Biology

EP Curriculum Map

Unit 1: Cells and multicellular organisms

Topic 1: Cells as the basis of life

Cell membrane

Content Descriptor	Lesson Names
describe the structure of the cell membrane (including protein channels, phospholipids, cholesterol and glycoproteins) based on the fluid mosaic phospholipid bilayer model	• Cell Membrane Structure
describe how the cell membrane maintains relatively stable internal conditions via the passive movement (diffusion, osmosis) of some substances along a concentration gradient explain how the cell membrane maintains relatively stable internal conditions via the process of active transport of a named substance against a concentration gradient	• Passive Transport - Diffusion • Passive Transport - Osmosis • Passive Transport - Facilitated Diffusion • Active Transport • Diffusion Experiments • Osmosis Experiments
understand that endocytosis is a form of active transport that usually moves large polar molecules that cannot pass through the hydrophobic cell membrane into the cell recognise that phagocytosis is a form of endocytosis	• Active Transport
predict the direction of movement of materials across cell membranes based on factors such as concentration, physical and chemical nature of the materials	• Passive Transport - Diffusion • Passive Transport - Osmosis • Passive Transport - Facilitated Diffusion • Active Transport • Diffusion Experiments • Osmosis Experiments
explain how the size of a cell is limited by the relationship between surface area to volume ratio and the rate of diffusion.	• Cell Size

Prokaryotic and eukaryotic cells

Content Descriptor	Lesson Names
recognise the requirements of all cells for survival, including - energy sources (light or chemical) - matter (gases such as carbon dioxide and oxygen) - simple nutrients in the form of monosaccharides, disaccharides, polysaccharides - amino acids, fatty acids, glycerol, nucleic acids, ions and water - removal of wastes (carbon dioxide, oxygen, urea, ammonia, uric acid, - water, ions, metabolic heat)	• Cell Survival
recognise that prokaryotic and eukaryotic cells have many features in common, which is a reflection of their common evolutionary past recall that prokaryotic cells lack internal membrane bound organelles, do not have a nucleus, are significantly smaller than eukaryotes, usually have a single circular chromosome and exist as single cells	• Prokaryotic Cells • Eukaryotic Cells • Prokaryotic vs. Eukaryotic Cells
understand that eukaryotic cells have specialised organelles to facilitate biochemical processes - photosynthesis (chloroplasts) - cellular respiration (mitochondria) - synthesis of complex molecules including proteins (rough endoplasmic reticulum), carbohydrates, lipids and steroids (smooth endoplasmic reticulum), pigments, tannins and polyphenols (plastids) - the removal of cellular products and wastes (lysosomes)	• Cell Organelles
identify the following structures from an electron micrograph: chloroplast, mitochondria, rough endoplasmic reticulum and lysosome	• Electron Micrographs
compare the structure of prokaryotes and eukaryotes.	• Prokaryotic Cells • Eukaryotic Cells • Prokaryotic vs. Eukaryotic Cells
recognise the requirements of all cells for survival, including - energy sources (light or chemical) - matter (gases such as carbon dioxide and oxygen) - simple nutrients in the form of monosaccharides,	• Cell Survival

disaccharides, polysaccharides - amino acids, fatty acids, glycerol, nucleic acids, ions and water - removal of wastes (carbon dioxide, oxygen, urea, ammonia, uric acid, - water, ions, metabolic heat)	
recognise that prokaryotic and eukaryotic cells have many features in common, which is a reflection of their common evolutionary past recall that prokaryotic cells lack internal membrane bound organelles, do not have a nucleus, are significantly smaller than eukaryotes, usually have a single circular chromosome and exist as single cells	• Prokaryotic Cells • Eukaryotic Cells • Prokaryotic vs. Eukaryotic Cells
understand that eukaryotic cells have specialised organelles to facilitate biochemical processes - photosynthesis (chloroplasts) - cellular respiration (mitochondria) - synthesis of complex molecules including proteins (rough endoplasmic reticulum), carbohydrates, lipids and steroids (smooth endoplasmic reticulum), pigments, tannins and polyphenols (plastids) - the removal of cellular products and wastes (lysosomes)	• Cell Organelles
identify the following structures from an electron micrograph: chloroplast, mitochondria, rough endoplasmic reticulum and lysosome	• Electron Micrographs
compare the structure of prokaryotes and eukaryotes.	• Prokaryotic Cells • Eukaryotic Cells • Prokaryotic vs. Eukaryotic Cells

