Biology – St Joseph's College

Subject vision statement

In line with the National Curriculum, Science looks to support students in their understanding and exploration of the world around them. Students develop skills that enable them to explain how and why things happen while being analytical and curious. Students are encouraged to think big and apply key ideas to everyday phenomenon. Each discipline (Biology, Chemistry and Physics) is taught through distinct topics, while links in understanding across the Sciences is constantly referenced. There is a large focus on practical work to support the understanding of concepts and to give students the opportunity to develop skills that are beyond learned content.

Intent statement

What: Key elements across all three sciences (e.g. particle behaviour, energy, living organisms, forces) are taught and developed across all key stages; each one drawing on fundamental concepts from previous learning and providing opportunity to develop and broaden students' understanding of the key themes that underpin scientific theory. Students revisit practical work regularly; developing skills linked to identifying variables, writing methods, analysing data and evaluating equipment and techniques, which enable them to become curious and independent scientists. Alongside developing scientific understanding, there is a core focus on the use of numeracy and literacy skills across all key stages, which enable students to successfully access all parts of the subject.

How: The structure of the Science curriculum provides varied opportunity for students to feel success and develop their interest in such a dynamic subject. Practical work, with key aspects such as planning, actioning, analysing and evaluating, is built in at every opportunity and given distinct focus. Students are encouraged to think like scientists and to develop their skill set beyond the acquisition of knowledge. The inclusion of a Reading Week in Key Stage 3 supports students in their development of key literacy skills, including analysing and evaluating sources of information and considering their validity. There is a high level of focus on the acquisition of new language to enable students to access the curriculum, thinking about the etymology and morphology of key terms. Numerical skills are woven throughout the Science curriculum, providing opportunity to model and develop these frequently.

At KS3 students are assessed using exam-style question during assessment points, focusing on the core skills to be a successful scientist: Knowledge recall, Mathematical skills, Graphical skills and Practical skills. Students have the option to select Triple Science as part of their GCSE choices. At KS4 students are assessed using GCSE exam questions, with final external assessments taking place at the end of the Year 11. At KS5 students can choose between the pure A Level subjects (Biology, Chemistry and Physics) or the

more contextual BTEC Applied Science course (offered as both a single and double option). A Levels are assessed at the end of the two-year course while the BTEC offers a blended approach of assessments throughout alongside high demand coursework tasks.

Why: Science enables us to explain what is happening around us; it encourages students to be curious and to ask questions. There is the opportunity to provide transferable skills, including numerical skills, analytical skills and high-quality oracy skills. Boosting science capital is of particular importance as the world develops new and exciting technology, and a rigorous but exciting curriculum is important for students to consider STEM subjects and careers in their future, where they will be at the centre of change and innovation.

Year 10						
	Autumn 1	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Topic	Cell Biology and Transport Understanding the different types of cells and how to examine cells using microscopes, cell division and applying the three types of transport.	Organisation Understanding and comparing how human and plant systems are organised. In detail- principles of organisms, digestive system and enzymes.	Infection and Response Explaining how the body responds to infection and disease. (Pathogens, communicable diseases, antibiotics and painkillers, development of drugs, vaccinations).	Bioenergetics Understanding the processes of respiration and photosynthesis, including the factors that influence them and their applications.	Revision	Ecology Understanding how ecosystems provide essential services that support human life and continued development. Lesson outline – communities, biotic factors and abiotic factors, measuring biodiversity (sampling), human impacts on the environment.
Building on (knowledge, concepts and skills)	Building on Key Stage 3 topics such as cells, microscopy, reproduction and inheritance. Developing the skilful use of mathematics within Biology and science, with a focus on magnification, image size and real size of cells and organelles. Graph work and analysing	Building on Key Stage 3 topics such as plant and animal structures along with functions. We have previously covered the digestive system, heart and lungs structures and their function in Y7 as well as the roles of leaves in photosynthesis in Y8.	Building on Key Stage 3 topics such as cell structure, health and lifestyle. Pandemics and defence systems, natural selection are also covered in Y9 which are expanded upon here in particular with reference to vaccinations.	Building on Key Stage 3 topics such as digestion, health, lifestyle, nutrients, exercise and respiration as well as structure and function of related tissues and experimental skills to allow investigation of photosynthesis.		Building on Key Stage 3 topics such as Ecosystem processes, extinctions, natural selections and adaptations. Also will have cross curricular links with Geography with the impact of humans on the environment here . Students will also build on the ecosystems topic in Y8 with knowledge of food chains and

