

Biology Unit: Animals including humans

Misconceptions

What some pupils think	Notes....
All ocean creatures are fish	Whales, dolphins, jellyfish and shellfish are not fish, but seahorses and sea dragons are fish!
All fish lay eggs	Some fishes give birth to live young, e.g. guppy, molly, swordtail, most types of sharks
Differences between vertebrates and invertebrates	Vertebrates are animals with backbones (vertebrae) or spinal column, e.g. birds, fishes, mammals, reptiles and amphibians; Invertebrates do not have backbones, e.g. insects, worms, molluscs
All mammals give birth to live young	Most mammals give birth to live young; The duck-billed platypus and spiny anteater are two mammals which lay eggs.
Spiders are insects; any tiny creepy crawlly is an insect	Spiders are not insects. They are arachnids, belonging to the same group as scorpions. They have four pairs of legs and two body segments. Insects have three pairs of legs and three body segments
Turtles and penguins are amphibians	Turtles are reptiles and penguins are birds.
Only large land mammals are animals	There are many different types of animals such as worms, spiders, sea anemone and corals.
Only large animals are consumers	Small animals may be consumers, e.g. the black widow spider is a consumer.
Male animals are always bigger and stronger than females.	That may generally be true for human beings, but it is not so for many animals, e.g. the queen ants and bees are much bigger than the males.
Digestion starts in the stomach	Digestion starts in the mouth, where the salivary amylase (a digestive enzyme) acts on the starch in food.
Digestion ends in the stomach or large intestine	Digestion ends in the small intestine, where carbohydrates, proteins and fats are digested. Proteins are digested in the stomach. Water and minerals are absorbed into the bloodstream in the large intestine.
The digestive system has 2 outlets	The digestive system has one outlet – the anus through which undigested food is discharged from the body.
Digestion is the process which releases usable energy from food	Digestion is the breakdown of large food molecules into small soluble ones. Respiration is the process by which energy is released from food.
Confusion over the sequence of the processes and anatomical route of digestion	Digestion starts in the mouth before the food goes through the gullet (oesophagus) where no digestion takes place. Food then goes to the stomach where proteins are digested before entering the small intestine. In the small intestine, fats, carbohydrates and proteins are digested. Digested food is absorbed through the wall of the small intestine into the bloodstream. Undigested food passes into the large intestine where water and minerals are absorbed by the body. The rest of the undigested food is stored in the rectum temporarily and discharged out of the body through the anus.
The discharge of undigested food through the anus is called excretion	The discharge of undigested food through the anus is called egestion or defecation. Excretion is the discharge of metabolic wastes from the body, e.g. urine excreted by the kidneys, carbon dioxide excreted by the lungs.
Gullet is not an organ	The gullet is an organ, which is formed by different types of tissues to perform a specific function. Skin is also an organ.
The gullet and windpipe are the same tube which splits at the end of the stomach and lungs	The gullet (oesophagus) and windpipe (trachea) are two different tubes. The gullet connects the mouth to the stomach while the windpipe leads to the lungs. A flap called the epiglottis closes the windpipe while food is being swallowed into the gullet. Clear

	illustrations or models of the digestive and respiratory systems may be used to help pupils correct the misconception
We breathe in oxygen and breathe out carbon dioxide	We breathe in air and the air we breathe in has more oxygen than the air we breathe out; we breathe out air with more carbon dioxide than the air that we breathe in. Pie-charts showing the compositions of inhaled and exhaled air may be shown to pupils to correct the misconception.
Inability to link the need for oxygen with the use of food	Oxygen is needed for aerobic respiration, to release energy from food in the cells.
Inhaled air remains in the head	The oxygen in inhaled air is transported to the cells all over the body by the red blood cells.
****Respiration is breathing **** This is one of the biggest misconceptions pupils have when they start secondary school	Respiration is a chemical reaction that occurs in ALL living plant and animal cells. Aerobic respiration (in the presence of oxygen) in plant and animal cells Glucose + Oxygen → Carbon Dioxide + water vapour (+ energy) Anaerobic respiration (without oxygen) in animal cells Glucose → Lactic acid Anaerobic respiration (Without oxygen) in plant cells Glucose → Ethanol + Carbon dioxide Breathing is the exchange of respiratory gases (Oxygen and Carbon dioxide) between the body and the surroundings through the respiratory system.
There are air tubes linking the heart and lungs	The lungs and the heart are linked by blood vessels.
Blood from the lungs and other parts of the body has only one gas- oxygen	Blood from the lungs is rich in oxygen.
No relationship between muscles and meat	Meat is the muscles of animals.
Muscles and brain are not involved in the workings of the digestive, circulatory and respiratory systems	The brain controls the workings of these systems and many of the organs in these systems are made up of muscular tissues.
Blood turns blue when it has no oxygen	Blood can be de-oxygenated or oxygenated, when cells and tissues use the oxygen during respiration the blood that returns to the heart has LESS oxygen in it than before. Blood is red whether it is oxygenated or de-oxygenated. This colour is due to the oxygen carrying pigment Haemoglobin. In a model of the circulatory system we use the colours red and blue to represent oxygenated and de-oxygenated blood to help us understand the flow of blood but this can present the misconception to pupils. Your veins appear blue(ish) when you look at your skin because of the light diffused by the skin.
Bigger organisms have bigger cells	Bigger organisms have more cells.
Cells are 2 dimensional and flat	Cells are 3 dimensional. They are not spherical either. Lots of pupils compare them to the shape of a football. Due to the nature of the jelly-like cytoplasm in a cell, the contents are able to flow slightly which means the shape of the cell is not definite.
We are born with all the cells we'll ever need	We are born with a huge number of cells. After fertilisation the fertilised egg divides and divides to make new cells, tissues and organs in order to form the foetus. When we're born, cells continue to divide

