

KS4 GCSE Biology – Year 10

		HT1 CELLS	HT2 REPRODUCTION & INHERITANCE	HT3 VARIATION & EVOLUTION	HT4 ORGANISATION	HT5 HOMEOSTASIS OF NERVOUS SYSTEM & BODY TEMPERATURE	HT6 HOMEOSTASIS OF ENDOCRINE SYSTEM
Learning outcomes/composite knowledge: Pupils will be able to...		LO1: Identify animal and plant cells. LO2: Mitosis LO3: Transport	LO1: Meiosis LO2: DNA LO3: Genetic engineering	LO1: Variation LO2: Evolution LO3: Prokaryotes vs Eukaryotes	LO1: Digestive enzymes LO2: Blood vessels vs transport in plants LO3: CHD & Cancer	LO1: Nervous System LO2: Reaction time LO3: Body temperature	LO1: Diabetes LO2: Kidney failure LO3: Hormones & Contraception
Knowledge Components	Summative Knowledge:	<p>Know that most animal cells have a nucleus, cytoplasm, membrane, mitochondria and ribosomes.</p> <p>Know that plant and algal cells also have a cell wall and often have chloroplasts and a permanent vacuole.</p> <p>Know the functions of the organelles.</p> <p>Know that cells differentiate to form different types of cells. Animal cells differentiate at an early stage, whereas many plant cells can differentiate throughout life.</p>	<p>Know that there are two types of reproduction: sexual and asexual reproduction.</p> <p>Know that cells in reproductive organs divide by meiosis to form gametes.</p> <p>Know that gametes are genetically different from each other.</p> <p>Know that some organisms can reproduce by either method, depending on conditions.</p> <p>Know that DNA is a polymer made up of two strands forming a double helix.</p> <p>Know that a gene is a small section of DNA.</p> <p>Know that each gene codes for a sequence of</p>	<p>Know the differences in the characteristics of individuals may be due to genes, environment and a combination of both.</p> <p>Know that selective breeding (artificial selection) is the process by which humans breed plants and animals for useful characteristics.</p> <p>Know the steps involved in selective breeding.</p> <p>Know that selective breeding of food plants has produced disease or weather resistant crops, more attractive or better flavoured fruits and crops that are easier to harvest.</p> <p>Know that selective breeding of animals has produced cows that produce more milk, animals that produce</p>	<p>Know that cells are the building blocks of living organisms.</p> <p>Know that a tissue is a group of cells with a similar structure and function.</p> <p>Know that organs are groups of tissues working together.</p> <p>Know that organs are organised into organ systems.</p> <p>Know that an organism is made up of several organ systems.</p> <p>Know that the human digestive system.</p> <p>Know that the structure and functions of the digestive system.</p> <p>Know the properties of enzymes.</p>	<p>Know that homeostasis is the regulation of internal conditions to maintain optimal conditions for enzyme action and cell function.</p> <p>Know that automatic control systems involve nervous responses and chemical responses.</p> <p>Know that control systems have receptors, a coordination centre and effectors.</p> <p>Know the structure and function of the nervous system.</p> <p>Know that the CNS is made up of the brain and spinal cord; receptors, different types of neurones, coordinator as brain or spinal cord, effectors, synapses.</p> <p>Required practical: investigate the effect of a</p>	<p>Know that the endocrine system is composed of endocrine glands that secrete hormones into the blood to be carried to a target organ where it has an effect.</p> <p>Know that the positions of the pituitary, thyroid, adrenal glands, ovaries and testes.</p> <p>Know that the positions of the pituitary, thyroid, adrenal glands, ovaries and testes.</p> <p>Know that the pituitary is the master gland. It secretes many hormones that affect other glands.</p> <p>Know that hormones are chemical messengers.</p> <p>Know that the effects of the endocrine system are slower, but longer acting than the nervous system.</p>