	the relationships between the factors of the X and Y axis.					interactions between organisms in ecosystems built on.
Building towards (knowledge, concepts and skills)	Developing skills to be able to compare and evaluate different types of microscopes and their uses; calculate magnification, actual size and image size; calculate the size of an object utilising a graticule and stage micrometre. Identify and explain the function of cell organelles, further looking into the structure of DNA and RNA and the mechanisms for DNA replication and the relevant enzymes involved.	Developing the ability to explain the roles of the digestive system with a particular highlight on the role of enzymes and their conditions. This is something that is seen later in y12. Students also build an understanding of the cardiovascular system with reference to blood transport and heart chambers- this is then built on later in the unit with an appreciation of CHD and its treatments- developing key evaluative skills. It also enables students to access 'response to exercise' later in the course in the Bioenergetics section of the course.	Students develop key knowledge to be able to describe the causes and preventions of many key pathogens, as well as distinguishing between their different treatment regimes. Human defence mechanisms both specific and nonspecific mechanisms are also covered here which are then extended upon in Y12. Students should also be able to evaluate the response of different treatments on higher tier, a skill which stand them in good stead for A-level study as well. Students should also be able to explain the different steps and importance of	Students develop and build on knowledge of KS3 to allow them to explore these 2 important biological reactions. Photosynthesis and PS1 and PS2 systems and light dependent and light independent reactions. Production of ATP through chemiosmosis. Respiration in in animals through glycolysis, Krebs cycle and oxidative phosphorylation and thus then exploring the roles of respiration in nervous impulses.		Students will develop the ability to see ecosystems as the sum of all organisms in them as well as the conditions in the environment (biotic and abiotic factors). Students will be able to link the adaptations in Y11. Furthermore, students should be able to investigate the effects of different factors and calculate plant distribution using quadrats and mathematical skills. Students will then seek to see how humans are damaging the environment through a range of different means. This is linked to future topics of biodiversity and sustainability at Y12/Y13. Furthermore

		Plant tissues and transport systems are also built upon in A-level with mass transport in plants covering transpiration and translocation in far more detail.	developing a drug through a series of clinical trials which has great application to later study of biomedical related courses.			students will build an understanding of nutrient cycling and how humans are disrupting it, again built on at A-level.
Independent enrichment (wider reading and learning suggestions)	**Free Science lessons on Youtube:** https://studymind.co.uk/notes/the-cell-cycle-and-mitosis/ https://www.healthline.com/nutrition/gut-microbiome-and-health#:~:text=Therefore%2C%20there%20are%20a%20number,system%20and%20other%20bodily%20processes. **CGP revision guide/ workbook/ knowledge organisers/ flashcards** https://www.nhs.uk/vaccinations/why-vaccination-is-important-and-the-safest-way-to-protect-yourself/#:~:text=Vaccines%20teach%20your%20immune%20system,give%20you%20life%20long%20protection. https://www.youtube.com/watch?v=rXzN89I4_Yk https://royalsociety.org/news-resources/projects/biodiversity/human-impact-on-biodiversity/#:~:text=The%20main%20direct%20cause%20of,timber%20which%20drives%20around%2020%25					
SMSC	Discussing the ethical and moral issues around stem cell therapy and embryonic stem cells. Vaccines and testing processes. Spreading of misinformation around pandemics and vaccinations.	Discussing ethical issues of heart and organ transplants, links to stem cells as a means to treat heart diseases.	Discussing the evidence from vaccinations and importance of validity of data with reference to the link between vaccinations and Autism. The importance of herd immunity in populations, and the ethics of clinical trials and the potential outcomes of them.	Discussing the importance of conserving plants on earth to allow carbon storage.		Discussion of the balance between human activity and growth and biodiversity and environmental consequences. Also cross curricular links to LCAs from chemistry for fossil fuels and products.
Careers	Scientist, Doctor, Laboratory Researcher, Clinical	Biologist, Veterinarian, Conservation	Doctor, Virologist, Infection Control	Academic researcher, Analytical chemist,		Environmentalist Agricultural scientist Farming