Internal membranes and enzymes

Content Descriptor	Lesson Names
explain, using an example, how the arrangement of internal membranes can control biochemical processes (e.g. folding of membrane in mitochondria increases the surface area for enzyme-controlled reactions)	• Internal Membranes
recognise that biochemical processes are controlled and regulated by a series of specific enzymes	• Introducing Enzymes
explain how reaction rates of enzymes can be affected by factors, including temperature, pH, the presence of	• Factors Affecting Enzymes • Examples of Enzyme Reactions

inhibitors, and the concentrations of reactants and products.	
describe the structure and role of the active site of an enzyme	• Enzyme Structure

Energy and metabolism

Content Descriptor	Lesson Names
recall that organisms obtain the energy needed to recycle Adenosine Triphosphate (ATP) from glucose molecules in the process of cellular respiration	• Introduction to Metabolism
recall that the process of photosynthesis is an enzyme-controlled series of chemical reactions that occurs in the chloroplast in plant cells and uses light energy to synthesise organic compounds (glucose), and the overall process can be summarised in a balanced chemical equation summarise the process of photosynthesis in terms of the light-dependent reactions and light-independent reactions demonstrate the relationship between the light-dependent reactions and light-independent reactions	• Photosynthesis • Factors Affecting the Rate of Photosynthesis • Light Reactions of Photosynthesis
recognise that cellular respiration is an enzyme-controlled series of chemical reactions and that the reaction sequence known as aerobic respiration (glycolysis, Krebs cycle and electron transfer chain) requires oxygen	• Aerobic Respiration
summarise the reactions of aerobic respiration by the chemical equation: glucose + oxygen -> carbon dioxide + water + energy C6H1206 + 602 -> 6C02 + 6H20 + 36–38 ATP recall that, with an undersupply of oxygen, ATP is produced from glucose by the reaction sequence known as anaerobic respiration (glycolysis with ‘fermentation’)	• Anaerobic Respiration
analyse multiple modes (i.e. diagrams, schematics, images) of energy transfer.	

Science as a Human Endeavour (SHE)

Content Descriptor	Lesson Names
Science as a Human Endeavour (SHE)	• Stem Cell Research • Photosynthesis and Productivity • Cell Membrane Model Development

Topic 2: Multicellular organisms

Cell differentiation and specialisation

Content Descriptor	Lesson Names
understand that stem cells differ from other cells by being unspecialised, and have properties of self-renewal and potency recognise that stem cells differentiate into specialised cells to form tissues and organs in multicellular organisms	• Stem Cells and Differentiation
recognise that multicellular organisms have a hierarchical structural organisation of cells, tissues, organs and systems.	• Hierarchy of Organisation

Gas exchange and transport

Content Descriptor	Lesson Names
explain the relationship between the structural features (large surface area, moist, one or two cells thick and surrounded by an extensive capillary system) and function of gaseous exchange surfaces (alveoli and gills) in terms of exchange of gases (oxygen, carbon dioxide)	• Introduction to Respiration • Breathing • Gas Exchange • Gas Exchange in Fish
explain how the structure and function of capillaries facilitates the exchange of materials (water, oxygen, carbon dioxide, ions and nutrients) between the internal environment and cells use data presented as diagrams, schematics and tables to predict the direction in which materials will be exchanged between	• Introduction to the Circulatory System • Heart • Blood Vessels • Blood

- alveoli and capillaries - capillaries and muscle tissue.	

