The Ellesmere Port C of E College

# BIOLOGY (TEACHER 2)

Part of the Frank Field Education Trust

## KS5 Curriculum Plan 2022-2023

**Year 12**

| | LP1 | LP2 | LP3 | LP4 | LP5 |
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| **TOPIC** | **Biological Molecules** | **Nucleotides, Nucleic Acids and Enzymes** | **Exchange Surfaces** | **Classification and Evolution** | **Hormonal Communication and Revision** |
| | How hydrogen bonding occurs between water molecules, monomers and polymers as biological molecules, the ring structure and properties of glucose, the chemical elements that make up biological molecules, the synthesis and breakdown of a disaccharide and polysaccharide by the formation and breakage of glyosidic bonds, the structures and properties of glucose, starch, glycogen, the structures and properties of cellulose, the structure of a triglyceride and a phospholipid, the synthesis and breakdown of triglycerides. | The general structure of an amino acid (monomer), the synthesis and breakdown of dipeptides and polypeptides (polymers), the structure of a nucleotide, the process of semi-conservative DNA replication, transcription and translation of genes resulting in the synthesis of polypeptides, the role of enzymes in catalysing reactions that affect metabolism at a cellular and whole organism level, the effects of inhibitors on the rate of enzyme controlled reactions, the need for coenzymes, cofactors, and prosthetic groups in some enzyme controlled | The need for specialised exchange surfaces, the structures and functions of the components of mammalian gaseous exchange system, the relationship between vital capacity, tidal volume, breathing rate and oxygen uptake, the mechanisms of ventilation and gas exchange in insects, the mechanisms of ventilation and gas exchange in bony fish, the need for transport systems in multicellular plants, the process of transpiration and the environmental factors that affect transpiration rate, the mechanism of translocation including the transport of assimilates between sources and sinks, the adaptations of plants to the availability of water in their environment, the taxonomic hierarchy of biological classification of species, the features used to classify organisms into the five kingdoms, the relationship between classification and phylogeny. | The evidence for the theory of evolution by natural selection, including fossils, DNA and molecular evidence, interspecific and intraspecific variation, the differences between continuous and discontinuous variation using examples form plants, animals and microorganisms, student t test to compare means of data values of 2 populations, the different types of adaptations of organisms to their environment, the mechanism by which natural selection can affect the characteristics of a population over time, how biodiversity may be considered at different levels, how sampling is used in measuring the biodiversity of a habitat and the importance of sampling random and non-random sampling, the use and interpretation of Simpson's Index of Diversity (d) to calculate the biodiversity of a habitat, how genetic biodiversity may be assessed, for example, by the calculation of the percentage of gene variants (alleles) in a genome, the factors affecting biodiversity, including human population growth, agriculture and climate change, the ecological, economic and aesthetic reasons for maintaining biodiversity in situ and ex situ methods of maintaining biodiversity. | Endocrine communication by hormones, the histology of the pancreas, how blood glucose concentration is regulated, the differences between type 1 and type 2 diabetes, the coordination of responses by the nervous and endocrine systems, the effects of hormones and nervous mechanisms on heart rate. |
| ***Skills*** | How to carry out and interpret the results of: Benedict's test for reducing and non-reducing sugars, how to carry out and interpret the results of: Benedict's test sensitivity using clinistix and serial dilutions, quantitative methods to determine the concentration of a chemical substance in a solution, carry out the emulsion test for lipids, how to carry out and interpret the results of the biuret test for proteins.<br>The principles of thin-layer chromatography, practical investigations into the purification of DNA by precipitation, the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme activity.<br>The dissection, examination and drawing of an insect trachea, practical investigations to estimate transpiration rates.<br>Student t test to compare means of data values of 2 populations, practical investigations collecting random and non-random samples in the field, the use and interpretation of Simpson's Index of Diversity (d) to calculate the biodiversity of a habitat.<br>The histology of the pancreas. | | | | |
| ***Key Vocab*** | Maltose, cellulose, beta glucose, alpha glucose, condensation reaction, haemoglobin, starch, amylose, fibrous proteins, hexose sugar, microfibrils, polymer, globular proteins, collagen, glycine, disulphide bonds, protease enzymes, beta pleated sheet, saturated, genetic code, mono-unsaturated, polyunsaturated, lipids, fatty acids, triglyceride, amylopectin, peptide bond, glyosidic bond, ester. | Nucleotide, pentose sugar, organic base, adenine, thymine, cytosine, guanine, uracil, phosphate group, mononucleotide, dinucleotide, polynucleotide, transcription, mutation, deoxyribose, RNA polymerase, ribose, phosphodiester, ATP, phosphorylation, codon, complementary, purine, pyrimidine, sugar phosphate backbone. | Surface area: volume ratio, exchange surface, concentration gradient, tracheae, tracheoles, spiracle, gill, gill filaments, diffusion distance, ventilation mechanism, adaptations, alveoli, capillary, countercurrent flow, gill arch, lamellae, oxygenated, deoxygenated, saturated, unsaturated, haemoglobin, deoxyhaemoglobin, oxyhaemoglobin, carboxyhaemoglobin, diffusion, osmosis, active transport, co-transport, active transport, permeability. | Classification, hierarchy, taxa, domain, kingdom, phylum, class, order, family, genus, species, physical characteristics, DNA sequencing, animalia, plantae, fungi, protoctista, prokaryotae, binomial, phylogeny, lineage, natural selection, allele frequency, evolution, anatomical, behavioural, physiological, convergent evolution, fossil record, natural selection, interspecific, intraspecific, characteristics, continuous variation, discontinuous variation, mutations, environment, genetic. | Endocrine, exocrine, hypothalamus, hormones, glands, pituitary gland, master gland, thyroid gland, pineal gland, adrenal gland, pancreas, ovaries, testes, alpha cells, beta cells, insulin, glucagon, glycogen, thermoregulation, osmoregulation, homeostasis, target organs, receptors, complementary, adrenaline, adenylyl cyclase, cAMP, kinase, glucose phosphate, cortex, medulla, corticosteroid, fight or flight, cortisol. |