	Researcher, Genetic Engineer	Officer, Ecologist, Farm Manager	Nurse, Pharmacist, Epidemiologist Microbiologist	Biomedical Scientist, Physical Therapy		Vet science Genetic engineering Food science.

Year 11						
	Autumn 1	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Topic	**Photosynthesis** Explain the effect of light intensity on the rate of photosynthesis and be able to interpret limiting factors graph. Understand how to use inverse proportion, the inverse square law and light intensity in the context of photosynthesis. Respiration- describe cellular respiration as an exothermic reaction that takes place in all living cells. Compare the differences between aerobic and anaerobic respiration in plants and animals and	**Inheritance and Variation** (Sexual and asexual reproduction, meiosis, DNA and the genome, variation, evolution, resistant bacteria, genetic engineering, classification).	**Homeostasis and response** (Homeostasis introduction, reflex arc, endocrine system, blood glucose control, hormones in reproduction, IVF, contraception, negative feedback Adrenaline and Thyroxine).	Revision	Revision	

	the amounts of energy transferred. Investigate the effects of exercise on the body and muscular contraction. Explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids.					
Building on (knowledge, concepts and skills)	Students should have prior knowledge of the structure of a leaf plant and its adaptation. The role of palisade cells and chloroplasts in photosynthesis. Plant tissue and transport tissues such as xylem and phloem and cell organelles such as mitochondria and their adaptations.	Students should have a basic prior knowledge of DNA and the function of the nucleus. Students should also be aware of the basics of sexual reproduction in plants and animals as covered in the reproduction topic in Y7. Students will have also covered the features of eukaryotes and prokaryotes earlier in Y10 which will allow some access to GM.	Students will have covered some of the knowledge of hormones in reproduction in Y7 with reference to the role of the menstrual cycle as well as the changes brought about by puberty. Students should also begin the topic with a basic understanding of the role of healthy and unhealthy diet which will be expanded upon in diabetes and blood glucose control.			
Building towards	Photosynthesis and PS1 and PS2 systems	Students will build a knowledge of how	Students will build a thorough			

(knowledge, concepts and skills)	and light dependent and light independent reactions. Production of ATP through chemiosmosis. Respiration in in animals through glycolysis, Krebs cycle and oxidative phosphorylation and thus then exploring the roles of respiration in nervous coordination and muscular contraction in Y13. There are also strong links to spirometry and the cardiac cycle with interpretation of data related to changes in exercise also being pivotal.	sexual reproduction is vital in driving evolution and genetic variation. Both concepts are expanded upon in A-level with meiosis covering crossing over and independent assortment of alleles as well as mutation. Evolution is covered at KS3 and then built on here looking at Darwin's theory and applying it to a range of examples including resistant bacteria, a theme that continues at A-level with antibiotics and links back to 'infection and response in Y10'. Students build a basic understanding of monogenic inheritance, with introduction to the ways that dominant and recessive conditions are inherited. This is expanded upon in Y12/Y13 with more advanced examples including	understanding of the key roles of homeostasis and conditions which should be controlled with reference to temperature, glucose, water levels. All of which are expanded upon in the Homeostasis topic in 13 with the kidney and pancreas explored in more detail. Students will also explore the role of neurons and synapses, as well as investigate the factors that influence them. This is built upon extensively in Y13 in the nervous coordination topic with the features of a reflex, resting and action potential and events at a synapse covered in detail. Students will also build knowledge of diabetes and its treatments which is expanded on in			

