| **Biology – ATAR Year 12****Unit 3** |
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| **Learning outcomes**By the end of this unit, students:* understand the cellular processes and mechanisms that ensure the continuity of life, and how these processes contribute to unity and diversity within a species
* understand the processes and mechanisms that explain how life on Earth has persisted, changed and diversified over the last 3.5 billion years
* understand how models and theories have developed over time
* use science inquiry skills to design, conduct, evaluate and communicate investigations into heredity, gene technology applications, and population gene pool changes
* evaluate, with reference to empirical evidence, claims about heredity processes, gene technology, and population gene pool processes, and justify evaluations
* communicate biological understanding using qualitative and quantitative representations in appropriate modes and genres.
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| **Week** | **SYLLABUS POINTS** | **Key Teaching Points** | **Resources & Homework** | **Assessment** |
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| **Science Understanding** | **Science as a Human Endeavour** | **Science Inquiry Skills** |
| **Term 1 Week 1**  | HeredityThe structural properties of the DNA molecule, including nucleotide composition and pairing and the hydrogen bonds between strands of DNA, allow for replication DNA is a helical double-stranded molecule that occurs bound to proteins in chromosomes in the nucleus, and as unbound circular DNA in the cytosol of prokaryotes, and in the mitochondria and chloroplasts of eukaryotic cellsThe continuity of life requires the replication of genetic material and its transfer to the next generation through processes, including binary fission, mitosis, meiosis and fertilisationSelect, construct and use appropriate representations, including models of DNA replication, transcription and translation, Punnett squares and allele frequencies in gene pools, to communicate conceptual understanding, solve problems and make predictions | Discuss course outline and assessment outline.Location of DNA in cellsOverall DNA StructureDNA Replication ProcessEukaryotic Chromosomes Homologous ChromosomesAutosomes and sex chromosomes.Loci and genesProkaryotic Chromosomes Cell Division | **Weebly****Khan Academy:**[Molecular Structure of DNA](https://www.khanacademy.org/science/high-school-biology/hs-molecular-genetics/hs-discovery-and-structure-of-dna/v/molecular-structure-of-dna)[Chromosomes, Chromatids and Chromatin](https://www.khanacademy.org/science/high-school-biology/hs-reproduction-and-cell-division/hs-chromosome-structure-and-numbers/v/chromosomes-chromatids-chromatin-etc)**Nelson**: Read Chapter 1QS 1.1, 1.2, 1.3, 1.4**Activity Sheets:**1.1 1.2, 1.3 |  |
| **Term 1 Week 2** | Proteins, including enzymes and structural proteins, are essential to cell structure and functioningProtein synthesis involves transcription of a gene into messenger RNA in the nucleus, and translation into an amino acid sequence at the ribosomeThe genetic code is a base triplet code; genes include ‘coding’ and ‘non-coding’ DNA, and many genes contain information for protein productionThe phenotypic expression of genes depends on the interaction of genes and the environmentSelect, construct and use appropriate representations, including models of DNA replication, transcription and translation, Punnett squares and allele frequencies in gene pools, to communicate conceptual understanding, solve problems and make predictions | What are Proteins? Focus: Enzymes.How are Proteins synthesised?DNA vs RNA Transcription Process Translation ProcessThe genetic Code (codons & amino acids).Environmental influences on phenotypic expression. | **Weebly**:**Khan Academy:**[Introduction to Amino Acids](https://www.khanacademy.org/science/biology/macromolecules/proteins-and-amino-acids/v/introduction-to-amino-acids?modal=1)**Nelson**: Read pp. 36-45QS 2.1, 2.2, 2.3, 2.4, 2.5**Activity Sheet:**2.2, 2.3 | **Term 1 Week 4** |
| **Term 1 Week 3** | Mutations in genes and chromosomes can result from errors in DNA replication or cell division, or from damage by physical or chemical factors in the environmentVariations in the genotype of offspring arise as a result of the processes of meiosis, including crossing over and random assortment of chromosomes, and fertilisation, as well as a result of mutations | Mutations as the source of genetic variation. Types of gene mutationsVariations in chromosomes.Activity 3.1 – Facial Tumours | **Weebly**:**Khan Academy:*** [Gene & environment interaction](https://www.khanacademy.org/science/ap-biology/heredity/environmental-effects-on-phenotype/v/gene-environment-interaction)
* [An Introduction to Genetic Mutation](https://www.khanacademy.org/science/ap-biology/gene-expression-and-regulation/mutations-ap/v/an-introduction-to-genetic-mutations)
* [The different types of mutations](https://www.khanacademy.org/test-prep/mcat/biomolecules/genetic-mutations/v/the-different-types-of-mutations)