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	<p>Know that differentiation is the generation of specialised cells which acquire different organelles to enable them to carry out specific functions.</p> <p>Know that stem cells are unspecialised cells that can differentiate to form many different types of cells.</p> <p>Know that chromosomes are found in the nucleus. They are made of DNA. Each chromosome carries a large number of genes.</p> <p>Know that in body cells chromosomes are found in pairs.</p> <p>Know that mitosis occurs during growth or to produce replacement cells.</p> <p>Know that mitosis forms part of the cell cycle.</p>	<p>amino acids to form a particular protein.</p> <p>Know that the genome is all the genetic material of an organism.</p> <p>Know that DNA is made up of four different nucleotides.</p> <p>Know that the bases on the two strands always join together in the same pairs: C with G and T with A.</p> <p>Know that some characteristics are controlled by a single gene. Each gene may have different forms called alleles.</p> <p>Know that the genes present, or genotype, operate at a molecular level to develop characteristics that are expressed as a phenotype.</p> <p>Know that genetic engineering involves modifying the genome of an organism to introduce a desired characteristic.</p>	<p>more, better flavoured or leaner meat.</p> <p>Know that selective breeding can lead to 'inbreeding' where some breeds are particularly prone to disease or inherited defects. Some breeds of dogs suffer from inbred defects.</p> <p>Know the work of Alfred Russel Wallace on natural selection and warning colouration in animals.</p> <p>Know that new species arise as a result of isolation, genetic variation, natural selection and speciation.</p> <p>Know that Charles Darwin published his theory of evolution by natural selection in 1859. It raised much controversy.</p> <p>Know that the theory of evolution by natural selection was only gradually accepted.</p> <p>Know that the theory of evolution by natural</p>	<p>Know that enzymes are biological catalysts.</p> <p>Know that the lock and key theory and collision theory can be used to explain enzyme action.</p> <p>Know that enzymes in the digestive system chemically digest food into small, soluble molecules that can be absorbed.</p> <p>Know the names of enzymes with substrates, products and sites of production.</p> <p>Know the structure of the heart and blood vessels.</p> <p>Know that the heart is a double pump.</p> <p>Know how the heart is adapted for its function.</p> <p>Know the names of the blood vessels associated with the heart.</p> <p>Know pacemaker cells regulate the beating of the heart.</p> <p>Know that artificial pacemakers correct</p>	<p>factor on human reaction time.</p> <p>Know that reflex actions are automatic and rapid to protect the body from harm.</p> <p>Know that the brain has billions of interconnected neurones.</p> <p>Know that different areas of the brain control different functions.</p> <p>Know that the eye contains receptors sensitive to light and colour.</p> <p>Know that the structure of the eye.</p> <p>Know that accommodation is the process of changing the shape of the lens to focus on near and far objects.</p> <p>Know that people may be long or short sighted. These can be corrected using lenses or surgery.</p> <p>Know that body temperature is monitored and controlled by the thermoregulatory centre in the brain. It has receptors</p>	<p>Know that blood glucose concentration is monitored and controlled by the pancreas. It produces insulin, which causes glucose from the blood to enter cells.</p> <p>Know that glucose is converted to glycogen in liver and muscle cells for storage.</p> <p>Know that water and nitrogen balance</p> <p>Know that water leaves the body via the lungs during exhalation.</p> <p>Know that water, ions and urea are lost from the skin in sweat.</p> <p>Know that there is no control over water, ion or urea loss by the lungs or skin.</p> <p>Know that excess water, ions and urea are removed via the kidneys in the urine.</p> <p>Know that if body cells lose or gain too much water by osmosis they do not function efficiently</p>

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		<p>Know that substances can move into and out of cells across membranes by diffusion.</p> <p>Know that oxygen, carbon dioxide and urea passes through cell membranes by diffusion.</p> <p>Know that osmosis is the movement of water from a dilute solution to a more concentrated solution through a partially permeable membrane.</p>	<p>Know that genes can be cut from the chromosome of a human or other organism and transferred into the cells of other organisms.</p>	<p>selection is now widely accepted.</p> <p>Know that fossils are the 'remains' of organisms from many years ago, which are found in rocks.</p> <p>Know that extinction may be caused by:</p> <ul style="list-style-type: none"> • changes to the environment over geological time • new predators • new diseases 	<p>irregularities in heart rate.</p> <p>Know fatty material builds up in coronary arteries reducing blood flow to the heart muscle.</p> <p>Know stents can be used to keep the coronary arteries open.</p> <p>Know statins reduce cholesterol levels, so fatty material is deposited more slowly.</p> <p>Know faulty heart valves can be replaced with biological or mechanical ones.</p> <p>Know heart failure can be treated with a heart and lung transplant.</p> <p>Know artificial hearts can be used whilst waiting for a transplant, or to allow the heart to rest and recover.</p> <p>Know how the lungs are adapted for efficient gas exchange.</p>	<p>sensitive to the temperature of the blood.</p> <p>Know that temperature receptors in the skin send impulses to the thermoregulatory centre.</p> <p>Know that sweat cools the body as it evaporates from the skin.</p>	<p>Know that the kidneys produce urine by filtration of the blood and selective reabsorption of useful substances.</p> <p>Know that all the sugar and dissolved ions needed by the body and as much water as the body needs are selectively reabsorbed.</p> <p>Know that urea, excess ions and water are excreted in urine.</p> <p>Know that kidney failure can be treated by kidney transplant or by using kidney dialysis.</p> <p>Know that a dialysis machine works by mimicking the function of the kidneys.</p> <p>Know that during puberty hormones cause sexual characteristics to develop.</p> <p>Know that in females oestrogen is produced by the ovaries. Eggs mature and are released (ovulation) every 28 days.</p>

