The Ellesmere Port C of E College

Science (GCSE Biology)

Part of the Frank Field Education Trust

KS4 Curriculum Plan 2024-25

		LP1	LP2	LP3	LP4	LP5
Year 10	TOPIC	***Cell structure and transport, Cell division***	***Organisation in plants and animals, The digestive system***	***Communicable diseases, preventing and treating diseases***	***Non-communicable, diseases, photosynthesis***	***Respiration***
	Knowledge	The microscope, how to use and comparison between the light and electron microscope. The structure of animal cells and the function the organelles. The structure of plant cells and the function of the organelles. RP: Using a light microscope to observe and draw animal and plant cells. Comparison of eukaryotic and prokaryotic cells. Description of structure and function of specialised cells. Describe and explain diffusion. Describe and explain active transport. Describe and explain osmosis. RP: The effect of osmosis on plant tissue. Calculate surface area to volume ratio. Describe and explain how exchange surfaces are adapted to their function. Explain mitosis. Compare mitosis and meiosis. Describe stem cells. Discuss the issues surrounding the clinical use of stem cells.	Describe the organisation of living things. Identify cells, tissues, organs and organ systems in both animals and plants. Describe the role of the human digestive system in maintaining life. Describe the organs and functions of these organs in the alimentary canal. Describe the accessory organs and functions of these organs. Explain the components and portions of a healthy diet. RP: Food tests Understand the role of digestive enzymes and why they are specific. Explain the factors affecting enzyme action. RP: The effect of pH on amylase. Understand how digestion is made more efficient through the role of bile and surface area. Describe the absorption of nutrients through the intestinal walls using diffusion, active transport and osmosis. Describe how the digestive system is adapted for exchanging materials.	To define health and the different causes of ill health. To know about microorganisms and that some can be pathogenic and some can useful. To understand how communicable disease can spread and the defence mechanisms the body has to reduce this. Understand that disease can be caused by bacteria, viruses, fungi or protists and the differences, symptoms and examples of each of these diseases. To understand that plants can also get diseases and some common ones and the problems they cause for the plant. How plants defend themselves against disease. How the spread of disease can be reduced with basic hygiene principles. How aseptic technique is applied to growing bacteria in a lab. RP: Investigating the effects of different disinfectants of bacterial growth. How the human body responds to disease using the immune system. Monoclonal antibodies and the advantages and disadvantages of these. What a vaccine is and how it leads to immunity. How antibiotics can be used to treat a disease and how painkillers can used to treat the symptoms of the disease. How drugs have been discovered and developed over time.	To understand that lifestyle can cause some diseases and these are examples of non-communicable diseases. How smoking and drinking alcohol increases the risk of developing a non-communicable disease. How diet and exercise can lead to obesity and deficiency diseases as examples of non-communicable diseases. To understand what cancer is, risk factors, how it causes illness and how it can be treated. Describe the process of photosynthesis. Understand how leaves are adapted for photosynthesis. Explain the factors which affect photosynthesis. Know how food production is increased by manipulating the limiting factors of photosynthesis. RP: Investigating the effect of light on the rate of photosynthesis. Review of diffusion, osmosis and surface area. Describing water movement in plants including the action and structure of the roots, root hair cells, xylem, stomata and guard cells. Investigate transpiration in plants. Describing mineral movement in plants including the action and structure of the roots, root hair cells and xylem. The movement of sugar through the phloem from source to sink. Understand how lack of minerals can lead to deficiency diseases in plant and to be able to identify these given symptoms.	Understand the process of aerobic respiration in humans and microbes. The impact of aerobic respiration on the carbon cycle. The process of anaerobic in humans and the formation of oxygen debt. How the circulatory system, digestive system and respiratory system work together to ensure that respiration can take place in every cell. How and why the body increases heart rate, breathing rate and breathing depth during exercise. The recovery period and what this means in terms of oxygen debt. Investigate the effect of different exercise on pulse rate. The effects of exercise on metabolism. Anaerobic respiration in yeast- the uses of the products. Investigate anaerobic respiration in yeast. Compare aerobic and anaerobic respiration in yeast and animals.