**Nelson**: Read pp. 63-82QS 3.1, 3.2, 3.3, 3.4Chpt Rv 3 **Activity Sheet:**3.1, 3.2, 3.3 |  |
| **Term 1 Week 4** | DNA sequencing enables mapping of species genomes; DNA profiling identifies the unique genetic makeup of individualsRecombinant DNA technology and DNA identification technologies are applied in agriculture and environmental conservationTransgenic organisms have been engineered for desirable traits, including resistance, faster growth rate, greater product quality and yield, and tolerance to adverse environmental conditionsBiotechnology can be used in environmental conservation for* monitoring endangered species
* assessing gene pools for breeding programs
* quarantine
 | Transgenic OrganismsCutting DNA, Recombining DNA, Amplifying DNA DNA Sequencing\*Gel Electrophoresis\*DNA SequencingGenetic CloningGene TransferDNA Profiling | **Weebly**:**Nelson**: Read p.132 -149QS 5.3, 5.4, 5.5, 5.6, 5.7Chpt Rv 5 |  |
| **Term 1 Week 5** | Identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomesConduct investigations, including the use of probabilities to predict inheritance patterns, real or virtual gel electrophoresis, and population simulations to predict population changes, safely, competently and methodically for the collection of valid and reliable dataRepresent data in meaningful and useful ways, including the use of mean, median, range and probability; organise and analyse data to identify trends, patterns and relationships; discuss the ways in which measurement error, instrumental accuracy, the nature of the procedure and the sample size may influence uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions | Practical Inquiry Task (1 week) |  | **Task 1:** Electrophoresis & Validation - 10% |
| **Term 1 Week 6** | Frequencies of genotypes and phenotypes of offspring are determined by patterns of inheritance, including dominance, autosomal and sex-linked alleles, multiple alleles and polygenesSelect, construct and use appropriate representations, including models of DNA replication, transcription and translation, Punnett squares and allele frequencies in gene pools, to communicate conceptual understanding, solve problems and make predictions | Mendelian GeneticsDominant/ Recessive GenesIncomplete, Partial and CodominancePunnett SquaresLethal phenotypes Multiple alleles and dihybrid inheritanceSex-linked Inheritance | **Weebly**:**Nelson**: Read p.92-118QS 4.1, 4.2, 4.3, 4.4.Chpt Rv 4**Activity Sheet:**4.1, 4.2, 4.3 |  |
| **Term 1 Week 7-8** | **Continuity of Life**Life has existed on Earth for approximately 3.5 billion years and has changed and diversified over timeEvidence for the theory of evolution includes:* comparative genomics (molecular evidence),
* the fossil record,
* comparative anatomy and embryology

Evolutionary relationships between groups can be represented using phylogenetic treesInterpret a range of scientific and media texts, and evaluate models, processes, claims and conclusions by considering the quality of available evidence, including interpreting confidence intervals in secondary data; and use reasoning to construct scientific argumentsTechnological developments in the fields of comparative genomics, comparative biochemistry and bioinformatics have enabled identification of further evidence for evolutionary relationships | Geological time Evidence for evolutionFossilsMolecularComparative anatomy and embryologyPhylogenetic treesTechnological developments | **Weebly**:**Nelson**: Read 154 -179QS 6.1, 6.2, 6.3, 6.4, 6.5Chpt Rv 6**Activity Sheet:**6.1, 6.2, 6.3 | **Task 2**: DNA and Inheritance Test - 5% |
| **Term 1 Week 9-10** | Natural selection occurs when selection pressures in the environment confer a selective advantage on a specific phenotype to enhance its survival and reproduction; this results in changes in allele frequency in the gene pool of a populationIn addition to environmental selection pressures, sexual selection, mutation, gene flow and genetic drift can contribute to changes in allele frequency in a population gene poolSelective breeding (artificial selection) through the intentional reproduction of individuals with desirable characteristics results in changes in allele frequencies in the gene pools over timeSpeciation and macro-evolutionary changes result from an accumulation of micro-evolutionary changes over timeDiffering selection pressures between geographically isolated populations may lead to allopatric speciationPopulations with reduced genetic diversity face increased risk of extinctionConservation planning to maintain viable gene pools must consider: biogeography, reproductive behaviour, population dynamics. | Natural selectionSources of variationNatural selectionGene flowGenetic driftArtificial selectionSpeciationCausesAllopatric speciationExamples of speciationConvergent evolutionDivergent evolution | **Weebly**:**Nelson**: Read 184 -204QS 7.1, 7.2, 7.3, 7.4, 7.5Chpt Rv 7**Activity Sheet:**7.1, 7.2, 7.3 | **Task 3:** Fossils and Evolution Extended Response – 5% |
| **Term 2 Week 1** | Using transgenic organisms may have adverse effects on genetic diversity and the environment, including* the effects on non-target organisms
* more rapid evolution of pesticide-resistant species
* the possibility of gene flow from crop species to weed species resulting in the emergence of ‘super weeds’