		dihybrid inheritance and epistasis.	Y13. Alongside the functioning of the kidney in triple Biology.			
Independent enrichment (wider reading and learning suggestions)	https://www.genome.gov/genetics-glossary/Genetic-Engineering#:~:text=For%20example%2C%20genetic%20engineering%20may,plants%20and%20livestock%2C%20and%20more. CGP revision guide/ workbook/ knowledge organisers/ flashcards Diabetes causes and treatments: https://www.mayoclinic.org/diseases-conditions/diabetes/symptoms-causes/syc-20371444					
SMSC		Debates over the advantages of screening alleles and the ethics here with reference to designer babies and the potential impact there. Debate is also opened for the ability to cover the ethics of Genetic engineering.	Debate over the ethical concerns regarding IVF and the pros and cons it brings with reference to embryo use. There are great links to earlier in the spec with diabetes and CHD. As well as diet and how it effects the kidney. The pros and cons of different treatments for kidney with reference to transplantation and dialysis.			
Careers	Fitness coach Agricultural scientists Genetic engineering	Biotechnology Genetic counselling Geneticist Fertility medicine	Surgeon Endocrinologist Epidemilogist Healthcare scientist Sport scientist Psychology (strong links to brain and endocrinology)			

Year 12						
	Autumn 1	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Topic	**Biological molecules** (Module 2) covering water, monomers and polymers, carbohydrates, lipids, protein structure and Nucleic acids. Cells and microscopy.	**Biological molecules** continued (DNA replication and protein synthesis and ATP_ Transport across membranes. Enzymes and cell division including enzyme models of activity, factors effect enzyme action, mitosis, meiosis, stem cells,	**Classification and Evolution** (Classification, 5 kingdoms, phylogeny, evolution, variation and statistic) Gas exchange (features of exchange surfaces, mammalian gas exchange, gas exchange in insects, fish and measuring gas exchange).	**Transport in Animals** Heart and blood vessels, tissue fluid, haemoglobin dissociation curves, ECGs and heart rate. **Transport in Plants** Transport in plants tissues, transpiration translocation, potometer, xerophytes and hydrophytes.	**Biodiversity and sampling** Biodiversity, measuring biodiversity, calculating genetic biodiversity, factors affecting biodiversity, conservation methods and legislation. Immune systems, response and defence mechanisms.	Review of PPEs and Independent research tasks
Building on (knowledge, concepts and skills)	Students will build upon their knowledge of monomers and polymers from the breakdown of digestion and how they are used. For cells students will build on their knowledge of	Students will build from GCSE knowledge where they have covered the roles of enzymes and conditions in which they work with required practical 4 and 5 at GCSE.	Classification and evolution revisits and builds on the hierarchy of classification covered at GCSE including the binomial system of classification. We delve deeper into the 5 kingdoms	Transport in Plants Students at GCSE will have covered plant tissues, including the leaves, roots and xylem and how they function. Students will have also covered plant transport with a brief overview of	Immune System This unit fits in at the end of Y12 as it builds on many of the key concepts that have been learned prior, including cell signalling, cell membranes, biodiversity (with	

	prokaryotic and eukaryotic structure including organelles and expand on this with reference to intracellular transport organelles such as the ER and Golgi. Students will build on their microscopy skills and further their scientific drawing and magnification calculations with use of a graticule and differential staining.	Students also build on mitosis and cancer covered at GCSE and link to health and disease, they also build on the skills of using integers to calculate the number of cells after a given time. All 3 of main ways transport in cells, active transport, diffusion and osmosis are covered at GCSE and we further this with a wider range of practical investigations and applications.	looking at unique features of them on a cellular level to begin to appreciate the depth of understanding within the field of classification. We also build on the structure of DNA and genome uses at GCSE whereby we begin looking at how this is used to create phylogenetic relationships. Within the topic of gas exchange we build on our knowledge of the lungs and adaptations from GCSE as well as transport across membranes from earlier in the year. This allows greater appreciation of what makes a good exchange surface and then allows coverage in greater depth of the gas exchange systems in fish and insects.	transpiration and the factors effecting it, use of potometers and the definition of translocation. Transport in Animals They will also revisit the blood vessels and structure of the heart first visited at GCSE and expanded upon here with more explanation of the adaptations, and adding on how tissue fluid is formed through the differences in hydrostatic and osmotic pressure in the capillaries, and how the heart is coordinated in electronically.	sourcing of drugs and classification of microbes) evolution (with regards to the antibiotics resistance). It also builds heavily on knowledge that was acquired at GCSE about the immune system, communicable diseases, treatments of diseases including vaccination and antibiotics. Biodiversity Biodiversity is heavily covered at GCSE biology including within topic 4.7 ecology. In this unit students build on their knowledge of sampling, human impacts on biodiversity and ways to conserve biodiversity. We build on this knowledge as well as other mathematical skills to be able to calculate Index of	