Exchange of nutrients and wastes

Content Descriptor	Lesson Names
identify the characteristics of absorptive surfaces within the digestive system and relate to the structure and function of the villi	• Digestive System Overview • Absorption of Nutrients
describe the role of digestive enzymes (amylase, protease, lipase) in chemical digestion	• Digestive Enzymes
recognise the different types of nitrogenous wastes produced by the breakdown of proteins	• Nitrogenous Waste
explain the function of each of the sections of the nephron and its function in the production of urine (glomerulus, Bowman's capsule, proximal and distal tubules, Loop of Henle, collecting tubule)	• Introduction to Excretory System • Excretory Organs • The Kidneys & Urine Production • The Nephron
explain how glomerular filtration, selective reabsorption and secretion across nephron membranes contribute to removal of waste.	• The Kidneys & Urine Production • The Nephron

Plant systems - gas exchange and transport systems

Content Descriptor	Lesson Names
describe the role of stomata and guard cells in controlling the movement of gases (oxygen, carbon dioxide and water vapour) in leaves	• Gas Exchange in Plants
explain how the leaf facilitates that gas exchange (oxygen, carbon dioxide and water vapour) in plants	• Gas Exchange in Plants • Leaf Structure and Photosynthesis
explain the relationship between photosynthesis and the main tissues of leaves (spongy and palisade mesophyll, epidermis, cuticle and vascular bundles)	• Leaf Structure and Photosynthesis
describe and contrast the structure and function of xylem and phloem tissue (sieve tubes, sieve plates, companion cells)	• Xylem and Phloem Structure
explain how water and dissolved minerals move through xylem via the roles of root pressure, transpiration stream and cohesion of water molecules discuss the factors (light, temperature, wind, humidity) that influence the rate of transpiration explain the transport of products of photosynthesis and	• Transpiration • Translocation

some mineral nutrients via translocation in the phloem.	

Science as a Human Endeavour (SHE)

Content Descriptor	Lesson Names
Science as a Human Endeavour (SHE)	• Animal Ethics • Bioartificial Organs • Organ and Tissue Transplantation

Unit 2: Maintaining the internal environment

Topic 1: Homeostasis

Homeostasis

Content Descriptor	Lesson Names
recall that homeostasis involves a stimulus-response model in which change in the condition of the external or internal environment is detected and appropriate responses occur via negative feedback	• Introduction to Homeostasis • Maintaining the Internal Environment
recognise that sensory receptors (chemo, thermos, mechano, photo, noci) detect stimuli and can be classified by the type of stimulus recall that effectors are either muscles (which contract in response to neural stimuli) or glands (which produce secretions)	• Stimulus-Response Model
interpret feedback control diagrams for either nervous or hormonal systems (i.e. recognise stimulus, receptors, control centre, effector and communication pathways)	• Negative and Positive Feedback
understand that metabolism describes all of the chemical reactions involved in sustaining life and is either catabolic or anabolic *explain why changes in metabolic activity alter the optimum conditions for catalytic activity of enzymes (with reference to tolerance limits).*	• Introduction to Metabolism

Neural homeostatic control pathways

Content Descriptor	Lesson Names
identify cells that transport nerve impulses from sensory receptors to neurons to effectors discriminate between a sensory neurone and a motor neurone (consider dendrites, soma, body, axon, myelin sheath, nodes of Ranvier, axon terminal and synapse) explain the process of the passage of a nerve impulse in terms of transmission of an action potential (conduction within neuron) and synaptic transmission	• Components of Neural Pathways • Passage of Nerve Impulses

(communication between neurones). Refer to neurotransmitters, receptors, synaptic cleft, vesicles, postsynaptic and presynaptic neurones and signal transduction	

Hormonal homeostatic control pathways

Content Descriptor	Lesson Names
recall that hormones are chemical messengers (produced mostly in endocrine glands) that relay messages to cells displaying specific receptors for each hormone via the circulatory or lymphatic system recognise how a cell's sensitivity to a specific hormone is directly related to the number of receptors it displays for that hormone (an increase in receptors = upregulation, a decrease = downregulation) describe how receptor binding activates a signal transduction mechanism and alters cellular activity (results in an increase or decrease in normal processes).	• The Endocrine System • Endocrine System in Action • Action of Hormones

Thermoregulation

Content Descriptor	Lesson Names
identify and explain the varying thermoregulatory mechanisms of endotherms and how they control heat exchange and metabolic activity in terms of - structural features (brown adipose tissue, increased number of mitochondria per cell, insulation) - behavioural responses (kleptothermy, hibernation, aestivation and torpor) - physiological mechanisms (vasomotor control, evaporative heat loss, countercurrent heat exchange, thermogenesis/metabolic activity from organs and tissues) - homeostatic mechanisms (thyroid hormones, insulin).	• Thermoregulation • Modelling Human Thermoregulation

