Biology Curriculum Overview – Year 13

Sequencing of topics	What knowledge will students develop? (Including key terminology)	What skills will students develop? (Including literacy & numeracy)	Assessment opportunities	Homework opportunities	Personal development (Ursuline Values, Catholic Social Teaching, Cultural Capital, Cross-curricular, Careers)	Curriculum links
Autumn Term 1						
Topic 5: On the wild side	○ Understand the terms ecosystem, community, population and habitat. ○ Understand that the numbers and distribution of organisms in a habitat are controlled by biotic and abiotic factors. ○ Understand how the concept of niche accounts for distribution and abundance of organisms in a habitat. ○ Understand the stages of succession which result in a climax community. ○ **CORE PRACTICAL 10:** Be able to carry out a study on the ecology of a habitat, including using quadrats and transects to determine distribution and abundance of organisms, and measuring abiotic factors appropriate to the habitat. (CPAC 1,2,4,5,6,8,11,12) ○ Understand the different types of evidence for climate change and its causes (including records of carbon dioxide levels, temperature records, pollen in peat bogs and dendrochronology)	○ Magnification ○ Rearranging equations ○ Order of magnitude ○ Drawing results tables ○ Analysing results ○ Calculating an average ○ Drawing graphs ○ Interpreting graphs ○ SD ○ Unit conversion ○ Hardy-Weinberg ○ SSDI ○ Measuring biodiversity ○ Species richness ○ Species evenness ○ Extrapolating data ○ Percentage change ○ Reading scientific reports ○ Writing scientific reports ○ Using key words ○ Practical skills	○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Scientific report writing	○ Practice exam questions done throughout ○ Research Tasks/Projects ○ Flipped Learning worksheet ○ Satchel/Neeto Quizzes	○ **United in harmony** when we appreciate the role of scientific break-throughs ○ **Grateful** for the beauty in a cell and how it works ○ **Faith-filled and hopeful** when seeing beyond the naked eye ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Discerning and joyful** when we consider the future	KS1/2 ○ Animal life cycles ○ Plant growth and health ○ Adaptation ○ Function of plant parts ○ Animal survival ○ Classification ○ Habitats ○ Food chains ○ Adaptation and the environment KS3 ○ Y7 Cells ○ Y7 Interdependence ○ Y8 Evolution KS4 ○ Y9 Evolution ○ Y10 ○ photosynthesis ○ Y10 Ecosystems and trophic levels ○ Y11 Effect of humans

	recognising correlations and causal relationships. ○ Understand the causes of anthropogenic climate change – including the role of greenhouse gases (carbon dioxide and methane) in the greenhouse effect. ○ Understand that data can be extrapolated to make predictions and that these are used in models of future climate change. ○ Understand that models for climate change have limitations. ○ Understand the effects of climate change (changing rainfall patterns and changes in seasonal cycles) on plants and animals (distribution of species, development and life cycles). ○ Understand the way in which scientific conclusions about controversial issues, such as what actions should be taken to reduce climate change or the degree to which humans are affecting climate change, can sometimes depend on who is reaching the conclusions. ○ Understand how reforestation and the use of sustainable resources including biofuels are examples of the effective management of the conflict between human needs and conservation. ○ Understand the overall reaction of photosynthesis as requiring energy from light to split apart the strong bonds in water				of medical healthcare ○ **Loving and compassionate/ Serviam** when students consider a career in conserving species ○ Dignity of God's people ○ Community and participation ○ Care for creation ○ Dignity of work ○ Peace and reconciliation ○ Solidarity ○ Personal ○ Social ○ Physical ○ Spiritual ○ Moral ○ Cultural ○ BTEC Health and social care ○ BTEC Applied human biology ○ BTEC PE ○ A-level Sociology ○ BTEC Sociology ○ A-level Psychology ○ BTEC Psychology ○ A-level Chemistry ○ A-level Maths ○ Meteorologists ○ Ecologist ○ Environmentalist ○ Biologist ○ Climate change scientist ○ Research	KS5 ○ Topic 5,7,8