	in order to grow or repair tissues. This means as we grow the number of cells in our bodies increases.
All cells have nuclei	Not all cells have nuclei, e.g. red blood cells do not have nuclei.
Organisms grow bigger when their cells grow bigger	Organisms grow bigger when their cells go through cell division and multiply.
A population higher on a food chain is a predator on all the organisms directly below it	A population higher on a food chain is a predator on only the organisms directly below it.
***The arrows on the food chain mean "Is eaten by" *** This is a common misconception in secondary school pupils	The arrows on a food chain represent the energy transferred to the organism on the next trophic level. Not all the chemical energy in the organism transferred into the consumer as some of the energy is transferred due to respiration, faeces and urine, not all of the organism is consumed and some parts of the organism may not be able to be digested.
The first stage of each life cycle is the egg	The stages in a life cycle are repeated and there is no first or last stage.
Eggs and seeds are non-living things	Eggs and seeds are living things
Babies are conceived in the stomach	Stomachs are for food, not babies! Fertilisation takes place naturally in the Fallopian tube (oviduct) of the female reproductive system and the fertilised egg, which develops into a ball of cells over time, develops in the uterus (womb) of the female to become a baby.
Confusion between mating and reproduction	In general, animals have to mate in order to reproduce but these are different processes.
Sexual reproduction must involve mating.	Sexual reproduction does not always involve mating, as in the case of flowering plants.
Bones are not living structures	Bones are living tissue which have their own blood vessels and are made of various proteins, minerals and vitamins.
Bones make the body move	The skeleton is a support structure for our body. Because bones are attached to muscles by tendons, when the muscles contract, the tendon can transmit the forces from muscle to bone which makes the bone move.
A muscle can pull or push on a bone	Muscles are attached to bones by the tendons. Muscles have two functions, to contract and relax. When muscles contract they shorten which pulls on the tendon attached to the bone and makes the bone move. Muscles often act in antagonistic pairs which allows the movement of the bone to go back to its original position
Confusion between ligaments and tendons	Ligaments are connective tissue that join bone to bone. They appear as crisscross bands that attach bone to bone and help to stabilise joints. Tendons are also connective tissue, they are strong flexible cords that allow us to move our limbs. They also prevent muscle injury by absorbing some of the impact your muscles take when you run, jump or do other movements.
Muscles are found in the arms	The human body contains around 600 muscles. Muscles are found all over the body. The heart is an organ largely made up of muscle tissue, the stomach is also an organ containing muscle tissue. Most skeletal muscles are attached by tendons to the bones of the skeleton
Air travels to the body in air vessels like blood	Air travels into the lungs, whereby tiny air sacs called alveoli are involved in gas exchange. The oxygen from air is transferred from the lungs into the bloodstream by diffusion. Waste carbon dioxide (produced from respiration) is transferred from the bloodstream back into the lungs. The air we breathe in has more Oxygen and less Carbon Dioxide than the air we breathe out. We only use about 4% of the oxygen in the air that we breathe in. Air we breathe in contains about 20% oxygen and air we breathe out contains about 16% oxygen.
All drugs are illegal	Medicines that we can buy over the counter or prescribed by doctors are also drugs.