Osmoregulation

Content Descriptor	Lesson Names
identify and explain the various homeostatic mechanisms that maintain water balance in animals (osmoregulators and osmoconformers) in terms of - structural features (excretory system)	• Osmoregulation I • Osmoregulation II • Osmoregulation Adaptations in Plants

- behavioural responses - physiological mechanisms - homeostatic mechanisms (antidiuretic hormone (ADH) and the kidney) identify and explain the various mechanisms that maintain water balance in plants in terms of structural features (stomata, vacuoles, cuticle) and homeostatic mechanisms (abscisic acid); consider xerophytes, hydrophytes, halophytes and mesophytes in responses	

Science as a Human Endeavour (SHE)

Content Descriptor	Lesson Names
Science as a Human Endeavour (SHE)	• Modelling Human Thermoregulation • Snake Antivenom Production • Use of Hormones in the Dairy Industry

Topic 2: Infectious diseases

Infectious disease

Content Descriptor	Lesson Names
identify the difference between infectious diseases (invasion by a pathogen and can be transmitted from one host to another) and non-infectious diseases (genetic and lifestyle diseases)	• Introduction to Infectious Diseases
identify the following pathogens: prions, viruses, bacteria, fungi, protists and parasites describe the following virulence factors that aid in pathogenesis: adherence factors, invasion factors, capsules, toxins and lifecycle changes	• Revision Lesson - Pathogens • Bacteria • Viruses • Fungi • Protists • Parasites • Prions
identify from given data and describe the following modes of disease transmission: direct contact, contact with body fluids, contaminated food, water and disease-specific vectors.	• Infection From Food • Infection From Water • Disease in Animals and Zoonoses • Infection From Others

Immune response and defence against disease

Content Descriptor	Lesson Names
understand how pathogens (bacterial and viral) can cause both physical and chemical changes in host cells that stimulate the host immune responses (introduction of foreign chemicals via the surface of the pathogen, production of toxins, recognition of self and non-self)	• Introduction to Immune Responses
recognise that all plants and animals have innate immune responses (general/non-specific) and that vertebrates also have adaptive (specific) immune responses	• Innate Immunity
recall examples of physical defence strategies (barriers and leaf structures) and chemical defence strategies (plant defensins and production of toxins) of plants in response to the presence of pathogens	• Plant Immunity and Defence
recall that the innate immune response in vertebrates comprises surface barriers (skin, mucus and cilia), inflammation and the complement system	• Innate Immunity
describe the inflammatory response (prostaglandins, vasodilation, phagocytes) and the role of the complement system	• Inflammation
explain the adaptive immune responses in vertebrates — humoral (production of antibodies by B lymphocytes) and cell-mediated (T lymphocytes) — and recognise that memory cells are produced in both situations interpret long-term immune response data analyse the differences and similarities between passive immunity (antibodies gained via the placenta and via antibody serum injection) and active immunity (acquired via natural exposure to a pathogen or through the use of vaccines) for both naturally and artificially acquired immunity.	• Adaptive immune response overview • Cell-Mediated and Antibody-Mediated (Humoral) Immunity

Transmission and spread of disease (epidemiology)

Content Descriptor	Lesson Names
recognise that the transmission of disease is facilitated by regional and global movement of organisms identify the interrelated factors affecting immunity (persistence of pathogens within host, transmission	• Disease Transmission • Spread of Disease

analyse these factors to predict potential outbreaks	• Disease Prevention • Modelling Disease Outbreak and Spread
evaluate strategies to control the spread of disease - personal hygiene measures - community level: contact tracing and quarantine, school and workplace - closures, reduction of mass gatherings, temperature screening and travel restrictions	• Modelling Disease Outbreak and Spread • Managing Pandemics in the Asia Region • Quarantine and Biosecurity
make decisions and justify them in regard to best practice for the prevention of disease outbreaks based on the critical analysis of relevant and current information	• Managing Pandemics in the Asia Region • Quarantine and Biosecurity
interpret data for the modelling of the spread of disease using secondary data or computer simulations.	• Modelling Disease Outbreak and Spread