	Skills	Using a microscope. Calculating magnification, image size and actual size. Scientific drawings of cells seen under a microscope. Experimental technique. Graph drawing skills and analysis of data. Discussion of precision, accuracy and reliability. Identification of anomalies. Calculating and comparing surface area to volume ratios. Making ethical, social and economic judgements. Describing the structure of living things and the passage of food through the digestive system. Conducting food tests and using quantitative data to form conclusions. Understanding how complementary shapes make enzymes specific. Knowing the shape of the graph when factors affect enzymes. Investigative techniques. Using qualitative and quantitative data to form conclusions on the action of amylase. Draw on knowledge from previous unit about surface area and volume as well as diffusion and osmosis. Discussing the importance of good hygiene and suggesting some ways to carry this out. Understand aseptic technique and how it should be carried out. Use discrete data to draw conclusions in an experiment. Construct a timeline on the development of medicine. Discuss ethics of vaccination programmes. Make balanced decisions when discussing lifestyle choices, health and freewill. Carry out a practical to see the effect of light on the rate of photosynthesis. Use quantitative data to draw conclusions. Be able to write a step by step method to ensure accurate results are collected. Use a potometer to see transpiration in plants and draw conclusions from this. Use knowledge of surface area and exchange mechanisms to understand how root hair cells are adapted for function. Use quantitative data to draw conclusions on the rate of anaerobic respiration in yeast. Use quantitative data to understand changes in pulse rate and how this is linked to exercise. Use prior learning to make judgements on exchanging materials.				
	Key Vocab	Organelle, ribosome, mitochondria, nucleus, cell membrane, cytoplasm, chloroplasts, vacuole, cell wall, plasmid, flagellum, slime capsule, eukaryote, prokaryote, diffusion, osmosis, active transport, mitosis, meiosis, gametes, growth, repair, specialisation, differentiation, stem cells, ethics.	Organelle, cell, tissue, organ, organ system, organism, digestive system, alimentary canal, accessory organs, mouth, oesophagus, stomach, small intestine, large intestine, rectum, anus, liver, pancreas, gastric juices, bile, absorption, villi, emulsification, specificity, complementary, active site, enzyme, substrate, limiting factors, protease, carbohydrase, lipase, amylase, starch, carbohydrate, protein, lipids, glucose, glycerol, fatty acids, amino acids, sugars.	Communicable, non-communicable, pathogen, disease, aseptic technique, petri dish, agar, incubator, inoculating loop, hygiene, defence mechanisms, immune system, monoclonal antibodies, antibiotics, antitoxins, pain killers, symptoms, vaccination, immunity, memory cells, bacteria, virus, fungi, protists.	Non-communicable, carcinogens, lifestyle, cancer, tumour, malignant, benign, photosynthesis, chlorophyll, palisade, mesophyll, spongy, waxy cuticle, epidermis, stomata, guard cells, transpiration, gas exchange, xylem, phloem, roots, root hair cells, minerals, deficiency, potometer, Elodea.	Respiration, glucose, oxygen, energy, mitochondria, cytoplasm, aerobic, anaerobic, lactic acid, oxygen debt, ethanol, carbon dioxide, diffusion, recovery time, fermentation.