	molecules, storing the hydrogen in a fuel (glucose) by combining it with carbon dioxide and releasing oxygen into the atmosphere. ○ Understand the light-dependent reactions of photosynthesis including how light energy is trapped by exciting electrons in chlorophyll and the role of these electrons in generating ATP, reducing NADP in photophosphorylation and producing oxygen through photolysis of water. ○ Understand the structure of chloroplasts in relation to their role in photosynthesis. ○ **CORE PRACTICAL 11:** Investigate photosynthesis using isolated chloroplasts (the Hill reaction). (CPAC 1,2,3,4,5,8) ○ Understand how phosphorylation of ADP requires energy and that hydrolysis of ATP provides an immediate supply of energy for biological processes. ○ Understand the light-independent reactions as reduction of carbon dioxide using the products of the light-dependent reactions (carbon fixation in the Calvin cycle, the role of GP, GALP, RuBP and RUBISCO). ○ Know that the products are simple sugars that are used by plants, animals and other organisms in respiration and the synthesis of new biological molecules (including					

	polysaccharides, amino acids, lipids and nucleic acids). ○ Be able to calculate net primary productivity. ○ Understand the relationship between gross primary productivity, net primary productivity and plant respiration. ○ Know how to calculate the efficiency of biomass **and** energy transfers between trophic levels. ○ Understand the effect of temperature on the rate of enzyme activity and its impact on plants, animals and microorganisms. ○ Understand how knowledge of the carbon cycle can be applied to methods to reduce atmospheric levels of carbon dioxide. ○ **CORE PRACTICAL 13:** Be able to investigate the effects of temperature on the development of organisms (such as seedling growth rate, brine shrimp hatch rates). (CPAC 1,2,3,5,8) ○ **CORE PRACTICAL 12:** Be able to investigate the effect of temperature on the rate of an enzyme-catalysed reaction, to include Q10. (CPAC 1,2,3,6,12) ○ Understand how evolution (a change in the allele frequency) can come about through gene mutation and natural selection. ○ Understand how isolation reduces gene flow between					

	populations leading to allopatric or sympatric speciation. ○ Understand the role of the scientific community (scientific journals, the peer review process, scientific conferences) in validating new evidence, including proteomics and genomics, that supports the accepted scientific theory of evolution.					
Autumn Term 2						
Topic 6: Infection, immunity and disease	○ Understand how one gene can give rise to more than one protein through post-transcriptional changes to messenger RNA (Mrna). *Note:* details of protein synthesis are now taught at AS so might need revision here. ○ Know how DNA profiling is used for identification and determining genetic relationships between organisms (plants and animals). ○ Know how DNA can be amplified using the polymerase chain reaction (PCR). ○ **CORE PRACTICAL 14:** Understand how to use gel electrophoresis to separate DNA fragments of different length. (CPAC 1,3,6,8) ○ Know the role of micro-organisms in the decomposition of organic matter and the recycling of carbon. ○ Be able to compare the structure of bacteria and viruses. ○ Understand how *Mycobacterium tuberculosis* (TB) and Human	○ Magnification ○ Rearranging equations ○ Order of magnitude ○ Drawing results tables ○ Analysing results ○ Calculating an average ○ Drawing graphs ○ Interpreting graphs ○ SD ○ Unit conversion ○ Percentage change ○ Logarithms ○ Extrapolating data ○ Exponential growth ○ Calculating diameter, radius and area of a circle ○ Using graphs to make predictions ○ Reading scientific reports ○ Writing scientific reports ○ Using key words ○ Practical skills	○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Scientific report writing	○ Practice exam questions done throughout ○ Research Tasks/Projects ○ Flipped Learning worksheet ○ Satchel/Neeto Quizzes	○ **United in harmony** when we consider the global use of antibiotics ○ **Grateful** for the beauty in a cell and how it works ○ **Faith-filled and hopeful** when seeing beyond the naked eye ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Dignity of the human person**	KS1/2 ○ Healthy human development KS3 ○ Y7 Cells ○ Y8 Photosynthesis KS4 ○ Y9 Communicable disease ○ Y9 Cells ○ Y10 Cell transport ○ Y10 photosynthesis ○ Y10 Homeostasis and the NS ○ Y10 Endocrine system KS5 ○ Topic 1,2,3,4,6,7