					biodiversity and interpret data from different sampling experiment using statistical testing.	
Building towards (knowledge, concepts and skills)	An understanding of biological molecules is essential for several other topics on the course. Protein structure and synthesis links inherently to the effect of mutations in Y13.	Biological Molecules links to many areas in the spec as discussed- the understanding of protein synthesis discussed this term is essential to the manipulating genomes topics and mutations in Y13s as well as then understanding how we can use the sequence knowledge. ATP covered in this unit is also strongly linked to respiration at the beginning of Y13 within oxidative phosphorylation as well its use in many important processes such as neuronal communication, muscular contraction and active transport.	Many topics in Y13 also link to this topic, of note respiration which is covered within term 1 of Y13 is an obvious link as the oxygen obtained here is then used in aerobic respiration, alongside interpretation of much of the practicals and the ability to scrutinise practical data. **Classification and evolution** link closely to the biodiversity topic in Y12 as well as sequencing of DNA which explored in Y13. Students are expected to be able apply the uses of DNA sequencing to classification to be able to explore phylogenetic relationships between species. This also links to bioinformatics	Future topics that relate to content and skills covered in this unit include: Genetic modification and selective breeding of plants to withstand conditions such as low water and drought in Y13. We will also cover the transport of oxygen and carbon dioxide in the blood and relate this to important real-life scenarios with different animals/types of haemoglobin and their different affinities. Finally, we will cover the electronic control of the heart and the electrocardiograms that are used in hospitals, to give valuable information on heart rate and conditions relate to its dysregulation.	Future topics in Y13 are also heavily linked to Biodiversity these include preservation and conservation covered as well as ways in which we ensure sustainable development with reference to coppicing and fisheries as this can be asked upon in synoptic questions. The immune system and infection and response is also linked to in Y13 with the coverage of mutations at the beginning of Y13, in particular linkage to antibiotic resistance. This also links indirectly to the use of immobilised enzymes and production of synthetic penicillin.	

		Enzymes are also another fundamental topic with many later curricular links including their use in genetic engineering (restriction enzymes) and all the reactions in respiration and photosynthesis. It is also a key reason that homeostasis covered in	covered in Y13 and its uses in classification.		Understanding in this area is also of high research importance at university level.	
Independent enrichment (wider reading and learning suggestions)	Links to articles: https://www.savemyexams.co.uk/a-level/biology/cie/22/revision-notes/2-biological-molecules/2-2-carbohydrates--lipids/2-2-1-biological-molecules-key-terms/ https://biokamikazi.files.wordpress.com/2013/10/biochemistry-stryer-5th-ed.pdf - **STRYER BIOCHEMISTRY** https://www.science.org/doi/pdf/10.1126/science.107.2775.254 - **quantitative methods of**	https://www.savemyexams.co.uk/a-level/biology/cie/22/revision-notes/2-biological-molecules/2-2-carbohydrates--lipids/2-2-1-biological-molecules-key-terms/ https://biokamikazi.files.wordpress.com/2013/10/biochemistry-stryer-5th-ed.pdf - **STRYER BIOCHEMISTRY** https://www.science.org/doi/pdf/10.1126/science.107.2775.254 - **quantitative methods of detecting carbohydrates**	Linnaeus and Race - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4326670/ Fungi and Insect Evolutionary Biology - https://www.moreaulab.entomology.cornell.edu/publications/ How Zoologists Organize Things; The Art of Classification, David Bainbridge **The evolution of mammalian gas exchange system- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1570919/**	***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1761997/-*** **transpiration** ***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1914204/-*** **translocation in plants** https://www.frontiersin.org/articles/10.3389/fpls.2022.1023595/full - xerophytic plants ***https://www.medicalnewstoday.com/articles/320565#how-it-works*** **- the heart and how it works** - ***https://www.ncbi.nlm.nih.gov/books/NBK499818/-*** **haemoglobin**	***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4290017/-*** **the gut microbiome in health and disease** - ***https://www.ncbi.nlm.nih.gov/books/NBK513277/-*** **antibiotic resistant bacteria** - ***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3312400/*** **- HIV and treatment** - ***https://www.ncbi.nlm.nih.gov/p***	

