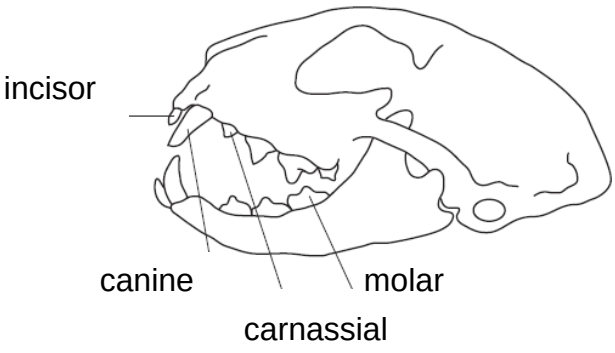
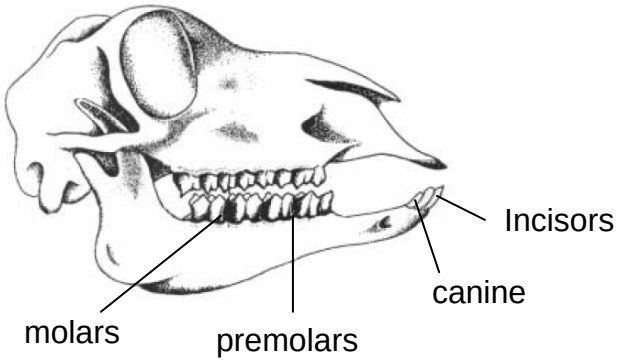
The Human Body

- What is food needed for? A balanced diet contains carbohydrates, proteins, fats and fibre as well as vitamins and mineral salts. These substances must be present in the correct proportions. Carbohydrates are found in sugar, rice, pasta, potatoes, and bread. Carbohydrates are a source of energy for other life processes. Protein is found in meat, eggs, fish, and cheese, and is needed for growth and repair. Fats are found in butter, margarine and oils and cheese. Fats are needed to make cell membranes and to insulate our bodies, and they also contain energy. Fibre or roughage is found in whole meal breads, fruit, vegetables and beans and cannot be totally digested. It gives food bulk so that the digestive system can push on it. Most of faeces is made up of fibre. A lack of some vitamins may lead to particular illnesses; e.g. a lack of Vitamin C (from oranges, limes etc.) leads to scurvy. Not having enough iron (a mineral) leads to anaemia.
- Teeth. We have 2 sets of teeth in a life time, milk teeth (20 teeth) and permanent teeth (32 teeth). Humans are omnivores, and so our teeth are adapted for eating plant material and meat. There are 4 kinds of teeth in an adult human jaw: Incisors - cutting and biting; canines - tearing; premolars - crush and grind; molars - crush and grind. The human dental Formula is: I 2/2; C 1/1; PM 2/2; M 3/3. The dental formula indicates the number of each tooth type on one side of the upper and corresponding lower jaw. The total number of teeth is twice the number in the dental formula.
- Enamel protects the teeth from physical and chemical damage and gives the tooth strength; Dentine gives the shape and rigidity to the tooth; The pulp cavity contains nerves, and blood vessels; Cement glues the tooth to the jawbone.
- The teeth and skulls of animals are related to their diet (herbivore, omnivore, or carnivore). Eg. Cats are carnivores. The last upper premolar and first lower molar of the cat are called carnassials and are used to slice meat and skin.





The cat has small short incisors, used for grooming; Long pointed CANINE teeth are used for piercing and holding other animals; Sharp premolars and molars cut and shear meat – like scissors. It can't really chew because of the big canines – it is more "bite, cut, gulp"! The skull has eyes that look forward for binocular vision – to judge distance, and short nasal passages – the sense of smell isn't that important as the animal relies more on eyesight.	The sheep is a herbivore and has large and well developed incisors used as blades for cutting plants and stripping away leaves. The canines are small and resemble incisors as it has no use for long canine teeth. There are no upper incisors or canines but a hard "palate" that acts like a chopping board. There is a gap between canines and premolars called a diastema where the tongue moves the food around between "grinds". The premolars and molars are large and wide across the tops for grinding and crushing. The animal chews from side to side. The skull has eyes on side of head allowing the animal a side field of view to watch for predators. It has a long nasal passage – for a good sense of smell.