	<p>A drug is a medicine or substance that has a physiological effect when introduced into the body.</p> <p>There are legal and illegal drugs.</p> <p>Illegal drugs are divided into Class A, B and C by the government.</p>
Drugs kill you	<p>Medicines when taken properly using the advice from a doctor/ pharmacist or health professional can help treat communicable and non-communicable diseases effectively.</p> <p>Recreational drugs such as caffeine, nicotine and alcohol should be used in moderation as all have risk factors to diseases like high blood pressure, cancers and liver damage (respectively).</p> <p>Different illegal drugs have different dangers associated with them.</p>
Drugs can only kill you if you overdose	<p>Some drugs can kill you the first time they are taken, The added danger is that some illegal drugs are “cut or mixed” with other chemicals that make it more toxic to the body.</p> <p>An overdose of any medicine, legal or illegal drug can be fatal as the body may not be able to breakdown the substance, which is a toxin and produce unwanted side effects.</p> <p>If drugs are injected and the needles are shared this also increases the risk of diseases like HIV and AIDs as well as hepatitis which can be life threatening</p>
For girls periods are the beginning of puberty	<p>Menstruation is one of the things that occur during puberty but it does not indicate the start of puberty. There are many physical and mental changes that occur during puberty and when they occur is different in every individual</p>
You can't get pregnant if you are on your period	<p>Pregnancy occurs if a sperm cell fertilises and egg cell in the oviduct. As ovulation cycles vary it is possible in the later days of a period that ovulation could occur.</p>
Puberty starts at the same time for girls and boys	<p>According to the National Institutes of Health, puberty usually begins in girls between 8 and 13 years of age, and in boys between 9 and 14 years of age.</p>
Puberty is scary and unpleasant	<p>As there are lots of emotional changes that occur during puberty, some adolescents can find it overwhelming when their feelings are so unpredictable. Some young people find it difficult to talk to their trusted adults about puberty and they may not fully understand what is going on. For most people puberty is something that is an accepted part of growing up.</p>
Puberty happens overnight	<p>Puberty occurs over a number of years in both girls and boys. The changes that occur mentally and physically take a number of years as your body responds to changes in hormone levels in the body.</p>
Only boys' voices get deeper during puberty	<p>Boys and girls' voices get deeper, in a girl it only deepens by a few tones. In a boy the larynx grows (larger than a girls) and the vocal cords lengthen and thicken. This causes the voice to deepen. During this period it may cause the voice to “crack” or “break” but this process only lasts a few months.</p>
Acne is caused by being unclean	<p>Acne is not caused by uncleanliness. In fact, washing the face too frequently to too aggressively can cause the skin to dry out. Dry skin responds by making more sebum, and more sebum is associated with more clogged pores. Acne can occur during puberty due to the changes in hormone levels and the sebaceous glands in skin are particularly sensitive to hormones. Acne can also run in families.</p>
Only boys produce body odour during puberty	<p>Boys and girls sweat more as a result of puberty. When the sweat gets broken down by bacteria, that is where the odour comes from. It is important for girls and boys to wash regularly with a mild soap/ gel and some girls and boys will start to wear anti-perspirant or deodorant</p>
Having mood swings means you're crazy	<p>Mood swings are a normal part of puberty and the hormones in your body make your emotions more intense. You may not have experienced these feelings before and your brain is adjusting to all the new hormones. The</p>

	part of the brain that is responsible for regulating emotions, deep thinking, reasoning and decision making is often the last to develop and this can sometimes lead to a child feeling like their emotions are out of control as they may not have the mental capacity to cope with them just yet (which causes even more irritability and frustration)
Pupils find it difficult to describe what is meant by double circulation	The blood in the circulatory system has to go to the lungs, where oxygen diffuses into the blood and then the blood needs to be pumped around then rest of the body. This means the blood enters and leaves the heart twice!
Confusion as to what the coronary arteries are and how heart attacks are caused	The coronary arteries are the vessels around the heart that provide the heart with oxygen and glucose for respiration. As the heart is largely made from muscle tissue it requires oxygen for respiration so energy can be released for the heart to contract and relax (and pump blood around the body). When fatty deposits build up in these arteries, it restricts blood flow to the heart, less oxygen is available for the heart muscle tissue and therefore can cause tissue death, this can then lead to a heart attack.
Blood is produced in the heart	The heart pumps blood around the body. There has to be a large force generated by the heart in order to pump blood around the whole body. Red blood cells are made in our bone marrow.
Veins contain dirty blood	The blood in veins is de-oxygenated. However, waste products are contained in both arteries and veins. Arteries to the liver, kidneys and spleen often have higher levels of waste materials. e.g. the renal artery contains more urea than the renal vein. If possible, avoid talking about clean and dirty blood which would then avoid the misconception.
The heart is the centre for feelings	This is not a new perspective. Aristotle believed the heart was the centre of the human body, the seat of the soul and the emotions, and a primary sense organ of the body. Anatomically, the heart's function is to pump blood around the body and pupils get confused as we draw heart shapes to represent the feeling of love and talk about broken hearts if we are upset.
Clean blood circulates on the left side of the body and dirty blood on the right.	This occurs due to the models use to represent oxygenated and de-oxygenated blood. Avoid talking about clean and dirty blood. A possible way to avoid the misconception is to colour the arterial blood in bright red and the venous blood as a red/brown colour; this means pupils can still distinguish between the two.