Year 11

TOPIC	LP1 *Hormonal control and homeostasis in action*	LP2 *Genetics*	LP3 *Variation and Evolution*	LP4 *Adaptations, organising an ecosystem and biodiversity and ecosystems*	LP5
Knowledge	Hormonal control and homeostasis in action Describe the structure of the nervous system and the location of the endocrine glands. Understand how the nervous system and endocrine system work together in automatic responses. Describe the structure and function of nerve cells and synapses. Describe the structure and function of the reflex arc. Explain the importance of and investigate reflex actions. Relate the structure of the eye to their functions. Understand how long and short sightedness occurs and how it can be corrected temporarily or permanently. Understand how and why blood glucose needs to be regulated in the body. The role of the pancreas and insulin in controlling blood glucose levels. Understand the different types of diabetes, how they occur and how they can be treated. Explain the role of thyroxine in the body. Explain how hormones interact to control the menstrual cycle. Explain how IVF is carried out and the advantages and disadvantages of the procedure. Understand how hormones can be used to control fertility in the form of contraception. Describe the effects of adrenaline. How body temperature is controlled to make sure it remains around a set point and apply this to context, identify the importance of this regulation. Understand how the body loses and gains water and why water balance in important for cell function. Know the structure of the kidneys. Explain the role of the kidneys in maintaining water and ion balance in the body. Understand how excess is converted into urea by the liver. Understand how the kidneys remove urea from the body and produces urine. Know how the action of ADH impacts the removal of water from the body. Understand the causes and symptoms of kidney failure. Describe the process of dialysis. Compare the advantages and disadvantages of dialysis and kidney transplants. Describe tropisms in plants and why they are needed. Describe the role of auxins in making these tropisms occur. Suggest some applications of auxins. RP: The effect of light and gravity on the growth of germinating seeds. Understand the role of gibberelins and ethene in cell division and the ripening of fruit. Suggest how these hormones can be used in farming.	Understand that some characteristics are inherited or due to the environment. Carry out an investigation in class to compare genetic and environmental characteristics. Describe fertilisation in plants and animals. Describe the structure and function of DNA in the nucleus. Understand that the human genome has been mapped out in the HGP and discuss the advantages and disadvantages of this. Understand how DNA is composed of nucleotides with complementary base pairs forming the double helix and 3 of these bases make up a codon which codes for one amino acid. Understand that the information in DNA from the nucleus by a strand of RNA formed during transcription. Know that the RNA travels to the ribosomes and the information in it forms a protein using transfer molecules. Know that not all of the DNA makes proteins, some sections called “junk DNA” are used to control the expression of characteristics. Know that mutations are changes in DNA and these can either be positive, negative or neutral. Understand the mechanism for mutation changes and how these impact protein structure. Recap mitosis. Describe the process of meiosis to form gametes. Know the process of fertilisation and how these leads to gender determination. Understand the processes of sexual and asexual reproduction and the advantages and disadvantages of these. Describe the process of cloning in plants. Describe the process of cloning in animals. Know who Gregor Mendel was and the work he carried out into inheritance including his monohybrid crosses. Predict the outcome of genetic crosses for genetic diseases in humans- focusing on CF and polydactyly. Understand how genetic screening can take place and the ethical and economic considerations of these processes. Describe how genetic engineering in carried out and the advantages and disadvantages of this procedure.	Recognise examples of variation in plants and animals. Explain how variation arises and the importance of variation to living things. Understand how living things are classified including the work of Carl Linneaus and Carl Woese. Understand how to interpret evolutionary trees and how they have developed over time. Define speciation and how it occurs as well as what a species actually is. Explain Darwin’s theory of evolution by natural selection and why it was not widely accepted at the time. Compare Darwin’s theory of evolution to La Marck’s theory of acquired characteristics. Understand that Darwin and Wallace both proposed similar theories of evolution at the same time. Explain how Darwin and Wallace both collected the evidence for their theories and what these entailed. Explain how Mendel contributed to the theory of evolution. Explain how the work of other scientists contributed to the gene theory. Explain what evidence we now have for the Theory of Evolution. Explain how fossils are formed and why the fossil record will never be completed. Understand how the fossil record is evidence of evolution. Use the complete fossil record of a horse to explain the evolution of this animal as well as applying evolution to the peppered moth. Explain how different scenarios can bring about extinction and how conservation projects can reduce extinction. Understand how antibiotic resistance is developed in bacteria and how this is evidence of evolution. Understand the effects of antibiotic resistance om the treatment of diseases. Describe the process of selective breeding and evaluate its advantages and disadvantages. Explore the ethical and economic considerations for selective breeding. Understand how genetic engineering is carried out and the possible benefits and issues with genetically modified crops. Review animal cloning including embryo transplants and adult cell cloning. Review how to clone a plant using tissue cultures and cuttings.	To know the important of communities in maintaining biodiversity Describe some factors which affect organisms in their environment. RP: Sample an area to determine population size. Describe competition in animals and plants. Explain how adaptations arise to aid living things overcome competition. Describe adaptations in animals and link to context. Describe adaptations in plants and link to context. Describe feeding relationships using food webs and chains. Use pyramids of numbers and biomass to represent feeding relationships. Describe predator prey relationships and the shape this takes on a graph. Describe the carbon cycle and the importance of this in an environment. RP: Determine the effect of temperature on the rate of decay. Explain how and why the human population has increased and some impact this has on biodiversity. Describe how human activities pollute the land and water. Describe global warming and its impact on biodiversity. Evaluate the impact on environmental change on organisms. Explain some ways people are trying to reduce the impact of human activity on biodiversity. Describe biomass loss at different trophic levels. Describe what food security is and the factors that affect it. Explain how farmers work to ensure food security and some of the methods used. Review learning of genetically modified crops and discuss ethical and environmental issues surrounding the use of these crops. Explain how to make food production more sustainable.	