Technological developments in the fields of comparative genomics, comparative biochemistry and bioinformatics have enabled identification of further evidence for evolutionary relationshipsCommunicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports | Task 4: First LessonCase-Studies:* Biotechnology & genetics in Environmental Conservation
* Biotechnology and Genetics in Sustainable Agriculture
 |  | **Task 4:** Continuity of Life Test - 5% |
| **Term 2 Week 2** | Represent data in meaningful and useful ways, including the use of mean, median, range and probability; organise and analyse data to identify trends, patterns and relationships; discuss the ways in which measurement error, instrumental accuracy, the nature of the procedure and the sample size may influence uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusionsDesign investigations, including the procedure(s) to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics, including animal ethics | Science Inquiry Skills & Genetics RevisionVisualising Chromosomes | Read Chapter 14 |  |
| **Term 2 Week 3****(AFW)** | Exam Revision |  |  |  |
| **Term 2 Week 4 - 5****(Exams)** | Exams & Year 12 Retreat |  |  | **Task 5:**Unit 3 Exam - 20% |

| **Biology – ATAR Year 12****Unit 4** |
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| Learning outcomesBy the end of this unit, students:* understand the mechanisms by which plants and animals use homeostasis to control their internal environment in a changing external environment
* understand the ways in which infection, transmission and spread of disease occur in vector-borne diseases
* understand how biological models and theories have developed over time
* use science inquiry skills to design, conduct, evaluate and communicate investigations into organisms’ responses to changing environmental conditions and infectious disease
* communicate biological understanding using qualitative and quantitative representations in appropriate modes and genres.
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| **Week** | **SYLLABUS POINTS** | **Key Teaching Points** | **Resources & Homework** | **Assessment** |
| --- | --- | --- | --- | --- |
| **Science Understanding** | **Science as a Human Endeavour** | **Science Inquiry Skills** |
| **Term 2 Week 6-7**  | **Homeostasis**Homeostasis is the process by which the body maintains a relatively constant internal environment; it involves a stimulus-response model in which change in external or internal environmental conditions is detected and appropriate responses occur via negative feedbackChanges in an organism’s metabolic activity, in addition to structural features and changes in physiological processes and behaviour, enable the organism to maintain its internal environment within tolerance limits (temperature, nitrogenous waste, water, salts, and gases)Thermoregulatory mechanisms include structural features, behavioural responses and physiological mechanisms to control heat exchange and metabolic activity; animals can be endothermic or ectothermicThe type of nitrogenous waste produced by different vertebrate groups can be related to the availability of water in the environmentAnimals have a variety of behavioural, physiological and structural adaptations to maintain water and salt balance in terrestrial and aquatic environmentsTo maintain water balance and allow for gas exchange, xerophytes and halophytes have a variety of structural and physiological adaptationsSelect, construct and use appropriate representations, including diagrams and flow charts, to communicate conceptual understanding, solve problems and make predictions | Stimulus Response ModelTerrestrial* Endotherms
* Ectotherms

Arid Environment* Thermoregulation
* Water/Salt balance

Aquatic Environment* Endotherms
* Ectotherms
* Thermoregulation
* Water/Salt balance
* Xerophytes
* Halophytes