	detecting carbohydrates The Language of the genes. Jones, S. Genome. Ridley, M.	The Language of the genes. Jones, S. Genome. Ridley, M. **Uncontrollable Cell Division is Cancer -** https://www.aaas.org/news/reading-cancer-books-connect-science-and-emotions-cancer **History of Cell Division Discovery -** https://www.visionlearning.com/en/library/Biology/2/Cell-Division-I/196 Y The Descent of Men. Jones, S.		- **dissociation curve** - ***https://www.ncbi.nlm.nih.gov/books/NBK482164/-*** **sickle cell anemia**	***mc/articles/PMC2923430/*** **- overview of immune response** - ***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7560117/-*** **vaccines** Biodiversity extra reading: *https://www.americanscientist.org/article/the-biodiversity-conservation-paradox* The Book of Hope: A Survival Guide for Trying Times – Jane Goodall Silent Spring – Rachel Carson Braiding Sweetgrass – Robin Wall Kimmerer	
SMSC	Discussion of protein structure in disease and how they are treated.	Enzymes and the diseases they are at the root of, as well as different examples of inhibitors and their	The option of looking into how classification has been used not only for animals but humans (caste/race ethics etc. that has	Students will cover the different heart conditions in ECGs and have opportunity to look at causes and treatments of these.		

		use in medicine (e.g. statins).	been at the root of human atrocities and segregation e.g. Belgian colonisation in the Rwandan genocide).			
Careers	Molecular Biologist Research Scientist Nutritional science.					

Year 13						
	Autumn 1	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Topic	**Respiration-** including glycolysis, Krebs cycle, oxidative phosphorylation, anaerobic respiration and energy cycles. **Photosynthesis-** photosynthesis reactions (light dependent reaction and light independent reaction), factors affecting photosynthesis.	**Coordination and control- nervous control and muscles-** nervous transmission, synapses, coordination and response, brain, reflexes, sliding filament. **Hormonal control –** pancreas, diabetes, negative feedback, regulating blood glucose, diabetes.	**Populations and sustainability/ Ecosystems:-** ecosystems and biomass, recycling within ecosystems nitrogen and carbon cycle, succession, population size, predator prey relationships, conservation and preservation, sustainability. **Homeostasis continued-** the	**Plant hormones -** plant hormones, plant responses to stress, tropisms in plants, commercial uses of plant hormones.	Revision for final exams based on PPE data.	

	Cellular control- body plans, mutations, variations, hox genes. **Genetic inheritance and speciation-** monohybrid inheritance, dihybrid inheritance, ratios, epistasis, speciation and artificial selection.	**Manipulating genomes -** DNA profiling, DNA sequencing. Using DNA sequencing, Genetic engineering, Gene technologies and ethics.	kidney and thermoregulation - controlling heart rate, thermoregulation structure and function of kidney, osmoregulation, excretion and the liver, kidney failure. **Cloning and Biotechnology-** Cloning in plants cloning in animals, microorganisms and biotechnology, culturing microbes, aseptic technique, immobilised enzymes.			
Building on (knowledge, concepts and skills)	**Respiration-** respiration builds on the knowledge of both types of respiration at GCSE including aerobic and anaerobic respiration and responses to exercise.	**Coordination and control and muscles-** build on the reflex arc covered in unit 5 of homeostasis in which the simple reflex arc is covered alongside the purpose of	**Populations and sustainability/ Ecosystems** Students will have covered the issues that face the planet with how humans are abusing land use during GCSE, there	Plant Hormones- building on key concepts of cell signalling and responses to the environment covered in Y12 and the action of hormones covered earlier in Y13.		

