ATAR HUMAN BIOLOGY

UNIT 3.1 INTRODUCTION, ENDOCRINE AND NERVOUS

OBJECTIVES

Introduction and Scientific Method

At the end of this section students should be able to:

1. *Define the term science.*
2. *Make observations using a range of senses.*
3. *Use scientific equipment to make more accurate observations.*
4. *Make inferences based on observations.*
5. *Explain the purpose of scientific method.*
6. Write a testable hypothesis.
7. Define and identify independent, dependent and control variables.
8. Define and explain the purpose of experimental and control setups.
9. Conduct an experiment controlling a number of variables.
10. Identify the sample size in an experiment and explain the need for having a large sample size.
11. Explain the purpose and method of random selection for experimental groups.
12. Explain the meaning and influence of experimental bias.
13. Conduct a ‘blind test’.
14. Explain why it is important to repeat experiments a number of times.
15. Discuss and identify biological variation and experimental error.
16. Identify the role of a placebo in the psychosomatic effect.
17. Draw an appropriate table and record data accurately into it.
18. Distinguish between continuous and discontinuous data.
19. Construct an appropriate graph for representing data.
20. Calculate the mean for a group of data.
21. Calculate percentage changes in data.
22. Write an appropriate conclusion for an experiment.
23. Design and conduct an extended investigation with a detailed method.
24. Identify weaknesses in experimental design and offer improvements.
25. *Use scientific equipment appropriately.*
26. *Carry out experiments in a safe manor.*
27. *Work cooperatively with others.*
28. *Respect the opinions of others and carry out meaningful discussions.*
29. Ethics are a set of moral principles or values observed by most people in society. Ethical behaviour follows those principles or values. Outline principles that an investigation involving humans must satisfy if it is to be ethically sound are:

Endocrine

1. State the differences between endocrine and exocrine glands.
2. Define the term 'endocrine system'.
3. Label a diagram showing the glands of the endocrine system.
4. Describe the relationship between the hypothalamus, pituitary and other endocrine glands.
5. Define the term 'hormone'.
6. Outline how different hormones (protein/amine and steroid) act differently to change cell function / action.
7. Explain enzyme amplification
8. Explain hormone clearance
9. Explain how concentrations of hormones in the blood can be controlled by the process of negative feedback or feedback loops.
10. Describe the differences in action between the anterior and posterior pituitary.
11. Describe the target tissue and function for each of the hormones released by the anterior lobe of the pituitary.
12. Describe the target tissue and function for each of the hormones released by the posterior lobe of the pituitary.
13. Name the hormones produced, their target tissues and their functions for the endocrine glands.
14. Define the terms 'metabolism' and 'basal metabolic rate'.
15. Explain the role of thyroxine in the control of basal metabolic rate.
16. Describe the causes and effects of hyperthyroidism and hypothyroidism.
17. Describe the roles of hormones involved in regulation of the menstrual and ovarian cycles.
18. Describe the differences in mode of action of hormones and nerves under the headings of: speed, specificity, nature of the message, transport of message and persistence of action.

Central and Peripheral Nervous System

Neurons

1. Explain the role of the nervous system.
2. Draw and label a diagram of a neuron.
3. Describe the function of the various parts of a neuron.
4. Describe the structure and function of sensory, connector and motor neurons.
5. Describe the structure and function on multipolar, bipolar and unipolar neurons.
6. Draw and label a diagram of a synapse.
7. Explain what a neuromuscular junction is.
8. Explain how a resting membrane potential in achieved.
9. Describe how a nerve impulse is generated and propagated!!!
10. Describe how nerve impulses are conducted across unmyelinated and myelinated fibres.
11. Explain in detail the transmission of a nerve impulse across a synapse.
12. Explain effects of chemicals on the transmission of a nerve impulse.

