Sample Course Outline

Human Biology

ATAR Year 12

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Sample course outline

Human Biology – ATAR Year 12

Unit 3 and Unit 4

Semester 1 – Homeostasis and disease

**Science Inquiry Skills**

All the following Science Inquiry Skills must be taught in each unit. The Science Inquiry Skills align with the Science Understanding and Science as a Human Endeavour content of the unit and are integrated throughout the learning experiences.

* identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes
* design 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
* conduct investigations safely, competently and methodically for the collection of valid and reliable data
* 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 limitations in data; and select, synthesise and use evidence to make and justify conclusions
* 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
* select, use and/or construct appropriate representations, including diagrams, models and flow charts, to communicate conceptual understanding, solve problems and make predictions.
* communicate to specific audiences, and for specific purposes, using appropriate language, nomenclature, genres and modes, including scientific reports

| **Week** | **Key teaching points** |
| --- | --- |
| 1–2 | **Endocrine system*** Endocrine glands
	+ location of endocrine glands – hypothalamus, pituitary, thyroid, parathyroid, pancreas, thymus, gonads, pineal and adrenal glands
	+ specific target organs and action of hormones secreted from endocrine glands – hypothalamus, pituitary, thyroid, parathyroid, pancreas and adrenal glands
	+ hypothalamic control of pituitary gland
* Hormones
	+ types of hormones – water-soluble, lipid-soluble
	+ synthetic hormones
		- development using recombinant DNA technology
		- for treatment of endocrine dysfunctions – diabetes mellitus, hypothyroidism and hyperthyroidism

**Commence Task 1:** Extended response – Recombinant DNA technology and its uses |
| 3 | **Central and peripheral nervous system*** Division of the nervous system
	+ central nervous system (CNS)
		- structure and function of the CNS – cerebellum, cerebrum, medulla oblongata, hypothalamus, corpus callosum, spinal cord, bones of the skull, meninges and cerebrospinal fluid

Practical activity: Brain dissection* + peripheral nervous system
		- autonomic and somatic
		- sympathetic and parasympathetic
		- afferent and efferent
 |
| 4–5 | * Receptors
	+ function of thermoreceptors, osmoreceptors, chemoreceptors, touch and pain receptors

Practical activity: Perception of stimuli* Neurons
	+ structure and function of neurons – sensory, motor and interneuron
	+ transmission of nerve impulses
	+ reflex arc

Practical activity: Reflexes**Submit Task 1:** Extended response – Recombinant DNA technology and its uses |
| 6 | * Nervous system disorders
	+ cell replacement therapy for treating Alzheimer’s and Parkinson’s
* Comparison of the endocrine and nervous systems
	+ speed of action
	+ duration of action
	+ nature and transmission of the message
	+ specificity of message
 |
| 7–8 | **Homeostasis*** Need for homeostasis
* Negative feedback/stimulus response models
* Thermoregulation
	+ methods of heat loss and gain
		- metabolic activity
		- conduction, convection, radiation
		- evaporation
	+ Methods of controlling heat loss and gain
		- physiological – vasoconstriction, vasodilation, shivering, sweating
		- behavioural
	+ Negative feedback/stimulus response model for thermoregulation

Practical activity: ThermoregulationCommence Task 2: Investigation – Temperature regulation mechanisms of the human body |
| 9 | * Regulation of blood sugar levels
	+ the liver
		- glycogenesis
		- glycogenolysis
		- gluconeogenesis
	+ the pancreas
		- insulin
		- glucagon
	+ the adrenal glands
		- glucocorticoids
		- adrenaline and noradrenaline
	+ negative feedback/stimulus response models for the regulation of blood sugar levels
	+ treatment of diabetes mellitus, including synthetic hormones and gene therapy
 |
| 10 | * Regulation of body fluid concentrations
	+ methods of water loss and gain
	+ ADH and aldosterone
	+ thirst reflex
	+ negative feedback/stimulus response models for the regulation of water balance
* Regulation of gas concentrations
	+ negative feedback model for the control of breathing
	+ voluntary control of breathing