	Also links to knowledge from the gas exchange topic in Y12 including different gas exchange surfaces. **Photosynthesis-** builds on the photosynthesis knowledge from GCSE including the reaction and factors effecting it as well as the required practical. **Cellular control-** cellular control is also linked to cell differentiation and cell division in Y12 which includes mitosis- which is controlled closely by the hox genes and has a range of roles in the body plan. **Genetic inheritance and speciation** Genetics of living systems (6.1.1) builds on information previously taught in Y12 regarding the genetic code, DNA and protein structure	them. Students also integrate knowledge of aerobic respiration and active transport here as both strongly link to both action potential, resting potential and contraction of the muscle with use of ATP linked throughout. **Hormonal control-** also builds on the homeostasis topic from Y11 unit 5, with blood glucose control and pancreas as well as negative feedback covered at surface level in GCSE. **Manipulating genomes:-** students should already be familiar with a basic understanding of DNA storage and genomes from GCSE as well as being touched upon in 'cellular control. Students also will have	are also links to biodiversity and the issues faced there that we cover in Y12. Students will also have covered interactions between different trophic levels and food chains lower down the school and should already be able to describe energy flow between trophic levels. Students will also possess a prior understanding on the need for sustainability from GCSE studies. **Homeostais continued-** in this section students may have covered the kidney at GCSE if they did triple , and will have touched upon its functionality and what happens if it goes wrong. Students will also have a basic understanding from GCSE of animals'			

	and begins to apply it to more contextual situations, Within the unit we discuss mutations and how they can impact, or not impact on protein structure which directly builds from 'nucleotides' in Y12 where we discuss the degeneracy of the genetic code and how changing codons changes the amino acid sequence and thus different layers of protein structure. Indeed, due to the degeneracy of the genetic code, most mutations are indeed non impactful or 'silent'. At GCSE students learn that the phenotype (physical characteristic of an organism) is linked to its genotype as well as environmental influence. This idea is reviewed within this unit and then built upon. We also revisit Meiosis and explain	covered genetic engineering at GCSE and so should have some familiarity with the concept of genome projects and using enzymes to isolate genes of interest and place them in different organisms for a number of uses.	adaptations that live in cold and warm environments.			

	how it leads to genetic variation with reference to independent segregation of alleles and crossing over of chromatids. Students also build on the monohybrid crosses that they cover at GCSE and begin looking at more complex outcomes from genetic inheritance such as dihybrid crosses, sex linkage and multiple alleles. Students will need to be able to both complete the diagrams and interpret the results to predict phenotypic ratios. Using this information, students will be able to decide if a condition is sex linked of epistatic.					
Building towards (knowledge, concepts and skills)	**Genetic inheritance** We also introduce the idea of gene expression within this unit at a post-transcriptional and post translational level with the lac	**Coordination and control and muscles:** Describe the different types of neurones. Explain how neurons are adapted for their function.	**Homeostasis continued:** Students will be building towards a more thorough understanding of the kidney with reference to selective	**Plant hormones:** By the end of this unit students will be able to describe the different uses of plant hormones commercially and by the plants themselves, with the		

