Year 13 Biology Curriculum Overview

Rationale: The Year 13 Biology curriculum is designed to further explore and investigate Biology by building a mind-set that allows skills to be continuously developed. Students will study and experience modules such as, Energy transfers, Response to stimuli, Population genetics and Gene expression. In doing so, pupils will develop their practical and investigative skills.

Term/Length of Time	Outline	Assessment/Teacher Feedback Opportunities	Homework and Literacy resources
Autumn 27 lessons (including assessment and responding to feedback lessons)	<u>Energy transfers in and between organisms</u> Students will build on their knowledge and skills about photosynthesis, respiration and energy in ecosystems from Y8 and GCSE Biology to learn about the importance of energy transfers. Students will learn that: Life depends on continuous transfers of energy. In photosynthesis, light is absorbed by chlorophyll and this is linked to the production of ATP. In respiration, various substances are used as respiratory substrates. The hydrolysis of these respiratory substrates is linked to the production of ATP. In both respiration and photosynthesis, ATP production occurs when protons diffuse down an electrochemical gradient through molecules of the enzyme ATP synthase, embedded in the membranes of cellular organelles. The process of photosynthesis is common in all photoautotrophic organisms and the process of respiration is common in all organisms, providing indirect evidence for evolution.	**Photosynthesis, respiration and energy in ecosystems** end of topic assessment in the style of exam questions Written and verbal feedback given throughout module through in-class activities and homework.	Homework is set weekly and contains a mixture of recall exam-style questions as well as more detailed application based exam style questions. All homework is reviewed with at least one detailed FAR (Feedback, Action, Response) marked by the teacher approximately once every 2 weeks **Optional homework tasks and Literacy resources:** SoL on science shared area, including PowerPoints, details of practical investigations, worksheets, revision resources, a range of AFL (assessment for learning) activities, research based tasks, model answers, short answer questions, exam questions, mark schemes, examiner's reports as well as homeworks. Biology offers many opportunities to develop and extend students' literacy skills. There is a large amount of new, subject-specific vocabulary, and so each unit includes a PLC (Personnel Learning checklist) which students will engage with throughout the unit. Students will use texts to find out information for themselves, using the functional layout of such texts, including index, contents and glossary sections of text books used in class, and also

32 lessons (including	In communities, the biological molecules produced by photosynthesis are consumed by other organisms, including animals, bacteria and fungi. Some of these are used as respiratory substrates by these consumers. Photosynthesis and respiration are not 100% efficient. The transfer of biomass and its stored chemical energy in a community from one organism to a consumer is also not 100% efficient. <u>Skills:</u> • Use of chromatography to investigate the pigments isolated from leaves of different plants, eg, leaves from shade-tolerant and shade-intolerant plants or leaves of different colours. • Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts. • Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms. • Calculate gross primary production and to derive the appropriate units. • Calculate the net productivity of producers or consumers from given data and the efficiency of energy transfers within ecosystems <u>Organisms respond to changes in their environments</u>	**Response to stimuli, nervous**	at home in an online format. Students will also review and connect information within topics. **Useful websites:** https://www.freesciencelessons.co.uk/a-level-revision-videos/a-level-biology/ https://www.physicsandmathstutor.com/biology-revision/a-level-aqa/ https://tailoredtutors.co.uk/subjects/biology/ https://app.senecalearning.com/dashboard **YouTube Channels:** https://www.youtube.com/@MissEstruchBiology/videos https://www.youtube.com/@MrPollockBiology/videos https://www.youtube.com/@AlevelBiologyHelp **Reading list:** Biodiversity: A Beginner's Guide John Spicer Oneworld Publications, 2006. The Diversity of Life (Revised edition) Edward O. Wilson Penguin, 2001. Ever Since Darwin: Reflections in Natural History Stephen Jay Gould W.W. Norton and Co., 1992.

assessment and responding to feedback lessons)	Students will build on their knowledge and skills about the nervous system and homeostasis from GCSE Biology to learn that: A stimulus is a change in the internal or external environment. A receptor detects a stimulus. A coordinator formulates a suitable response to a stimulus. An effector produces a response. Receptors are specific to one type of stimulus. Nerve cells pass electrical impulses along their length. A nerve impulse is specific to a target cell only because it releases a chemical messenger directly onto it, producing a response that is usually rapid, short-lived and localised. In contrast, mammalian hormones stimulate their target cells via the blood system. They are specific to the tertiary structure of receptors on their target cells and produce responses that are usually slow, long-lasting and widespread. Plants control their response using hormone-like growth substances. <u>Skills:</u> • Investigation into the effect of an environmental variable on the movement of an animal using a choice chamber. • Use values of heart rate (R) and stroke volume (V) to calculate cardiac output (CO), using the formula • Interpret information relating to examples of negative and positive feedback. • Production of a dilution series of a glucose solution and use of colorimetric techniques to produce a calibration curve with which to	**coordination and homeostasis** end of topic assessment in the style of exam questions Written and verbal feedback given throughout module through in-class activities and homework.	Field Guide to Bacteria Betsy Dexter Dyer Cornell University Press, 2003. Fifth Miracle: The Search for the Origin of Life Paul Davies Simon and Schuster, 1998. Genome: Autobiography of a Species In 23 Chapters Matt Ridley Fourth Estate, 2000 The Greatest Show on Earth: The Evidence for Evolution Richard Dawkins Black Swan, 2010 How We Live and Why We Die: The Secret Lives of Cells Lewis Wolpert Faber and Faber, 2010 On the Origin of Species (Revised edition) Charles Darwin OUP, 2008. The Origin of Life J.D. Bernal Weidenfeld and Nicholson, 1969 Plant Physiology (Biology: Form and Function) Irene Ridge Hodder and Stoughton, 1991. The Rough Guide to Genes and Cloning Jess Buxton Rough Guides, 2007. The Selfish Gene Richard Dawkins OUP, 2006. Understanding the Human Genome Project. 2nd edition. Palladino, Michael A. Pearson Education, 2005. Viruses: A Very Short Introduction Dorothy H. Crawford OUP, 2011.

