

UNIT 4 : BIOLOGY

HOW DOES LIFE CHANGE AND RESPOND TO CHANGES OVER TIME?

AREA OF STUDY 1: HOW ARE SPECIES RELATED?

Outcome 1: On completion of this unit you will be able to analyse evidence for evolutionary change, explain how relatedness between species is determined, and elaborate on the consequences of biological change in human evolution.

AREA OF STUDY 2: HOW DO HUMANS IMPACT ON BIOLOGICAL PROCESSES?

Outcome 2: On completion of this unit you will be able to describe how tools and techniques can be used to manipulate DNA, explain how biological knowledge is applied to biotechnical applications, and analyse the interrelationship between scientific knowledge and its applications in society.

AREA OF STUDY 3: PRACTICAL INVESTIGATION

Outcome 3: On the completion of this unit you will be able to design and undertake an investigation related to cellular processes and/or biological change and continuity over time, and present methodologies, findings and conclusions in a scientific poster.

Week	Topic
1	<p>AREA OF STUDY 3: PRACTICAL INVESTIGATION Weeks 1 to 3. Students undertake an extended practical investigation.</p> <p>AREA OF STUDY 2: HOW DO HUMANS IMPACT ON BIOLOGICAL PROCESSES? Biological knowledge and society</p> <ul style="list-style-type: none"> ❑ Strategies that deal with the emergence of new diseases in a globally connected world, including the distinction between epidemics and pandemics, the use of scientific knowledge to identify the pathogen, and the types of treatments. ❑ The use of chemical agents against pathogens including the distinction between antibiotics and antiviral drugs with reference to their mode of action and biological effectiveness.
2	<ul style="list-style-type: none"> ❑ The concept of rational drug design in terms of the complementary nature (shape and charge) of small molecules that are designed to bind tightly to target biomolecules (limited to enzymes) resulting in the enzyme's inhibition and giving rise to a consequential therapeutic benefit, illustrated by the Australian development of the antiviral drug Relenza as a neuraminidase inhibitor.
3	<p>AREA OF STUDY 2: HOW DO HUMANS IMPACT ON BIOLOGICAL PROCESSES? DNA manipulation</p> <ul style="list-style-type: none"> ❑ The use of enzymes including endonucleases (restriction enzymes), ligases and polymerases. ❑ Amplification of DNA using polymerase chain reaction. ❑ The use of gel electrophoresis in sorting DNA fragments, including interpretation of gel runs.

	<ul style="list-style-type: none"> ❑ The use of recombinant plasmids as vectors to transform bacterial cells.
4	<p>AREA OF STUDY 1: HOW ARE SPECIES RELATED? Changes in the genetic makeup of a population</p> <ul style="list-style-type: none"> ❑ Causes of changes in allele frequencies in a population's gene pool including types of mutations (point, frameshift, block) as a source of new alleles. ❑ Chromosomal abnormalities (aneuploidy and polyploidy). ❑ Environmental selection pressures on phenotypes as the mechanism for natural selection, gene flow and genetic drift (bottleneck and founder effect).
5	<p>AREA OF STUDY 1: HOW ARE SPECIES RELATED? Changes in the genetic makeup of a population</p> <ul style="list-style-type: none"> ❑ Biological consequences of such changes in terms of increased or reduced genetic diversity. ❑ Processes of evolution including through actions of mutations and different selection pressure on a fragmented population and subsequent isolating mechanism (allopatric speciation) that prevent gene flow. ❑ The manipulation of gene pools through selective breeding programmes.
6	<p>AREA OF STUDY 1: HOW ARE SPECIES RELATED? Changes in biodiversity over time</p> <ul style="list-style-type: none"> ❑ Significant changes in life forms in Earth's geological history including the rise of multicellular organisms, animals on land, the first flowering plants and mammals. ❑ Evidence of biological change over time including from palaeontology (the fossil record, the relative and absolute dating of fossils, types of fossils and the steps in fossilisation), biogeography, developmental biology and structural morphology. ❑ Patterns of biological change over geological time including divergent evolution, convergent evolution and mass extinctions.
7	<p>AREA OF STUDY 1: HOW ARE SPECIES RELATED? Determining the relatedness between species</p> <ul style="list-style-type: none"> ❑ Molecular homology as evidence of relatedness between species including DNA and amino acid sequences, mtDNA (the molecular clock) and DNA hybridisation technique. ❑ The use of phylogenetic trees to show relatedness between species. ❑ The evolution of novel phenotypes arising from chance events within genomes, specifically sets of genes that regulate developmental processes and lead to changes in the expression of a few master genes found across the animal phyla, as demonstrated by the expression of the gene BMP4 in beak formation of the Galapagos finches and jaw formation in the cichlid fish of Africa.
8	<p>AREA OF STUDY 1: HOW ARE SPECIES RELATED? Human change over time</p> <ul style="list-style-type: none"> ❑ Shared characteristics that define primates, hominoids and hominins. ❑ Major trends in hominin evolution from the genus <i>Australopithecus</i> to the genus <i>Homo</i> including structural, functional and cognitive changes and the consequences for cultural evolution.
9	<p>AREA OF STUDY 1: HOW ARE SPECIES RELATED? Human change over time</p>

	<ul style="list-style-type: none"> ❑ The human fossil record as an example of a classification scheme that is open to interpretations that are contested, refined or replaced when new evidence challenges them or when a new model has greater explanatory power, including whether <i>Homo sapiens</i> and <i>Homo neanderthalensis</i> interbred and the placement of <i>Homo denisovans</i> into the <i>Homo</i> evolutionary tree.
10	AREA OF STUDY 2: HOW DO HUMANS IMPACT ON BIOLOGICAL PROCESSES? Biological knowledge and society <ul style="list-style-type: none"> ❑ Techniques that apply DNA knowledge (specifically gene cloning, genetic screening and DNA profiling) including social and ethical implications and issues. ❑ The distinction between genetically modified and transgenic organisms, their use in agriculture to increase crop productivity and to provide resistance to insect predation and/or disease, and the biological, social and ethical implications that are raised by their use.
	School holidays
	School holidays
11	Revision
12	Revision
13	Study Week Commences
14	Biology Exam Friday 2 nd November 9.00-11.45am

SCHOOL BASED ASSESSMENT

SACs covered in Unit 4 will contribute 24% of your study score for Units 3 and 4 Biology.

Outcome	Marks Allocated	Assessment Task
Outcome 1 Analysis of evidence for evolutionary change, explain how relatedness between species is determined, and elaborate on the consequences of biological change in human evolution.	30	A report using primary and secondary data.
Outcome 2 Describe how tools and techniques can be used to manipulate DNA, explain how biological knowledge is applied to biotechnical applications, and analyse the interrelationship between scientific knowledge and its applications in society.	30	A report of a laboratory investigation.
Outcome 3 Design and undertake an investigation related to cellular processes and/or biological change and continuity over time, and present methodologies, findings and conclusions in a scientific poster.	30	A structured Scientific poster using VCAA template.