Plan investigation for completion in Week 8 | **Weebly****Nelson**: Read Chapter 8 & 9p212 - 272All Question sets from Chpt 8 & 9**Activity Sheet:**8.1, 8.2, 8.3, 9.1, 9.2, 9.3 |  |
| **Term 2 Week 8-9** | Identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomesDesign investigations, including the procedure(s) to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics, including the rights of living organisms.Conduct investigations, including using models of homeostasis and disease transmission, safely, competently and methodically for valid and reliable collection of dataRepresent data in meaningful and useful ways, including the use of mean, median, range and probability; organise and analyse data to identify trends, patterns and relationships; discuss the ways in which measurement error, instrumental accuracy, the nature of the procedure and sample size may influence uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusionsCommunicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports | Biology Camp Thursday & Friday Week 8 | **Weebly****Nelson**: Read Chapter 14 | **Task 6:** HomeostasisInvestigation &Validation - 10% |
| **Term 2 Week 10** | **Infectious disease**Infectious disease differs from other disease in that it is caused by invasion by a pathogen and can be transmitted from one host to anotherZoonoses, such as influenza, can be transmitted between vertebrate speciesThe major groups of organisms that cause disease are bacteria, fungi, protists and viruses; each group can be distinguished by its structural characteristics | Nature of diseaseTerminologyTransmissionMajor groups of pathogens structure | **Weebly****Nelson**: Read Chapter 10 pp.278-302QS 10.1, 10.2, 10.3, 10.4, 10.5**Activity Sheet:**10.1 | **Task 7:** Homeostasis Test – 5% |
| **Term 3 Week 1** | The spread of a specific disease involves a range of interrelated factors, including* + growth of the pathogen population
	+ density of the host population
	+ mode of transmission

Transmission and spread of disease is facilitated by regional and global movement of organismsSusceptibility of urban areas to epidemics and pandemics of infectious disease can be due to population density, variation in living conditions and healthcare provisions Contemporary models can project the spread of disease and simulate the effects of possible interventions. Supercomputing has enabled models to predict the relationships between epidemic frequency and location, and factors such as population size, environmental change, persistence and antibiotic resistance | Susceptibility of urban areasSpread of diseaseInterrelated factorsModelling | **Weebly****Nelson**: Read Chapter 13 pp.366-387All Chpt 13 Questions**Activity Sheets:**13.2, 13.3 |  |
| **Term 3 Week 2-3** | Diseases caused by these major pathogen groups include* tuberculosis, tetanus, crown gall of plants
* chytridiomycosis (amphibian chytrid fungus disease)
* malaria, Phytophthora dieback (jarrah dieback now considered a Protist)
* influenza, Ross River virus, viral diseases of honeybees, Australian bat lyssavirus

Interpret a range of scientific and media texts, and evaluate models, processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments. | Week 2: Bacteria & FungiWeek 3: Protists & VirusesCase Studies | **Weebly** |  |
| **Term 3 Week 4-5** | The life cycle of a pathogen and its associated diseases, including the method of invading the host, the impact on the host, and the mode of transmission (direct or indirect), determines its success for survivalThe distribution of mosquito-borne diseases may be affected by global climatic changesMany pathogens evolve rapidly in a changing environment | Pathogen Life CyclesImpact of climate changeEvolution rate of pathogens in changing environments | **Weebly****Nelson:** “Forms of Transmission” pp. 292-301QS 10.5**Activity Sheet:**10.3 | **Task 8:** Infectious Diseases Test – 5% |
| **Term 3 Week 6-8** | Management strategies are used to control the spread of infectious diseases, including* quarantine, immunisation – herd immunity, disruption of pathogen life cycle, medications – antibiotics and antivirals, physical preventative measures

Quarantine measures protect Australia’s agriculture industry and environment against the influx of disease-carrying materials and organisms in the face of increasing global trade and travelInternational cooperation and communication are needed to evaluate the risk of the spread of disease, including the emergence of new viral diseasesInterpret a range of scientific and media texts, and evaluate models, processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments | Management StrategiesInternational CooperationQuarantineCase Studies | **Weebly,****ER Research Task Handed out Wk 6.** | **Task 9:** Spread of Disease Extended Response – 5% |
| **Term 3 Week 9-10** | Exam Preparation | Exam Revision and Exams |  | **Task 10:** Final Exam 30% |