Divisions of the nervous system

1. Draw an overview diagram to represent the nervous system.
2. Describe the structure of the spinal cord.
3. Describe the difference between the autonomic and somatic divisions of the nervous system.
4. Explain the role of the autonomic nervous system in body functioning.
5. Describe the sympathetic and parasympathetic divisions of the autonomic nervous system.
6. Describe the effects of sympathetic and parasympathetic stimulation of body organs.
7. Compare and contrast the nerve pathways of the somatic and autonomic nervous system
8. Describe the fight- or-flight responses and their role in enabling the body to adapt in threatening situations.
9. Describe the differences in mode of action of hormones and nerves under the headings of: speed, specificity, nature of the message, transport of message and duration of action.

Central nervous system, receptors and reflex arc

1. State the two major components that make up the central nervous system.
2. Describe three ways by which the central nervous system is protected.
3. Label a diagram of the brain and describe the functions of each part (cerebrum, cerebellum, medulla oblongata, hypothalamus, corpus callosum).
4. Label the major lobes of the brain on a diagram.
5. State the three types of functional area in the cerebral cortex and the roles they play.
6. Describe the structure and function of the spinal cord.
7. Describe the location and make up of grey and white matter.
8. Explain what a receptor is.
9. Identify the location and role of the following receptors, thermoreceptors, osmoreceptors, chemoreceptors, touch receptors and pain receptors.
10. State why reflex arcs are used by the body and give examples of when reflex arcs are used.
11. Draw and label a diagram of a reflex arc and explain the pathway a nerve impulse would travel in a reflex arc.
12. Explain the difference between a spinal reflex and an acquired reflex.

YEAR 12 ATAR HUMAN BIOLOGY

UNIT 3.2 HOMEOSTASIS

1. At the end of this unit students should be able to:
2. Define the following terms; External environment, Internal environment, Optimal, Homeostasis.
3. State the need for steady-state control systems in the body.
4. List five factors that are kept constant in the body by homeostatic mechanisms.
5. Draw a stimulus-response feedback model including stimulus, receptor, modulator, effector, response and feedback.
6. Describe the role played by each part of the stimulus-response feedback model
7. Describe how control systems act at the physiological and behavioural levels.
8. Write the word equation for cellular respiration.
9. List the inputs and outputs of an active cell. Explain thermoregulation.
10. Define the term Endothermic.
11. Describe ways excess heat can be lost from the body surfaces in hot conditions.
12. Describe ways heat loss can be prevented from leaving the body surfaces in cold conditions.
13. Describe ways the body can decrease heat production in hot conditions.
14. Describe ways the body can increase heat production in cold conditions.
15. Explain how heat can be lost from the body by the processes of convection, conduction, radiation and evaporation.
16. Complete a stimulus-response feedback model for the maintenance of core temperature.
17. Define the following terms; Internal environment, Intercellular fluid, Intracellular fluid, Extracellular fluid, Plasma and Regulation.
18. Explain the need for regulation of the composition of body fluids (pH, concentration of nutrients and wastes).
19. Explain the relationship between cytoplasm, tissue fluid and plasma in terms of concentration of substances.
20. Define the term excretion.
21. Name the source of and excretory pathway of a number of metabolic wastes.
22. Explain the difference between elimination and excretion.
23. Explain the process of deamination in the liver and explain how and why urea is produced.
24. List the functions of the kidney.
25. Label the diagram of the urinary system.
26. Label a diagram of the kidney.
27. Describe the functions of the parts of the kidney and urinary system .
28. Label a diagram of a nephron.
29. Explain the function of the parts of the nephron.
30. Explain the role of Anti Diuretic Hormone.
31. Describe the steady state control mechanism for the regulation of water balance.
32. Describe how blood sugar levels are regulated between meals and during exercise involving the hypothalamus, liver, pancreas, insulin, cortisol, adrenalin and glucagon.
33. Complete a stimulus-response feedback model for blood glucose level.
34. List factors that influence breathing rate and depth.
35. Describe the role of carbon dioxide receptors, respiratory centre, proprio-receptors and the cerebral cortex in the control of breathing.
36. Complete a stimulus-response feedback model for breathing.
37. Explain the circulatory changes that take place during exercise.
38. Explain specifically how and why it is important to regulate blood pressure.
39. List factors that can cause an increase in heart rate and stroke volume.
40. Describe the role of the cardiovascular regulating centre, proprio-receptors, blood pressure receptors, cerebral cortex and adrenal medulla in the control of heart rate and stroke volume.
41. Complete a stimulus-response feedback model for heart rate/stroke volume/blood pressure.
42. Describe what is meant by hormonal disruption to homeostasis using examples.
43. Describe Diabetes.
44. Distinguish between Type 1 and Type 2 Diabetes.
45. Describe the cause, symptoms and treatments for Type 1 Diabetes.
46. Describe the cause, symptoms and treatments for Type 2 Diabetes.
47. Describe the cause, symptoms and treatments of Hyperthyroidism and Hypothyroidism.