**Submit Task 2:** Investigation – Temperature regulation mechanisms of the human body |
| 11 | **Response to infection*** Pathogens
	+ types of pathogens – viruses and bacteria
	+ transmission of pathogens
		- direct and indirect contact
		- transfer by body fluids
		- disease-specific vectors
		- contaminated food and water
 |
| 12 | * External defence mechanisms against pathogens
	+ skin
	+ digestive tract
	+ urogenital tract
	+ respiratory system
	+ the ear
	+ the eye
* Non-specific immune response
	+ inflammation
	+ fever
 |
| 13 | * Specific immune responses
	+ antibody-mediated immunity
	+ cell-mediated immunity
* Treatment and prevention of pathogen-induced infections
	+ antiviral drugs
		- mode of action
	+ antibiotic drugs
		- mode of action
	+ vaccines
		- types
		- mode of action
		- production, including the use of recombinant DNA technology
* Immunity
	+ passive and active immunity
	+ herd immunity

Practical activity: Modelling herd immunity* + immunisation
		- social influences on immunisation programs
		- economic influences on immunisation programs
		- cultural influences on immunisation programs

**Task 3:** Test – Response to infection |
| 14 | Revision |
| 15 | **Task 4:** Examination – Semester 1 |

Semester 2 – Human variation and evolution

**Science Inquiry Skills**

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|  |  |
| --- | --- |
| Week | Key teaching points |
| 1 | **Mutations*** Causes of gene and chromosomal mutations
	+ DNA replication
	+ cell division
	+ mutagens
* Mutations can be favourable or unfavourable for survival
* Causes of variation
	+ mutations introducing new alleles
	+ environmental influence on genotypes producing a variety of phenotypes
 |
| 2–4 | **Gene pools*** Gene pools and populations
* Causes of changes to gene pools
	+ mutations
	+ selection pressures
	+ random genetic drift, including founder effect
	+ barriers to gene flow
* Effect of genetic diseases on gene pools
	+ sickle-cell anaemia

Practical activity: Genetic diseases and changing gene pools**Task 5:** Practical – Simulating changes to gene pools |
| 5–6 | * Natural selection
	+ mechanisms underpinning evolution by natural selection
		- variation
		- isolation
		- struggle for existence
		- selection
		- speciation

Practical activity: Natural selection |
| 7–9 | **Evidence for evolution*** Comparative biochemistry
	+ DNA (genomic and mitochondrial) and proteins
	+ biotechnological techniques used to facilitate DNA sequencing
		- polymerase chain reaction (PCR) – denaturing, annealing, elongation
		- gel electrophoresis

Practical activity: Gel electrophoresis* Bioinformatics
* Phylogenetic trees

Practical activity: Our close relations**Task 6:** Extended response – Furtherevidence for evolution |
| 10 | * Fossils
	+ fossil formation
	+ problems and limitations of the fossil record
	+ application and limitations of dating methods
		- relative dating techniques – stratigraphy and index fossils
		- absolute dating techniques – radiocarbon and potassium-argon

Practical activity: Dating fossils |
| 11–13 | **Hominid evolutionary trends*** Classification of humans as great apes
* Differences between humans and other great apes
	+ relative size of cerebral cortex
	+ mobility of digits
	+ stance and locomotion – bipedalism, brachiation, quadrupedalism
	+ prognathism and dentition

Practical activity: Comparing apes and humans * Possible relatedness and evolutionary pathways
	+ *Australopithecus afarensis*
	+ *Australopithecus africanus*
	+ *Paranthropus robustus*
	+ *Homo habilis*
	+ *Homo erectus*
	+ *Homo neanderthalensis*
	+ *Homo sapiens*

Practical activity: Trends in hominid skulls* Tool cultures of Homo habilis, Homo erectus, Homo neanderthalensis and Homo sapiens
	+ trends in manufacturing techniques and materials
	+ as evidence for cognitive evolution and lifestyle

**Task 7:** Test – Evidence for evolution and hominid evolutionary trends |
| 14 | Revision |
| 15 | **Task 8:** Examination – Semester 2 |