chloroplasts in a plant cell.
- Chlorophyll traps light energy and uses it to combine carbon dioxide and water. This forms glucose and oxygen.
- The water needed for photosynthesis is collected from the soil through the roots and is transported around the plant in xylem cells.
- Leaves have air spaces between their leaves called stomata. This is where the product Oxygen leaves the plant and Carbon Dioxide enters the plant.
- The three things needed for photosynthesis to occur are light, water and carbon dioxide.
- The word equation for photosynthesis is :



Tropisms

- A tropism is a growth of a plant in response to a stimulus, e.g. gravity, light.
- Geotropism is a plant's response to gravity. Geotropism causes the roots of a plant to grow downwards.
- Phototropism is a plant's response to light. Phototropism causes a plant's stem to grow towards the light.

Plant Reproduction

Types of Plant Reproduction

- Sexual Reproduction in plants occurs when a male and female gamete fuse together. It involves two parents. Eg: buttercup.
- Asexual Reproduction is when new plants are formed from one parent only.

Parts of a Flower

- Petal: this attracts insects because of its appealing colour and scent.
- Sepals protect the flower before it blooms.
- Carpel: produces female sex cells (eggs).
- Stamen: produces male sex cells (pollen).

Parts of the Carpel

- Stigma: this is the landing place for pollen.
- Style: this connects the stigma to the ovary.
- Ovary: produces and contains the ovules which produce the female gamete (egg).

Parts of the Stamen

- Anther: this makes the grains of pollen.
- Filament: this is the stalk of the stamen which supports the carpel.

Stages of Sexual Reproduction

Pollination

- This is the transfer of pollen from a stamen to a carpel.
- Pollen can be transferred by wind or by insects.
- Wind pollinated flowers have large amounts of pollen, stamens and carpels that hang outside the petals. Eg: grasses.
- Insect pollinated flowers have a nice smell, brightly coloured petals and nectar to attract insects. the stamens and carpels are often inside the petals. Eg: a rose.

Fertilisation

- This is the joining of a male and a female gamete to form a zygote.
- A pollen grain grows a pollen tube through the style and down to the ovary.
- The male gamete passes through the tube into the ovule and fuses with the egg.
- The ovule becomes a seed.
- The ovary then swells to become the fruit and the petals, stamens and carpels fall off the flower.

Dispersal

- This is a method of carrying seeds as far away as possible from a parent plant.
- This can be done by wind, water, animals or self dispersal.
- Wind dispersal: the seeds/fruits are light and might have wings or hairs. Example: dandelion, sycamore, grasses.
- Water dispersal: the seeds/fruit are light and buoyant so they will float. Example: water lily, coconut, alder, duck weed.
- Animal dispersal: fleshy and tasty, may have hooks. Examples: blackberry, strawberry, raspberry, goose grass (stick weed).
- Self dispersal: pods that explode to release the seeds. Examples: peas, lupin, wallflowers.

Germination

- The growth of a new plant from a seed.
- Conditions needed: water, oxygen, suitable temperature.

Parts of a Seed

- Testa: protective outer coat
- Plumule: a baby shoot
- Radicle: a baby root
- A food supply

Ecology & Habitat Study

Ecology

- Ecology is the study of the relationships of living things with one another and their environment (everything surrounding an organism).
- A habitat is a small part of an ecosystem where a plant or animal lives.
Eg: a woodland
- An ecosystem is a large area with similar plants and animals. Eg: Desert & Rainforest.

Food Chains & Webs

- A food chain is a chain showing how organisms are linked by what they eat.
- Solar energy is transferred through a food chain.
- The feeding level is the position of a particular organism in a food chain. Producers are at the first feeding level.
- A food web is a number of intersected food chains.

Producers, Consumers & Decomposers

- Producers are green plants that make their own food.
- Consumers are all organisms other than producers.
- Only animals can be consumers.
- There are two types of consumers: carnivores and herbivores.
- Carnivores only eat meat, eg. hawk, fox.
- Herbivores only eat plants, eg. cow, rabbit.
- Decomposers are organisms that feed on dead animals or plants.