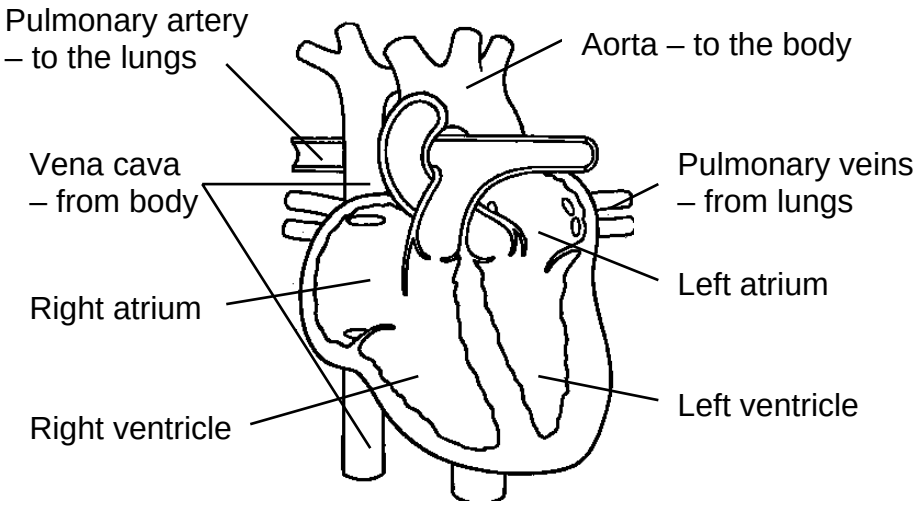
Food

- The food we eat consists of large pieces of material. We bite off small pieces and chew them up into even smaller ones and swallow them. Once it gets to the stomach the food is further broken down by being churned around by the muscular walls of the stomach. This is called physical digestion.
- The purpose of digestion. Substances our body needs cannot be absorbed into our blood until they have been converted into small soluble chemicals which can be absorbed into our blood. This is done with the aid of protein molecules called enzymes and other chemicals in our gut, and is called chemical digestion. Enzymes are very important substances because they control the chemical reactions that happen in our bodies. Vitamins and minerals do not have to be digested because they are already small enough to get into our blood.
- The role of saliva in digestion. Saliva contains an enzyme called amylase. It starts to work as soon as we put food into our mouths. Amylase digests the long, complex starch molecules, splitting it up into shorter, simpler sugar molecules.
- The human digestive system: Chemical digestion starts in the mouth, as enzymes in the saliva start to break down starch. Food is then moved to the stomach, where chemical digestion continues with the help of protein digesting enzymes and hydrochloric acid in the gastric juices. The food then moves into the small intestine, where other enzymes continue the process of digestion. The liver produces bile to help break down fats but bile is not an enzyme. The intestine is lined with tiny protuberances called villi which have very thin walls and a good blood supply. They allow the products of digestion to be absorbed from the gut into the blood. The remaining indigestible food moves to the large intestine, where any extra water is absorbed. It is then excreted from the anus as faeces.
- Food tests: Test for starch, sugar and protein. Crush some food in a pestle and mortar, add a spatula-full to a test tube, add 5 mL of water and stir. Add the test reagent. (If the food is a very “hard food” heat the food and water for a few minutes first to soften it)

Test for	Reagent	Positive test
Carbohydrates - starch	Iodine solution	Turns blue-black
Carbohydrates - glucose	Warm with Benedict's solution	Orange/red precipitate
Protein	Add a few drops of dilute copper sulfate solution, followed by a few drops of sodium hydroxide	Purple or violet precipitate
Fat	Rub a food sample onto a piece of paper. Leave to dry.	Translucent stain round the sample when held up to the light