Skills	Pupils will be able to carry out an investigation to investigate the effects of different factors on plant growth- they will write a method, analyse and evaluate their quantitative data. Pupils will also be able to reason the need for different treatments for the same conditions. Pupils will be able to construct punnet squares to determine the possible genotypes and phenotypes of offspring. Pupils will be able to use probability and ratio to determine the likelihood of passing on genetic diseases. Pupils will be able to model the structure of DNA and the mechanism of protein synthesis. Pupils will be able to discuss ethical considerations when discussing genetic screening. Pupils will be able to make economic judgements when discussing the HGP. Pupils should be able to make ethical arguments for and against various procedures. Pupils will understand how cloning, genetic engineering and selective breeding are carried. Pupils will be able to describe the process of evolution and determine the evidence for this. Pupils will be able to make ethical judgements regarding various human activities. They will be able to carry out a practical investigation to gather quantitative data on the rate of decay. Pupils will be able to construct graphs and pyramids to represent feeding relationships. Pupils will sample a habitat and calculate medial values and total area to determine total population size. Pupils will be able to carry out an investigation to investigate the effects of different factors on plant growth- they will write a method, analyse and evaluate their quantitative data. Pupils will also be able to reason the need for different treatments for the same conditions.				
Key Vocab	Homeostasis, endocrine, nervous, synapses, reflex arc, myelinated sheaf, impulse, neurotransmitter, reflex arc, stimulus, response, effector, sensory, receptor, relay, CNS, motor, gland, hormone, target cell, thermoregulation. Glucoregulation, osmoregulation, kidneys, urea, urine, loop of Henley, bowman’s capsule, dialysis, menstruation, IVF. Urine, bladder, ADH, pituitary gland, insulin, diabetes, hyperglycaemia, hypoglycaemia.	DNA, nucleotide, complementary base pairs, codon, mutations, transcription, translation, ribosomes, RNA, messenger molecule, transfer molecule, double helix, transcription, translation, monohybrid, punnet square, genotype, phenotype, dominant, recessive, homozygous, heterozygous, haploid, diploid, gametes, fertilisation, mitosis, meiosis, chromosomes, human genome project, gender, probability, ratio, genetic screening, cystic fibrosis, genetic engineering.	Evolution, fittest, natural selection, artificial selection, fossil record, evidence, Darwin, la Marck, Wallace, Linneaus, Woese, Mendel, classification, kingdom, phylum, class, order, genus, species, evolutionary trees, genetic modification, selective breeding, fossils, evidence, extinction, endangered, conservation, resistance.	Ecology, biodiversity, community, population, habitat, biotic, abiotic, predator, prey, trophic levels, biomass, numbers, pyramids, graphs, sustainability, human population, food security, genetic engineering, genetically modified crops, deforestation, peat bog destruction, carbon cycle, global warming, climate change, adaptations, interspecific, intraspecific, competition.	Homeostasis, endocrine, nervous, synapses, reflex arc, myelinated sheaf, impulse, neurotransmitter, reflex arc, stimulus, response, effector, sensory, receptor, relay, CNS, motor, gland, hormone, target cell, thermoregulation. Glucoregulation, osmoregulation, kidneys, urea, urine, loop of Henley, bowman’s capsule, dialysis, menstruation, IVF. Urine, bladder, ADH, pituitary gland, insulin, diabetes, hyperglycaemia, hypoglycaemia.