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							<p>Know that in males testosterone is produced by the testes and stimulates sperm production.</p> <p>Know the roles of FSH, LH, oestrogen and progesterone in the menstrual cycle of a woman.</p> <p>Know the types of hormonal and non-hormonal contraception</p>
	Disciplinary Knowledge:	<p>Know how to model plant and animal cells.</p> <p>Know how to observe under a microscope. Make labelled drawings</p> <p>Know how to use bio viewers or root tip squashes to show chromosomes and mitosis.</p> <p>Know how to prepare slides of onion epidermis, rhubarb epidermis, cheek cells, spirogyra, moss etc.</p>	<p>Know how scientific developments can be used to control reproduction.</p> <p>Know how to use bio-viewers, video clips or images to show chromosomes and meiosis.</p> <p>Know the power and limitations of science and consider any ethical issues.</p> <p>Know how to extract DNA from fruits such as onions or kiwi fruit. Know how to observe the long strands which are the polymer.</p> <p>Know how to model DNA structure.</p>	<p>Know how to measure variation in a plant species growing in different areas of school grounds.</p> <p>Know how to produce a model to describe selective breeding.</p> <p>Know the social, economic and ethical implications of selective breeding.</p> <p>Know how to model an evolutionary timeline.</p> <p>Know why Darwin's theory of evolution by natural selection states that all species evolved from simple life forms that first</p>	<p>Know how to view sections of the small intestine under a microscope.</p> <p>Know how to make a model to show how the villi increase the surface area of the small intestine.</p> <p>Know that temperature must be controlled by use of a water bath or electric heater.</p> <p>Know how to use a continuous sampling technique to determine the time taken to</p>	<p>Know how to use a model brain to identify different areas.</p> <p>Know the historical use of lobotomies, considering ethical issues.</p> <p>Know how to use a model of the eye.</p> <p>Know how to use a model eye to show long and short sight and their correction.</p> <p>Know how to complete ray diagrams.</p> <p>Know how to plan and carry out an investigation into the effect of a factor on human reaction time</p>	<p>Know how to relate hormone release and hormone action to the control system model.</p> <p>Know how doctors used to diagnose diabetes by tasting fake urine, then test with Benedict's solution and glucose test strips. Evaluate the methods.</p> <p>Know how to draw animal cells exposed to saline, dilute and concentrated salt solutions. Explain the observations.</p>

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	<p>Know how to model mitosis.</p> <p>Know how to calculate surface area: volume ratios for different sized objects or using data about organisms.(ratios)</p> <p>Know how to make predictions with explanations.</p> <p>Know how to investigate the effect of water and concentrated salt solution on onion/ beetroot/ rhubarb cells.</p> <p>Know how to model osmosis.</p>	<p>Know how to model base pairing.</p> <p>Know how to use a model to identify mutations in the base sequence.</p> <p>Know how to complete Punnett squares and genetic crosses. Interpret the results and describe the offspring. (% & fractions)</p> <p>Know how to use a model to explain genetic inheritance in pea plants and using unfamiliar information.</p> <p>Know how to use a model to describe genetic engineering techniques.</p> <p>Know how to take cuttings and compare with the parent plants.</p> <p>Know how to produce cauliflower clones using aseptic technique.</p> <p>Know how to produce a model to describe embryo transplants.</p>	<p>developed more than three billion years ago.</p> <p>Know how to use a model to explain natural selection</p> <p>Know how to use a model to explain speciation.</p>	<p>completely digest a starch solution at a range of pH values.</p> <p>Know how to interpret observations of the action of a catalyst and of catalase from celery, potato, fresh liver and boiled liver on hydrogen peroxide.</p> <p>Know that the rate of a reaction can be measured by measuring the volume of gas given off in a given time.</p> <p>Know how to calculate the rate using data obtained.</p> <p>Know how the equipment could be adapted to investigate the effect of a factor on the rate of the reaction.</p> <p>Know how to make predictions and identify variables.</p> <p>Know how to use bead model</p> <p>Know how to plot and interpret graphs about enzyme activity; determine optimal</p>	<p>Know how to use a model to describe a reflex action.</p> <p>Know how to investigate the effect of sweating on the rate of cooling using a model - tubes of hot water wrapped in wet and dry paper towels.</p> <p>Know how to plot cooling curves and make conclusions.</p> <p>Know how to analyse data and interpret information about sweating and temperature.</p>	<p>Know how to use a model torso.</p> <p>Know how to use a model kidney.</p> <p>Know how to dissect a pig's kidney. Use cocktail sticks and stickers to make 'flags' for the key features and photograph the labelled kidney to stick in books.</p> <p>Know the economic, ethical and medical considerations regarding treatment of kidney failure and evaluate the choice of treatments for kidney failure.</p> <p>Know how to analyse urine samples and identify who each one came from. Give reasons for the conclusions.</p> <p>Know the personal, social, economic and ethical implications of contraceptive use.</p>