	Immunodeficiency Virus (HIV) infect human cells, causing a sequence of symptoms that may result in death. ○ Know the major routes pathogens may take when entering the body. ○ Understand the role of barriers in protecting the body from infection, including the roles of skin, stomach acid, and gut and skin flora. ○ Understand the non-specific responses of the body to infection, including inflammation, lysozyme action, interferon, and phagocytosis. ○ Understand the roles of antigens and antibodies in the body's immune response including the involvement of plasma cells, macrophages and antigen-presenting cells. ○ Understand the differences between the roles of B cells (including B memory and B effector cells) and T cells (T helper, T killer and T memory cells) in the body's immune response. ○ Understand how individuals may develop immunity (natural, artificial, active, passive). ○ Understand how the theory of an 'evolutionary race' between pathogens and their hosts is supported by the evasion mechanisms shown by pathogens.				when considering healthcare ○ **Discerning and joyful** when we consider the future of medical healthcare ○ **Loving and compassionate/ Serviam** when students consider a career helping others ○ **Family and community** when we consider the impact of infectious disease ○ Dignity of God's people ○ Community and participation ○ Care for creation ○ Dignity of work ○ Peace and reconciliation ○ Solidarity ○ Personal ○ Social ○ Physical ○ Spiritual ○ Moral ○ Cultural ○ BTEC Health and social care ○ BTEC Applied human biology ○ BTEC PE ○ A-level Sociology ○ BTEC Sociology ○ A-level Psychology ○ BTEC Psychology	

	○ Understand the difference between bacteriostatic and bactericidal antibiotics. ○ Understand how to determine the time of death of a mammal by examining the extent of decomposition, stage of succession, forensic entomology, body temperature and degree of muscle contraction. ○ **CORE PRACTICAL 15:** Investigate the effect of different antibiotics on bacteria. (CPAC 1,2,3,5,8,9) ○ Know how an understanding of the contributory causes of hospital acquired infections have led to codes of practice regarding antibiotic prescription and hospital practice that relate to infection prevention and control.				○ A-level Chemistry ○ A-level Maths ○ Immunologist ○ Microbiologist ○ Research ○ Biomedical scientist ○ Epidemiology ○ Histopathologist	
Spring Term 1						
Topic 7: Run for your life	○ Know the way in which muscles, tendons, the skeleton and ligaments interact to enable movement, including antagonistic muscle pairs, extensors and flexors. ○ Understand the process of contraction of skeletal muscle in terms of the sliding filament theory, including the role of actin, myosin, troponin, tropomyosin, calcium ions (Ca^{2+}), ATP and ATPase. ○ Know the structure of a muscle fibre. ○ Understand the structural and physiological differences between fast and slow twitch muscle fibres.	○ Magnification ○ Rearranging equations ○ Order of magnitude ○ Calculating area, diameter and radius ○ Drawing results tables ○ Analysing results ○ Calculating an average ○ Drawing graphs ○ Interpreting graphs ○ Percentage change ○ Reading a spirometer trace ○ Balancing equations ○ Reading scientific reports ○ Writing scientific reports ○ Using key words ○ Practical skills	○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Scientific report writing	○ Practice exam questions done throughout ○ Research Tasks/Projects ○ Flipped Learning worksheet ○ Satchel/Neeto Quizzes	○ **United in harmony** when we appreciate the role of scientific break-throughs ○ **Grateful** for the beauty in a cell and how it works ○ **Faith-filled and hopeful** when seeing beyond the naked eye ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and	KS1/2 ○ Healthy human development KS3 ○ Y7 Cells ○ Y7 Movement ○ Y8 Breathing ○ Y8 Respiration KS4 ○ Y10 Cell transport ○ Y10 Respiration ○ Y10 Homeostasis and the NS ○ Y10 Endocrine system ○ Y11 Digestive system