	identify the concentration of glucose in an unknown 'urine' sample.		What Mad Pursuit Francis Crick Penguin, 1990.
34 lessons (including assessment and responding to feedback lessons)	<u>Genetics, populations, evolution and ecosystems</u> Students will build on their knowledge and skills about genetics and evolution from GCSE Biology to learn that: The theory of evolution underpins modern Biology. All new species arise from an existing species. This results in different species sharing a common ancestry, as represented in phylogenetic classification. Common ancestry can explain the similarities between all living organisms, such as common chemistry (eg all proteins made from the same 20 or so amino acids), physiological pathways (eg anaerobic respiration), cell structure, DNA as the genetic material and a 'universal' genetic code. The individuals of a species share the same genes but (usually) different combinations of alleles of these genes. An individual inherits alleles from their parent or parents. A species exists as one or more populations. There is variation in the phenotypes of organisms in a population, due to genetic and environmental factors. Two forces affect genetic variation in populations: genetic drift and natural selection. Genetic drift can cause changes in allele frequency in small populations. Natural selection occurs when	**Inherited change, populations & evolution and populations in ecosystems** end of topic assessment in the style of exam questions Written and verbal feedback given throughout module through in-class activities and homework.	Junk DNA: A Journey through the Dark Matter of the Genome Nessa Carey Icon Books Ltd, 2015 Immune: A journey into the mysterious system that keeps you alive Philipp Dettmer Random House, 2021

	alleles that enhance the fitness of the individuals that carry them rise in frequency. A change in the allele frequency of a population is evolution. If a population becomes isolated from other populations of the same species, there will be no gene flow between the isolated population and the others. This may lead to the accumulation of genetic differences in the isolated population, compared with the other populations. These differences may ultimately lead to organisms in the isolated population becoming unable to breed and produce fertile offspring with organisms from the other populations. This reproductive isolation means that a new species has evolved. Populations of different species live in communities. Competition occurs within and between these populations for the means of survival. Within a single community, one population is affected by other populations, the biotic factors, in its environment. Populations within communities are also affected by, and in turn affect, the abiotic (physicochemical) factors in an ecosystem. <u>Skills:</u> • Investigate genetic ratios using crosses of Drosophila or Fast Plant® • Use information to represent phenotypic ratios in monohybrid and dihybrid crosses. • Show understanding of the probability associated with inheritance.		

20 lessons (including assessment and responding to feedback lessons)	• Calculate allele, genotype and phenotype frequencies from appropriate data using the Hardy–Weinberg equation. • Investigation into the effect of a named environmental factor on the distribution of a given species. <u>The control of gene expression</u> Students will build on their knowledge and skills about genetics from GCSE Biology to learn that: Cells are able to control their metabolic activities by regulating the transcription and translation of their genome. Although the cells within an organism carry the same coded genetic information, they translate only part of it. In multicellular organisms, this control of translation enables cells to have specialised functions, forming tissues and organs. There are many factors that control the expression of genes and, thus, the phenotype of organisms. Some are external, environmental factors, others are internal factors. The expression of genes is not as simple as once thought, with epigenetic regulation of transcription being increasingly recognised as important. Humans are learning how to control the expression of genes by altering the epigenome, and how to alter	**Gene expression and recombinant DNA technology** end of topic assessment in the style of exam questions Written and verbal feedback given throughout module through in-class activities and homework.	

	genomes and proteomes of organisms. This has many medical and technological applications. Consideration of cellular control mechanisms underpins the content of this section. Students who have studied it should develop an understanding of the ways in which organisms and cells control their activities. This should lead to an appreciation of common ailments resulting from a breakdown of these control mechanisms and the use of DNA technology in the diagnosis and treatment of human diseases. <u>Skills:</u> • Evaluate the use of stem cells in treating human disorders. • Interpret data provided from investigations into gene expression • Evaluate appropriate data for the relative influences of genetic and environmental factors on phenotype. • Use gel electrophoresis to produce 'fingerprints' of food dyes.			