Adaption

- Adaption is a change that plants or animals make to help them survive better in their habitat.
- Example 1: Dandelions have a parachute mechanism to disperse seeds.
- Example 2: Hedgehogs have sharp spines to protect them from predators.
- Example 3: Ladybirds have a brightly coloured shell to warn of their bitter taste.

Competition

- Competition for scarce resources occurs in a habitat between organisms.
- Plants compete for light, eg. oak trees grow tall to catch more light.
- Animals compete for food, eg. hawks and foxes compete for the same food.

Interdependence

- When organisms in a habitat need each other for survival.
- Example: Flowers provide nectar for insects and insects pollinate flowers.

Tools for a Habitat Study

- Quadrat: a square frame with an area of 1 metre squared used to estimate plant & insect numbers. Used by placing randomly in a habitat multiple times and recording the number of plants/insects in the frame. This is then averaged to find the number of plants/animals per square metre.
- Pooter: used to suck up small insects to be examined.
- Pitfall Trap: small insects fall into a can in the ground which is covered by a board balancing on stones. The insects are then collected the next day and examined.
- Beating Tray: a tray is put under a shrub/tree and beat with a stick. Small insects are dislodged from the shrub/tree and fall onto the tray.
- Line Transect: a rope marked at regular intervals which is placed across a habitat. A plant directly underneath or touching a mark is recorded.

Conservation, Pollution, Human Activities & Waste Management

Conservation

- Conservation is careful management of a habitat.

Pollution

- Pollution is damage to the environment caused by the dumping of waste materials.
- Air pollution is caused by burning fossil fuels.
- Water pollution is caused by oil spillages and fertilisers being washed into rivers.
- Soil pollution is caused by acid rain, overuse of fertilisers and the dumping of waste.

Human Activities

- Human Activities have both positive and negative effects on the environment.
- Positive effects of Human Activity:
 - 1) green spaces are maintained.
 - 2) reducing our energy needs by increasing insulation in buildings.
 - 3) using unleaded instead of leaded petrol and smokeless fuels.
- Negative effects of Human Activity:
 - 1) global warming as a result of the burning of fossil fuels.
 - 2) overuse of fertilisers on farms.

Waste Management

- Waste Management is the way that we deal with our waste.
- There are multiple ways of disposing of waste.
 - 1) Landfill Sites - Adv: convenient, methane produced can be used for fuel. Disadv: smell, rats, poisonous chemicals, space.
 - 2) Incineration - Adv: huge volumes, clean, efficient, small land space needed. Disadv: ash, poisonous fumes, public fear.
 - 3) Recycling - Adv: environmentally friendly, saves money/energy. Disadv: not everything can be recycled.

Microbiology & Biotechnology

Micro-organisms

- Micro-organisms are very small organisms.
- There are three types of micro-organisms: fungi, bacteria and viruses.

Fungi

- These are the largest micro-organisms.
- They are visible by eye and by microscope.
- Examples: mushrooms, bread mould, yeast.
- They contain no chlorophyll and therefore can not make their own food.
- Beneficial effects:
 - 1) They are decomposers.
 - 2) Antibiotic production, e.g: penicillin.
 - 3) Food production, e.g: yeast in wine/alcohol/bread.
- Harmful effects:
 - 1) Athlete's foot.
 - 2) Food spoilage.
 - 3) Dry rot in wood.

Bacteria

- One cell, microscope needed to see.
- Beneficial effects:
 - 1) They are decomposers.
 - 2) Antibiotic production.
 - 3) Yoghurt production.
- Harmful effects:
 - 1) Illness, e.g. tonsillitis and food poisoning.
 - 2) Food spoilage, e.g. causes milk to turn sour.
 - 3) Tooth decay.

Viruses

- Smallest micro-organism, special microscope needed to see.
- Responsible for flu, cold, measles, mumps, aids.
- Antibodies not Antibiotics.
- Vaccines.

Biotechnology

- The science of using micro-organisms to make useful substances.
- Food manufacture: bread, beer, wine, yoghurt.
- Medicine manufacture: penicillin, insulin, vaccines.