	○ Understand the overall reaction of aerobic respiration as splitting of the respiratory substrate, including glucose, to release carbon dioxide as a waste product and reuniting of hydrogen with atmospheric oxygen with the release of a large amount of energy. ○ Understand the roles of glycolysis in aerobic and anaerobic respiration, including the phosphorylation of hexoses, the production of ATP, reduced coenzyme, pyruvate and lactate (details of intermediate stages and compounds are not required). ○ **CORE PRACTICAL 16:** Investigate rate of respiration practically. (CPAC 1,2,3,8,12) ○ Understand the role of the link reaction and the Krebs cycle in the complete oxidation of glucose and formation of carbon dioxide (CO_2), ATP, reduced NAD and reduced FAD (names of other compounds are not required) and why these steps take place in the mitochondria, unlike glycolysis which occurs in the cytoplasm. ○ ii) Understand that respiration is a many-stepped process with each step controlled and catalysed by a specific intracellular enzyme. ○ Understand how ATP is synthesised by oxidative phosphorylation associated with				carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Dignity of the human person** when considering healthcare ○ **Discerning and joyful** when we consider the future of medical healthcare ○ **Loving and compassionate/ Serviam** when students consider a career helping others ○ Dignity of God's people ○ Community and participation ○ Care for creation ○ Dignity of work ○ Peace and reconciliation ○ Solidarity ○ Personal ○ Social ○ Physical ○ Spiritual ○ Moral ○ Cultural ○ BTEC Health and social care ○ BTEC Applied human biology	○ Y11 Circulatory system and NCD KS5 ○ Topic 1,2,3,6,8

	the electron transport chain in mitochondria, including the role of chemiosmosis and ATP synthase. ○ Understand what happens to lactate after a period of anaerobic respiration in animals. ○ Know the myogenic nature of cardiac muscle. ○ Understand how the normal electrical activity of the heart coordinates the heart beat, including the roles of the sinoatrial node (SAN), the atrioventricular node (AVN), the bundle of His and the Purkyne fibres. ○ Understand how the use of electrocardiograms (ECGs) can aid the diagnosis of cardiovascular disease (CVD) and other heart conditions. ○ Know how to calculate cardiac output. ○ Understand how variations in ventilation and cardiac output enable rapid delivery of oxygen to tissues and the removal of carbon dioxide from them, including how the heart rate and ventilation rate are controlled and the roles of the cardiovascular control centre and the ventilation centre in the medulla oblongata. ○ **CORE PRACTICAL 17:** Investigate the effects of exercise on tidal volume, breathing rate, respiratory minute ventilation and oxygen consumption using				○ BTEC PE ○ A-level Sociology ○ BTEC Sociology ○ A-level Psychology ○ BTEC Psychology ○ A-level Chemistry ○ A-level Maths ○ Meteorologists ○ Ecologist ○ Environmentalist ○ Biologist ○ Climate change scientist ○ Research ○ Doctor ○ Nurse ○ Physiotherapy	

	data from spirometer traces.(CPAC 1,2,8,12) ○ Understand the principle of negative feedback in maintaining systems within narrow limits. ○ Understand homeostasis and its importance in maintaining the body in a state of dynamic equilibrium during exercise, including the role of the hypothalamus and the mechanisms of thermoregulation. ○ Understand how genes can be switched on and off by DNA transcription factors including hormones. ○ Understand the analysis and interpretation of data relating to possible disadvantages of exercising too much (wear and tear on joints, suppression of the immune system) and exercising too little (increased risk of obesity, cardiovascular disease (CVD) and diabetes), recognising correlation and causal relationships. ○ Understand how medical technology, including the use of keyhole surgery and prostheses, is enabling those with injuries and disabilities to participate in sports. ○ Be able to discuss different ethical positions relating to whether the use of performance-enhancing substances by athletes is acceptable.					