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UNIT 3.3 IMMUNE SYSTEM, INFECTION AND BIOTECHNOLOGY

1. At the end of this unit students should be able to:
2. Define the term communicable disease/ infectious disease.
3. Describe the difference between contagious diseases and those spread by a vector.
4. Define pathogen and explain what the most common pathogens of humans are.
5. Describe the major methods of pathogen transmission.
6. Describe the typical structure of a bacterial cell
7. Distinguish between the common bacterial classifications of cocci, bacilli, spirilla and vibrio.
8. Explain how a virus is reliant on a host cell to reproduce.
9. Explain the general structure of a virus.
10. Explain the difference between Non-specific defences and specific defences against pathogens.

Non Specific Defence

1. Explain the action of the following as an external defence against pathogens.

Skin, Mucous membranes, Hairs, Cilia, Acids, Lysozyme, Cerumen, Body fluids flushing action

1. Define protective reflex
2. Describe the roll of sneezing, coughing, vomiting and diarrhoea as protective reflexes.
3. Define phagocyte.
4. Describe the process of phagocytosis.
5. Describe the roles of Leucocytes and Macrophages in internal non-specific defence.
6. Describe the three purposes of the inflammatory response.
7. Outline the four signs of inflammation.
8. Describe the process of inflammation, explaining the roles of Mast cells, Histamine and Herapin.
9. Describe the steps that take place during fever.
10. Describe the benefits of fever in non specific immune response.
11. Describe the structure of the lymphatic system.
12. Define the role of the lymphatic system.
13. Describe and explain the role of the lymphatic system in particular lymph nodes in the body’s internal non specific defence against pathogens.

Specific Resistance

1. Distinguish between the terms "non- specific and specific".
2. Define antibody mediated immunity.
3. Define the terms antigen, antibody and antigen-antibody complex.
4. List six ways antibodies can provide resistance to infection.
5. Describe the sequence of events which leads to antibody production in antibody mediated immunity.
6. Explain the origins and roles of Plasma cells and memory B cells.
7. Define cell-mediated immunity.
8. Describe the functions of Killer T cells, Helper T cells, Suppressor T cells and memory T cells.
9. Compare the production and function of Leukocytes, B- Lymphocytes (B-cells) and T – Lymphocytes (T-cells).
10. Describe the sequence of events which occur in cell mediated immunity
11. Compare and contrast the primary and secondary response.
12. Define the following terms; immunity, passive immunity, active immunity, natural immunity and artificial immunity.
13. Define the term vaccine.
14. Describe the four types of vaccines.
15. Describe the reason for vaccination.
16. Explain how social, ethical, and cultural factors can impact on the participation of individuals in immunisation programs.
17. Explain the difference between antibiotics and Antiviral drugs.
18. Explain the difference between bactericidal drugs and bacteriostatic drugs.
19. Distinguish between broad spectrum antibiotics and narrow spectrum antibiotics.
20. Explain why it is difficult to produce effective antiviral drugs.