| Year 13 | LP1 | LP2 | LP3 | LP4 | LP5 |
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| **TOPIC** | **Patterns of Inheritance and Variation** | **Manipulating Genomes** | **Cloning and Biotechnology** | **Populations and Sustainability** | |
| ***Knowledge*** | Types of gene mutations and their possible effects on protein production and function, the regulatory mechanisms that control gene expression at the transcriptional level and post translational level, the genetic control of the development of body plans in different organisms, the contribution of both environmental and genetic factors to phenotypic variation, genetic diagrams to show patterns of inheritance, the use of phenotypic ratios to identify linkage (autosomal and sex linkage) and epistasis, using the chi-squared test to determine the significance of the difference between observed and expected results, factors that can affect the evolution of species, the use of the Hardy-Weinberg principle to calculate allele frequencies in populations. | The role of isolating mechanisms in the evolution of new species, the principles of artificial selection and its uses, DNA profiling and its uses, the principles and uses of electrophoresis, the principles of DNA sequencing, how genome sequencing has allowed for genome wide comparisons between individuals and species, the principles of genetic engineering, the techniques used in genetic engineering, the ethical issues relating to the genetic modification of organisms, the principles of, and potential for, gene therapy in medicine, natural clones in plants and the production of natural clones for use in horticulture. | Natural clones in animal species, how artificial clones in animals can be produced by artificial embryo twinning or by enucleation and somatic cell nuclear transfer, the use of microorganisms in biotechnological processes, the use of microorganisms in biotechnological processes to include penicillin production, insulin production and bioremediation, the importance of manipulating the growing conditions in batch and continuous fermentation in order to maximise the yield of production required, the uses of immobilised enzymes in biotechnology and the different methods of immobilisation, ecosystems and the influence of biotic and abiotic factors, biomass transfers through ecosystems, the role of decomposers in ecosystems | The recycling of carbon and nitrogen within ecosystems, the process of primary succession in the development of an ecosystem, how the distribution and abundance of organisms in an ecosystem can be measured, the factors that determine size of a population, interspecific and intraspecific competition, predator-prey relationships, the reasons for, and differences between, conservation and preservation, how the management of an ecosystem can provide resources in a sustainable way, how ecosystems can be managed to balance the conflict between conservation/preservation and human needs, the effects of human activities on the animal and plant populations in environmentally sensitive ecosystems and how these human activities are controlled. | |
| ***Skills*** | Genetic diagrams to show patterns of inheritance including dihybrid inheritance, using the chi-squared test to determine the significance of the difference between observed and expected results, the use of the Hardy-Weinberg principle to calculate allele frequencies in populations.<br>How to take plant cuttings as an example of a simple cloning technique.<br>How to cultivate microorganisms effectively, using aseptic technique, the standard growth curve of microorganisms in a closed culture.<br>The use of sampling and recording methods to determine the distribution and abundance of organisms in a variety of ecosystems | | | | |
| ***Key Vocab*** | Genes, alleles, gene, locus, genotype, phenotype, homologous chromosomes, dominant, recessive, observable characteristics, homozygous, heterozygous, expression, dominance, codominance, test crosses, linkage, sex linkage, autosomal linkage, Hardy-Weinberg, Chi square, evolution, allele frequencies. | Genetic sequencing, DNA, primers, DNA polymerase, free nucleotides, thermocycler, PCR, DNA synthesis, electrophoresis, pyrosequencing, ssDNA, template, ATP sulfurylase, luciferase, apyrase, Adenosine 5' phosphosulfate (APS), luciferin, complementary, genetic fingerprinting, genome, non-coding, extraction, amplification, genetic engineering, recombinant DNA, transgenic organisms, restriction endonucleases, vector, genetically modified organisms, gene therapy. | Cloning, vegetative propagation, micropropagation, tissue culture, meristem, sterile culture, callus, plantlets, embryo twinning, somatic cell nuclear transfer, enucleation, surrogate, non-reproductive cloning, batch culture, log phase, lag phase, primary metabolites, continuous and discontinuous culture, bioremediation, fermenters, yield, immobilised, glucose isomerase, glucoamylase, penicillin acylase, aminoacylase. | Succession, primary succession, progressive colonisation, barren terrain, pioneer species, biodiversity, climax community, secondary succession, recolonization, conservation, genetic diversity, preservation, sustainability, coppicing, pollarding, rotational coppicing, over-fishing, aquacultures, *in situ* , *ex situ* , integrity, habitat, fragmented, genetic diversity, reproductive success, re-introduction. | |