Science as a Human Endeavour (SHE)

Content Descriptor	**Lesson Names**
Science as a Human Endeavour (SHE)	• Modelling Disease Outbreak and Spread • Managing Pandemics in the Asia Region • Quarantine and Biosecurity

Unit 3: Biodiversity and interconnectedness

Topic 1: Describing biodiversity

Biodiversity

Content Descriptor	Lesson Names
recognise that biodiversity includes the diversity of species and ecosystems	• Factors Affecting Biodiversity
determine diversity of species using measures such as species richness, evenness (relative species abundance), percentage cover, percentage frequency and Simpson's diversity index	• Factors Affecting Biodiversity • Measuring Biodiversity
use species diversity indices, species interactions (predation, competition, symbiosis, disease) and abiotic factors (climate, substrate, size/depth of area) to compare ecosystems across spatial and temporal scales	• Species Interrelationships • Ecosystems • Abiotic Factors • Biotic Factors and Competition • Symbiosis • Biomes
explain how environmental factors limit the distribution and abundance of species in an ecosystem.	• Species Distributions

Classification processes

Content Descriptor	Lesson Names
recognise that biological classification can be hierarchical and based on different levels of similarity of physical features, methods of reproduction and molecular sequences	• Classification • Classifying Ecosystems
describe the classification systems for - similarity of physical features (the Linnaean system) - methods of reproduction (asexual, sexual — K and r selection) - molecular sequences (molecular phylogeny — also called cladistics)	• Linnaean Classification • Classification Systems
define the term clade recall that common assumptions of cladistics include a common ancestry, bifurcation and physical change interpret cladograms to infer the evolutionary	*Further development planned*

relatedness between groups of organisms analyse data from molecular sequences to infer species evolutionary relatedness	
recognise the need for multiple definitions of species	• Identifying Species
identify one example of an interspecific hybrid that does not produce fertile offspring (e.g. mule, Equus mulus)	*Further development planned*
explain the classification of organisms according to the following species interactions: predation, competition, symbiosis and disease	• Classification Systems
understand that ecosystems are composed of varied habitats (microhabitat to ecoregion) interpret data to classify and name an ecosystem explain how the process of classifying ecosystems is an important step towards effective ecosystem management (consider old-growth forests, productive soils and coral reefs)	• Classifying Ecosystems
describe the process of stratified sampling in terms of - purpose (estimating population, density, distribution, environmental gradients and profiles, zonation, stratification) - site selection - choice of ecological surveying technique (quadrats, transects) - minimising bias (size and number of samples, random-number generators, counting criteria, calibrating equipment and noting associated precision) - methods of data presentation and analysis	• Stratified Sampling

Science as a Human Endeavour (SHE)

Content Descriptor	Lesson Names
Science as a Human Endeavour	*Further development planned*

Topic 2: Ecosystem Dynamics

Functioning Ecosystems

Content Descriptor	Lesson Names
sequence and explain the transfer and transformation of solar energy into biomass as it flows through biotic	• Introduction to Functioning Ecosystems • Ecological Energy Efficiency

components of an ecosystem, including - converting light to chemical energy - producing biomass and interacting with components of the carbon cycle	
analyse and calculate energy transfer (food chains, webs and pyramids) and transformations within ecosystems, including - loss of energy through radiation, reflection and absorption - efficiencies of energy transfer from one trophic level to another - biomass construct and analyse simple energy-flow diagrams illustrating the movement of energy through ecosystems, including the productivity (gross and net) of the various trophic levels	• Ecological Energy Efficiency • Food Chains and Food Webs
describe the transfer and transformation of matter as it cycles through ecosystems (water, carbon and nitrogen)	• The Carbon Cycle • The Nitrogen Cycle • The Water Cycle
define ecological niche in terms of habitat, feeding relationships and interactions with other species	• Ecological Niches
define keystone species and understand the critical role they play in maintaining the structure of a community	• Keystone Species • Conservation of Keystone Species
understand the competitive exclusion principle	• Ecological Relationships
analyse data to identify species (including microorganisms) or populations occupying an ecological niche	• Ecological Niches
analyse data (from an Australian ecosystem) to identify a keystone species and predict the outcomes of removing the species from an ecosystem.	• Keystone Species • Conservation of Keystone Species

Population Ecology

Content Descriptor	Lesson Names
define the term carrying capacity explain why the carrying capacity of a population is determined by limiting factors (biotic and abiotic) calculate population growth rate and change (using birth, death, immigration and emigration data) use the Lincoln Index to estimate population size from	• Populations and Carrying Capacity • Limiting Factors • Human Population & Changing Environments

secondary or primary data analyse population growth data to determine the mode (exponential growth J-curve, logistic growth S-curve) of population growth discuss the effect of changes within population-limiting factors on the carrying capacity of the ecosystem.	