Heart & Lungs

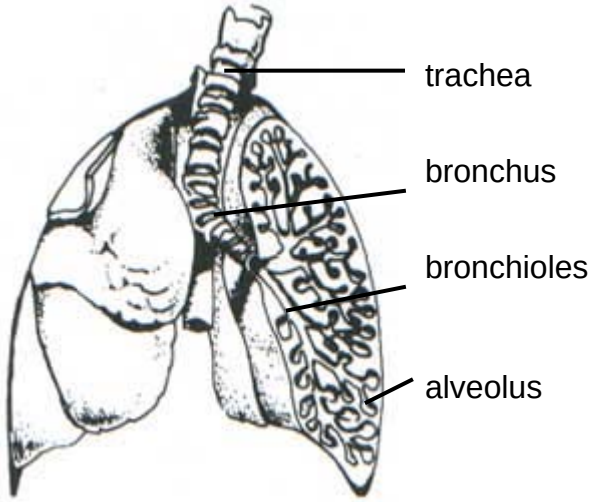
- The circulatory system is the body's main transport system, carrying food and oxygen to the cells and taking waste products away.
- The heart is a muscular pump with 4 chambers. It pumps blood round the circulatory system. To get all the way round, blood has to go through the heart twice and so it is called a double circulation. The left side of the heart pumps the oxygenated blood from the lungs around the rest of the body. This is a long journey so the left ventricle of the heart has more muscular walls. The right side of the heart pumps de-oxygenated blood to the lungs where it picks up oxygen. When you look at a diagram of the heart the left side of the heart appears on the right of the diagram. Valves are present in the heart which control the direction of blood flow through the heart:



- Path taken by blood: LUNGS → pulmonary veins → left atrium → left ventricle → aorta → BODY → vena cava → right atrium → right ventricle → pulmonary artery → *and back to LUNGS*
- Pulse: The time the heart takes to return to a normal at-rest rate after exercise is called recovery time. It is a measure of the body's general fitness. The shorter the recovery time, the higher the level of fitness. A trained athlete's heart can pump more blood with each beat and his or her heart rate is slower and an athlete's recovery time is shorter. During each heartbeat, the muscles of the heart contract causing a wave of pressure (the pulse) which forces blood through the arteries. The pulse can be felt at various points on the body where the arteries are just under the skin. With exercise or physical activity the heart rate increases to supply the muscles with more oxygen to produce extra energy. The heart can beat up to 200 times per minute with extreme exercise.
- The blood's job is to transport materials around the body, and to fight disease. It consists of a pale yellow coloured liquid called plasma, with red blood cells (catty oxygen), white blood cells (fight disease) and platelets floating in it. Platelets are cell fragments that form clots to help repair cuts.
- Blood vessels: There are three types of blood vessel. Arteries are thick-walled muscular tubes which carry blood under high pressure away from the heart so their walls need to be strong. The artery leading from the heart to the rest of the body is called the aorta. Veins are thin walled tubes whose job is to carry blood back to the heart. They have a big diameter and valves to keep blood flowing in the right direction. Capillaries are very narrow tubes which carry blood through our tissues and their walls

are just one cell thick which allows oxygen, food and waste products to easily pass through them, into and out of the surrounding cells.

- Lungs. We breathe in (inhale) sucking air into our lungs and then breathe out (exhale) expelling it again. This allows an exchange of gases to take place: oxygen is absorbed from the lungs into the blood, and carbon dioxide is removed from the blood and breathed out. Inhaled air travels down the trachea and through one of the two bronchi into one of the lungs. It then passes through many branched bronchioles, to reach tiny sacs called alveoli. In the alveoli oxygen passes out of the air into the blood, and carbon dioxide passes out of the blood into the air in the alveoli to be exhaled. When we exercise we breathe much faster than when we are "at rest" because the hard working muscles need more energy, so they must respire faster. To do this needs more oxygen and more carbon dioxide (waste) is produced, so the breathing rate has to go up.



Gas	% in inhaled air	% in exhaled air
Oxygen	21	16
Carbon dioxide	0.03	4
Nitrogen	78	78

- Effect of smoking on health. Many people die every year as a result of smoking-related illnesses. Cigarettes contain around 4000 different chemicals. Nicotine is highly addictive and a carcinogen (cancer causing chemical). Tar is brown and sticky like treacle and contains carcinogens. Carbon monoxide reduces the ability of the red blood cells to carry oxygen around the body. There are also other irritants and toxic substances in the smoke. Smokers are more likely to have raised blood pressure and heart disease, stomach cancers, stomach ulcers, and lung disease such as smoker's cough, emphysema, bronchitis and lung cancer. Smoking during pregnancy is very dangerous and leads to an increased risk of miscarriages, premature births and low weight of babies at birth. Passive smoking is inhaling other peoples' cigarette smoke and it has been linked with the health problems in adults and children such as worse asthma, irritation of eyes, nose and throat, wheezing and chronic coughs.