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					temperatures and pH values.		<p>Know how to study contraceptives in an exhibition and evaluate the different types.</p> <p>Know how to plan and set up an investigation into the effect of light on growth of shoots.</p> <p>Know how to plan and carry out an investigation into the effect of rooting hormones on the growth of cuttings. Decide what will be the dependent variable.</p>
National Curriculum reference	<p>Cells as the basic structural unit of all organisms</p> <p>Adaptations of cells related to their functions</p> <p>The main sub-cellular structures of eukaryotic and prokaryotic cells</p> <p>Stem cells in animals and meristems in plants</p>	<p>The genome as the entire genetic material of an organism</p> <p>How the genome, and its interaction with the environment, influence the development of the phenotype of an organism</p> <p>The potential impact of genomics on medicine</p> <p>Most phenotypic features being the result of multiple, rather than single, genes</p>	<p>Genetic variation in populations of a species</p> <p>The process of natural selection leading to evolution</p> <p>The evidence for evolution</p> <p>Developments in biology affecting classification</p>	<p>Enzymes</p> <p>Factors affecting the rate of enzymatic reactions</p> <p>Carbohydrates, proteins, nucleic acids and lipids as key biological molecules</p> <p>The relationship between the structure and functions of the human circulatory system</p>	<p>Principles of nervous coordination and control in humans</p> <p>The relationship between the structure and function of the human nervous system</p> <p>The relationship between structure and function in a reflex arc</p> <p>Homeostasis</p>	<p>Homeostasis</p> <p>Principles of hormonal coordination and control in humans</p> <p>Hormones in human reproduction, hormonal and non-hormonal methods of contraception</p>	

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		<p>Single gene inheritance and single gene crosses with dominant and recessive phenotypes</p> <p>Sex determination in humans</p>		<p>The need for transport systems in multicellular organisms, including plants</p> <p>The relationship between health and disease</p> <p>The impact of lifestyle factors on the incidence of non-communicable diseases</p>		
Common misconceptions	Pupils often mistake diffusion, osmosis and active transport for each other.	Pupils often confuse the number of cell division in meiosis with those in mitosis.	Pupils often think clones live as long as their donor parents.	Pupils often think that plants don't have blood vessels.	Pupils often think that the brain co-ordinates reflex actions.	Pupils often think that hormonal contraceptives protects against STIs.
Exemplar Composite Task(s)	<p>LO1: Microscopy Use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.</p> <p>LO2: Create a labelled poster describing the process of mitosis</p> <p>LO3: Required Practical: Osmosis</p>	<p>LO1: Create a meiosis poster and compare the steps with mitosis.</p> <p>LO2: Label a model of DNA, gene and chromosome.</p> <p>LO3: Explain the advantages and disadvantages of genetic engineering</p>	<p>LO1: Present information about variation in tables and charts.</p> <p>LO2: Describe the evidence for the theory of evolution by natural selection.</p> <p>LO3: Compare The structures of prokaryotic and eukaryotic cells</p>	<p>LO1: Carry out a safe, controlled investigation to measure the rate of the catalase under different conditions.</p> <p>LO2: Compare how substances are transported to tissues in human and plants.</p> <p>LO3: Compare the characteristics of CHD and cancer.</p>	<p>LO1: Describe the CNS and PNS</p> <p>LO2: Carry out a controlled investigation testing the effect of distraction on reaction time, present and analyse the results.</p> <p>LO3: Analyse data and interpret information about sweating and temperature.</p>	<p>LO1: Use Benedict's solution to test strips and evaluate the methods.</p> <p>LO2: Draw animal cells exposed to saline, dilute and concentrated salt solutions. Explain the observations.</p> <p>LO3: Brainstorm personal, social, economic and ethical implications of contraceptive use.</p>

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	Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.				