West Kirby Grammar School

Curriculum Map – Year 13 (part B) – Biology (2022-23)

Topic name	Term	Skills developed	Link to NC subject content	Prior learning	Next link in curriculum
3.5 Energy transfers in and between organisms (A-level only)	Summer Year 12 and Autumn Year 13	• AT a - investigate the effect of named environmental variables on the rate of photosynthesis using aquatic plants, algae or immobilised algal beads. • AT g and b **Required practical 7:** 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. **Required practical 8:** Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts. • AT b - use a redox indicator to investigate dehydrogenase activity. • AT b and i **Required practical 9:** Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms.	• 3.5.1 Photosynthesis • 3.5.2 Respiration 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.	**Links from GCSE:** **KS4 YEAR 10** **4.4** Bioenergetics **4.4.1** Photosynthesis **4.4.2** Respiration	• N/A
3.7 Genetics, populations, evolution and ecosystems	Autumn Spring	• AT h investigate genetic ratios using crosses of Drosophila or Fast Plant® • MS 0.3 use information to represent phenotypic ratios in monohybrid and dihybrid crosses. • MS 1.4 show understanding of the probability associated with inheritance. • MS 1.9 use the X^2 test to investigate the significance of differences between expected	• 3.7.1 Inheritance • 3.7.2 Populations • 3.7.3 Evolution may lead to speciation 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	**Links from GCSE:** **KS4 YEAR 11** **4.6** Inheritance, variation and evolution •	• N/A

		and observed phenotypic ratios • AT k collect data about the frequency of observable phenotypes within a single population. • MS 2.4 calculate allele, genotype and phenotype frequencies from appropriate data using the Hardy–Weinberg equation. • MS 1.5 apply knowledge of sampling to the concept of genetic drift • PS 1.2 devise an investigation to mimic the effects of random sampling on allele frequencies in a population. • AT l use computer programs to model the effects of natural selection and of genetic drift.	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 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.		
3.8 The control of gene expression	Spring Summer	• AT i produce tissue cultures of explants of cauliflower (Brassica oleracea). • AT g investigate the specificity of restriction enzymes using extracted DNA and electrophoresis. • AT g use gel electrophoresis to produce 'fingerprints' of food dyes (dependent on equipment – possible trip)	• 3.8.1 Alteration of the sequence of bases in DNA can alter the structure of proteins • 3.8.2 Gene expression is controlled by a number of features • 3.8.3 Using genome projects • 3.8.4 Gene technologies allow the study and alteration of gene function allowing a better understanding of organism function and the design of new industrial and medical processes	**Links from GCSE:** **KS4 YEAR 11** **4.6** Inheritance, variation and evolution •	• N/A

			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 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.		