Biotechnology Objectives

1. Explain what is meant by the Human Genome.
2. Describe how hereditary diseases can be identified using DNA sequencing.
3. Explain how electrophoresis can be used to produce a DNA fingerprint (profiling).
4. Describe the technique of polymerase chain reaction in replicating DNA molecules.
5. Explain the structure and use of genetic probes.
6. Define `recombinant DNA technology.
7. Explain the process of recombinant DNA technology.
8. Describe how Insulin can be produced using recombinant DNA technology.
9. Describe how recombinant DNA technology can be used to produce vaccines.
10. Explain some of the problems with producing vaccines using recombinant DNA technology.
11. Describe how gene therapy may be used to treat genetic disorders like Diabetes mellitus, Cystic Fibrosis and Huntington’s disease.
12. Define cell replacement therapy.
13. Describe how cell replacement therapy can be used to treat neurodegenerative disorders such as Parkinson’s and Alzheimer’s diseases.

ATAR HUMAN BIOLOGY

UNIT 4.1 MECHANISMS OF EVOLUTION

OBJECTIVES

At the end of this unit students should be able to:

Biotechnology Objectives

1. Explain what is meant by the Human Genome.
2. Explain what DNA sequencing is and describe the process of DNA sequencing.
3. Explain how electrophoresis can be used to produce a DNA fingerprint (profiling).
4. Describe the technique of polymerase chain reaction in replicating DNA molecules.
5. Define `recombinant DNA technology’.
6. Explain the process of recombinant DNA technology.
7. Describe how hormones such as Insulin can be produced using recombinant DNA technology.
8. Describe how recombinant DNA technology can be used to produce vaccines.
9. Explain some of the problems with producing vaccines using recombinant DNA technology.
10. Describe how gene therapy may be used to treat genetic disorders like Diabetes mellitus, Cystic Fibrosis and Huntington’s disease.
11. Explain the process of cell replacement therapy.
12. Describe Parkinson’s and Alzheimer’s diseases
13. Describe how cell replacement therapy can be used to treat neurodegenerative disorders such as Parkinson’s and Alzheimer’s diseases.
14. Developments in biotechnology have increased access to genetic information of species, populations and individuals, existing now and in the past, the interpretation and use of which may be open to ethical considerations. Describe some of these ethical considerations.

Mutations and Gene Pools

1. Define the term gene pool.
2. Describe the difference between gene mutations and chromosomal mutations.
3. Identify that mutations in genes and chromosomes can result from errors in DNA replication, cell division or from damage caused by mutagens.
4. Explain how mutagenic agents can change the rates of mutations.
5. Explain the difference between somatic and germline mutations.
6. Describe the effects of gene and chromosomal mutations of particular diseases; including, Tay-Sachs disease, thalassemia and sickle-cell anaemia.

Evolutionary Mechanisms

1. Explain how a number of processes; including, random assortment, crossing over, non-disjunction, random fertilisation and mutations cause variations between individuals of a species.
2. Identify the mutations that produce new alleles in populations can be favourable or unfavourable.
3. Define the term natural selection.
4. Describe how random genetic drift and the founder effect can influence the genetic make up of populations.
5. Explain how gene flow can affect allele frequencies in populations.
6. Explain the types of barriers that can prevent the exchange of genes between populations.
7. Explain how different genotypes can produce a variety of phenotypes, which can vary rates of survival.
8. Explain how genetic diseases including Tay-Sachs disease, thalassemia and sickle-cell anaemia can result in changes to allele frequencies.
9. Define the term adaptation and distinguish, using examples, between structural physiological and behavioural.
10. Describe the basic principles of the theory of evolution.
11. Apply the principals of evolution to explain how a population can change its structure.
12. Explain how sickle cell anaemia and body stature are examples of natural selection in humans.
13. Describe the process of speciation.