Spring Term 2						
Topic 8: Grey matter	○ Know the structure and function of sensory, relay and motor neurones including the role of Schwann cells and myelination. ○ Understand how phytochrome and IAA bring about responses in plants to environmental cues, including their effects on transcription. ○ Understand how a nerve impulse (action potential) is conducted along an axon including changes in membrane permeability to sodium and potassium ions and the role of the myelination. ○ Know the structure and function of synapses in nerve impulse transmission, including the role of neurotransmitters, including acetylcholine. ○ Understand how the nervous systems of organisms can cause effectors to respond to a stimulus. ○ Understand how the pupil dilates and contracts. ○ Understand how the nervous systems of organisms can detect stimuli with reference to rods in the retina of mammals, the roles of rhodopsin, opsin, retinal, sodium ions, cation channels and hyperpolarisation of rod cells in forming action potentials in the optic neurones. ○ Understand how co-ordination is brought about through nervous and hormonal control in animals.	○ Magnification ○ Rearranging equations ○ Order of magnitude ○ Calculating area, diameter and radius ○ Drawing results tables ○ Analysing results ○ Calculating an average ○ Drawing graphs ○ Interpreting graphs ○ Potential difference ○ Percentage change ○ Reading scientific reports ○ Writing scientific reports ○ Using key words ○ Practical skills ○ Reading scientific reports ○ Writing scientific reports ○ Using key words ○ Practical skills	○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Scientific report writing	○ Practice exam questions done throughout ○ Research Tasks/Projects ○ Flipped Learning worksheet ○ Satchel/Neeto Quizzes	○ **United in harmony** when we appreciate the importance of greater research and knowledge of the brain and NS ○ **Grateful** for the beauty in a cell and how it works ○ **Faith-filled and hopeful** when seeing beyond the naked eye ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Dignity of the human person** when considering healthcare ○ **Discerning and joyful** when we consider the future of medical healthcare ○ **Loving and compassionate/**	KS1/2 ○ Senses ○ Healthy human development ○ Genetic variation KS3 ○ Y7 Cells ○ Y7 Movement KS4 ○ Y9 Cells ○ Y10 Homeostasis and the nervous system ○ Y10 Endocrine system ○ Y11 Genetic variation KS5 Topic 1,2,3,5,6,7

	○ Know the location and functions of the cerebral hemispheres, hypothalamus, cerebellum and medulla oblongata in the human brain. ○ Understand how magnetic resonance imaging (MRI), functional magnetic resonance imaging (Fmri), positron emission tomography (PET) and computed tomography (CT) scans are used in medical diagnosis and the investigation of brain structure and function. ○ Understand what happens during the critical period so that mammals can develop their visual capacities to the full. ○ Understand the role animal models have played in the research into human brain development and function, including Hubel and Wiesel's experiments with monkeys and kittens. ○ Understand how animals, including humans, can learn by habituation. ○ Understand the methods used to investigate the contributions of nature and nurture to brain development, including evidence from the abilities of new-born babies, animal experiments, studies of individuals with damaged brain areas, twin studies and cross-cultural studies.				**Serviam** when students consider a career helping others ○ **Family and community** when we consider the impact of disease ○ Dignity of God's people ○ Community and participation ○ Care for creation ○ Dignity of work ○ Peace and reconciliation ○ Solidarity ○ Personal ○ Social ○ Physical ○ Spiritual ○ Moral ○ Cultural ○ BTEC Health and social care ○ BTEC Applied human biology ○ BTEC PE ○ A-level Sociology ○ BTEC Sociology ○ A-level Psychology ○ BTEC Psychology ○ A-level Chemistry ○ A-level Maths ○ Neurologist ○ Psychologist ○ Therapist ○ Counsellor ○ Social work ○ Doctor ○ Nurse ○ Midwife	

	○ **CORE PRACTICAL 18:** Investigate habituation to a stimulus. (CPAC 1,2,3,5,8) ○ Be able to discuss the moral and ethical issues relating to the use of animals in medical research from two ethical standpoints. ○ Understand how imbalances in certain, naturally occurring, brain chemicals can contribute to ill health, including dopamine in Parkinson's disease and serotonin in depression, and to the development of new drugs. ○ Understand the effects of drugs on synaptic transmissions, including the use of L-Dopa in the treatment of Parkinson's disease and the action of MDMA in Ecstasy. ○ Understand how the outcomes of genome sequencing projects are being used in the development of personalised medicine and the social, moral and ethical issues this raises. ○ Know how drugs can be produced using genetically modified organisms (plants, animals and microorganisms). ○ Understand the risks and benefits associated with the use of genetically modified organisms.				○ Ophthalmologist ○ Pharmacist ○ Research ○ Biomedical scientist	

Summer Term
Revision, study leave and A-Level exams