Changing Ecosystems

Content Descriptor	Lesson Names
explain the concept of ecological succession (refer to pioneer and climax communities and seres) differentiate between the two main modes of succession: primary and secondary identify the features of pioneer species (ability to fixate nitrogen, tolerance to extreme conditions, rapid germination of seeds, ability to photosynthesise) that make them effective colonisers	• Succession • Adaptations, Humans and Succession
analyse data from the fossil record to observe past ecosystems and changes in biotic and abiotic components	• Past Ecosystems I: A Brief History of the Earth • Past Ecosystems II: Evidence
analyse ecological data to predict temporal and spatial successional changes	• Succession
predict the impact of human activity on the reduction of biodiversity and on the magnitude, duration and speed of ecosystem change.	• Human Impacts on Land • Human Impacts on Wetlands • Human Impacts on Forest Biomes • Human Impacts on Marine Biomes

Science as a Human Endeavour (SHE)

Content Descriptor	Lesson Names
Science as a Human Endeavour (SHE)	*Further development planned*

Unit 4: Heredity and and the continuity of life

Topic 1: DNA, genes and the continuity of life

DNA structure and replication

Content Descriptor	Lesson Names
understand that deoxyribonucleic acid (DNA) is a double-stranded molecule that occurs bound to proteins (histones) in chromosomes in the nucleus, and as unbound circular DNA in the cytosol of prokaryotes, and in the mitochondria and chloroplasts of eukaryotic cells	• Basics of DNA • Structure of DNA
recall the structure of DNA, including - nucleotide composition - complementary base pairing - weak, base-specific hydrogen bonds between DNA strands	• Nitrogenous Bases
explain the role of helicase (in terms of unwinding the double helix and separation of the strands) and DNA polymerase (in terms of formation of the new complementary strands) in the process of DNA replication. Reference should be made to the direction of replication.	• DNA Replication

Cellular replication and variation

Content Descriptor	Lesson Names
within the process of meiosis I and II - recognise the role of homologous chromosomes - describe the processes of crossing over and recombination and - demonstrate how they contribute to genetic variation compare and contrast the process of spermatogenesis and oogenesis (with reference to haploid and diploid cells).	• Mitosis • Meiosis • Mitosis vs. Meiosis • Spermatogenesis • Oogenesis
demonstrate how the process of independent assortment and random fertilisation alter the variations in the genotype of offspring.	• Meiosis

Gene expression

Content Descriptor	Lesson Names
define the terms genome and gene	• Genes
understand that genes include 'coding' (exons) and 'noncoding' DNA (which includes a variety of transcribed proteins: functional RNA (i.e. tRNA), centromeres, telomeres and introns. Recognise that many functions of 'noncoding' DNA are yet to be determined)	• Genes • Protein Synthesis
explain the process of protein synthesis in terms of - transcription of a gene into messenger RNA in the nucleus - translation of mRNA into an amino acid sequence at the ribosome (refer to transfer RNA, codons and anticodons)	• Protein Synthesis
recognise that the purpose of gene expression is to synthesise a functional gene product (protein or functional RNA); that the process can be regulated and is used by all known life	• Regulating Gene Expression
identify that there are factors that regulate the phenotypic expression of genes - during transcription and translation (proteins that bind to specific DNA sequences) - through the products of other genes - via environmental exposure (consider the twin methodology in epigenetic studies)	• Protein Synthesis • Regulating Gene Expression
recognise that differential gene expression, controlled by transcription factors, regulates cell differentiation for tissue formation and morphology	• Regulating Gene Expression
recall an example of a transcription factor gene that regulates morphology (HOX transcription factor family) and cell differentiation (sex-determining region Y).	• Regulating Gene Expression