	operon as a classic example used for reference- it should be noted this example may not come up as is seen in the book and examiners like to ask variations to get students to apply their knowledge. This is also important and links to mutations as changes in gene expression can lead to many diseases including cancer. We also look at the body plans for developing genes which are mediated by HOX genes or Homeobox genes, again which when dysregulated can lead to birth defects such as polydactyly. Mitosis and Apoptosis are also revisited in the context of development, with the consequences for too much and too little of each being explored as well as how they are regulated and respond to stress. This	Name and explain the role of sensory receptors. Explain resting potentials and action potentials. Describe the processes that occur at the synapse. Explain how synapses help to regulate the nervous impulse.s Describe the organisation of the nervous system. Explain the structure and function of the human brain. Describe voluntary and involuntary reactions. Identify types of skeletal muscle Explain the sliding filament model. **Genetic manipulation:-** Outline the principles involved in DNA technology with reference to DNA sequencing, PCR and DNA profiling.	reabsorption, the loop of Henle and Counter current as well as analysis of the different treatments and their pros and cons. Students will also explore the functionality of the liver in deamination and the production of urine. **Cloning and Biotechnology:** Students will learn about natural examples of clones in plants and animals and how humans have harnessed the ability clone them for uses in agriculture and medicine. Students will cover the pros and cons of these methods and ethical concerns with them. Furthermore, students will learn about the many possibilities that using microbes	knowledge of roles in tropisms and responses to stress.		

	is essential for future degrees covering cancer, mitosis, and the genetic basis of diseases at university.	To be able to describe how each of the above techniques are used in the real-world e.g. forensics, identification of species, genome sequencing, epidemiology, bioinformatics. To be able to outline the concept of synthetic biology and discuss its applications. To be able to detail the process of creating transgenic bacteria from isolating the gene, to preparing a DNA vector, to insertion of plasmid and identification of transgenic organisms. To be able to discuss the applications of genetic engineering e.g. pest resistant crops, the production of	brings, the bacterial growth curve and scaling up as well as how immobilised enzymes allow the potential for wide usage alongside benefit of reducing downstream cost. This will be extremely beneficial for students looking to pursue biotechnology related degree paths. **Populations and sustainability** Students will be working to explain the effects of humans on the environment and how we have the responsibility to make sure that it is maintained for future generations to enjoy. Methods of how this is achieved through legislation and ecological practices will be discussed- especially useful for budding			

		human insulin and apply the principles to it To be able to discuss the ethics of genetic engineering and gene technologies. To be able to discuss the potential for genetic therapies. To be able to outline the 2 types of genetic therapy. All content covered in this unit is particularly pertinent for anyone studying genetics or a related degree as the technologies discussed here have great industrial use. **Hormonal control-** in this first section students will aim to be expert in the pancreas and how it regulates blood sugar, furthermore, linking it to both types of diabetes. Diabetes type 2 is	conservationists and ecologists.			

		covered in detail within in many biomedical degrees given that it is the final stop along the line for many metabolic disorders which plague the modern world.				
Independent enrichment (wider reading and learning suggestions)	https://www.newscientist.com/article/2301794-scientists-keep-inventing-ways-for-pigs-to-breathe-via-their-rectum/	https://www.researchgate.net/profile/Antonello-Bonci/publication/8069179_Synaptic_plasticity_and_drug_addiction/links/5b85649d299bf1d5a72e8472/Synaptic-plasticity-and-drug-addiction.pdf The Brain: The Story of You – David Eagleman The Brain: Everything You Need to Know – New Scientist The Man Who Mistook His Wife for a Hat and Other Clinical Tales – Oliver Sacks Down the rabbit hole- Andrew Ropper	https://pubs.acs.org/doi/10.1021/acsomega.2c07560#:~:text=The%20immobilized%20enzymes%20can%20be,suitable%20carrier%20materials%20are%20chosen.- https://my.clevelandclinic.org/health/diseases/15096-chronic-kidney-disease -Kidney Disease.			

		Dr Peter Attia- Outlive 'Sugar Fat chance'- Dr Robert Lustig				
SMSC	Students may cover topics relating to this such as the debate over embryonic screening for mutations as well as ethics for selective breeding.	Students may cover related diseases of the nervous system, as well as explore how different drugs affect activity at the synapse. Ethics of Genetic manipulation and debate over the pros and cons.	Students will discuss the ethics and issues of different kidney diseases including kidney transplants and diseases. Students will also discuss the ethics and issues with cloning and may come across different views on either side, as well as the use of microbes in biotechnology.	Students may link the use of commercial plant hormones to food security.		
Careers		Endocrinologist Doctor Bioinformatics analyst Genetic counsellor Forensic science Healthcare Research scientist.				