Evidence For Evolution

1. Describe how the following provide evidence for evolution. (i) Comparative studies of DNA (genomic and mitochondrial), (ii) Fossils, (iii) Comparative studies of anatomy, (iv) Comparative studies of proteins, (v) Comparative studies of embryology.
2. Define comparative genomics, comparative biochemistry and bioinformatics.
3. Explain how the developments in fields of comparative genomics, comparative biochemistry and bioinformatics, have refined existing models and theories of evolution.
4. Define the terms homologous and vestigial organ.
5. Explain how geographical distribution of related species can be used as evidence for evolution.
6. Biotechnological techniques provide evidence for evolution by using PCR (to amplify minute samples of DNA to testable amounts), bacterial enzymes and gel electrophoresis to facilitate DNA sequencing of genomes
7. Interpret phytogenic trees that show evolutionary relationships between groups.

Year 12 ATAR - Human Biology

Unit 2.3 - Fossils and Human Evolution

Dating Objectives

At the end of this unit student should be able to:

1. Define the following terms: a) Artifact b) Kitchen-middens, c) Palaeontology, d) Archaeology, e) Fossil, f) Index fossil
2. Describe the process of fossilisation
3. List the conditions that are favourable for fossilisation
4. List the conditions that would not be favourable for fossilization
5. Explain how different materials require different conditions for fossilization. (e.g.: Teeth, bones and tissue.)
6. Explain why only a very small proportion of animal remains are fossilized.
7. Explain why even if fossils are formed only a small percentage are found.
8. Describe and interpret the organisation of geological time scale.
9. State the difference between relative and absolute dating techniques.
10. Describe the following dating techniques
    1. Stratigraphy
    2. Fluorine analysis,
    3. Radiocarbon (Carbon 14)
    4. Potassium-argon,

In terms of :

1. If it is relative or absolute,
2. The time period it can be used for,
3. The material used,
4. The source of the material,
5. Theory
6. Method
7. Advantages and limitations of application.
8. Describe the problems that are associated with the fossil record.

Primate Evolutionary Trends Objectives

At the end of this unit student should be able to:

1. Interpret the hierarchy of classification of primates.
2. List the general features that classify humans into the primate order
3. Briefly describe the following primate features
4. Body specialisation
5. Limbs and digits
6. Stereoscopic vision
7. Olfaction
8. Dentition
9. Relative brain size
10. Reproductive cycle/behaviour
11. Explain the following terms
12. Arboreal
13. Pentadactyl
14. Opposable
15. Prehensile
16. Stereoscopic
17. Olfaction
18. Platyrrhine
19. Catarrhine
20. Brachiation
21. Identify from photographs and diagrams the various Hominids (Orang-utans, Gorillas, Chimpanzees and Humans).
22. Describe trends in the family Hominidae, consisting of great apes, extinct and modern humans referring to the following characteristics:
    1. Digits
    2. Dentition
    3. Smell
    4. Vision
    5. Brain
    6. Gestation
    7. Development

Hominin Evolution Trends Objectives

At the end of this unit student should be able to:

1. Distinguish between hominids and hominins.
2. Describe the adaptations for bipedalism in hominins compared to quadrapedalism (great apes) specifically:
   1. Skull
   2. Vertebral column
   3. Jaw
   4. Pelvis
   5. Carrying angle
   6. Knee
   7. Foot
   8. Centre of Gravity
3. Describe the

i) distribution (temporal and geographic)

ii) time of evolution and evolutionary relationships

iii) distinguishing features including skull diagrams

of the following hominins

* 1. Australopithecus afarensis
  2. Australopithecus africanus
  3. Paranthropus robustus
  4. Homo habilis
  5. Homo erectus
  6. Homo neanderthalensis
  7. Homo sapiens

1. Define the terms cultural evolution
2. Describe the characteristics required for cultural evolution to take place.
3. Compare and contrast cultural and biological evolution.
4. Describe the trends in the development of tools (formal classification of tools not required), culture and lifestyle of the following:
   1. Homo habilis
   2. Homo erectus
   3. Homo neanderthalensis
   4. Homo sapiens
5. Describe the major cultural trends that have taken place as cultures have evolved.
6. Describe the role of food sharing and food gathering in cultural evolution.
7. Describe how the agricultural revolution had an impact on further cultural evolution.