Mutations

Content Descriptor	Lesson Names
identify how mutations in genes and chromosomes can result from errors in - DNA replication (point and frameshift mutation) - cell division (non-disjunction) - damage by mutagens (physical, including UV radiation, ionising radiation and heat and chemical)	• Mutations

explain how non-disjunction leads to aneuploidy use a human karyotype to identify ploidy changes and predict a genetic disorder from given data	
describe how inherited mutations can alter the variations in the genotype of offspring.	• Phenotype and Survival

Inheritance

Content Descriptor	Lesson Names
predict frequencies of genotypes and phenotypes using data from probability models (including frequency histograms and Punnett squares) and by taking into consideration patterns of inheritance for the following types of alleles: autosomal dominant, sex linked and multiple	• Inheriting Alleles and Punnett Squares • Making Punnett Squares • Monohybrid Inheritance • Incomplete and Codominance • Pedigree Charts • Sex Linkage • Sex Linkage, Punnett Squares and Pedigrees
define polygenic inheritance and predict frequencies of genotypes and phenotypes for using three of the possible alleles.	• Polygenic Inheritance

Biotechnology

Content Descriptor	Lesson Names
describe the process of making recombinant DNA - isolation of DNA, cutting of DNA (restriction enzymes) - insertion of DNA fragment (plasmid vector) - joining of DNA (DNA ligase) - amplification of recombinant DNA (bacterial transformation)	• Recombinant DNA • Enzymes in Biotechnology
recognise the applications of DNA sequencing to map species' genomes and DNA profiling to identify unique genetic information	• Biotechnological Techniques • DNA Sequencing • DNA Profiling and Forensics
explain the purpose of polymerase chain reaction (PCR) and gel electrophoresis appraise data from an outcome of a current genetic biotechnology technique to determine its success rate.	• Biotechnological Techniques • Gel Electrophoresis • Polymerase Chain Reaction • Genetically Modified Organisms • Transgenesis: Food Production • Social and Ethical Implications of Biotechnology

Science as a Human Endeavour (SHE)

Content Descriptor	Lesson Names
Science as a Human Endeavour	*Further development planned*

Topic 2: Continuity of life on Earth

Evolution

Content Descriptor	Lesson Names
define the terms evolution, microevolution and macroevolution determine episodes of evolutionary radiation and mass extinctions from an evolutionary timescale of life on Earth (approximately 3.5 billion years) interpret data (i.e. degree of DNA similarity) to reveal phylogenetic relationships with an understanding that comparative genomics involves the comparison of genomic features to provide evidence for the theory of evolution.	• Evolution on Earth

Natural selection and microevolution

Content Descriptor	Lesson Names
recognise natural selection occurs when the pressures of environmental selection confer a selective advantage on a specific phenotype to enhance its survival (viability) and reproduction (fecundity)	• Darwin's Theory of Evolution • Natural Selection
identify that the selection of allele frequency in a gene pool can be positive or negative interpret data and describe the three main types of phenotypic selection: stabilising, directional and disruptive	• Phenotypic Selection
explain microevolutionary change through the main processes of mutation, gene flow and genetic drift	• Microevolutionary Change Mechanisms

Speciation and macroevolution

Content Descriptor	Lesson Names
recall that speciation and macroevolutionary changes result from an accumulation of microevolutionary changes over time identify that diversification between species can follow one of four patterns: divergent, convergent, parallel and coevolution	• Patterns of Diversification

describe the modes of speciation: allopatric, sympatric, parapatric	• Modes of Speciation • Instantaneous Speciation
understand that the different mechanisms of isolation — geographic (including environmental disasters, habitat fragmentation), reproductive, spatial, and temporal — influence gene flow	• Mechanisms of Isolation
explain how populations with reduced genetic diversity (i.e. those affected by population bottlenecks) face an increased risk of extinction	• Genetic Drift
interpret gene flow and allele frequency data from different populations in order to determine speciation.	• Gene Flow and Allele Frequency

Science as a Human Endeavour (SHE)

Content Descriptor	**Lesson Names**
Science as a Human Endeavour	*Further development planned*