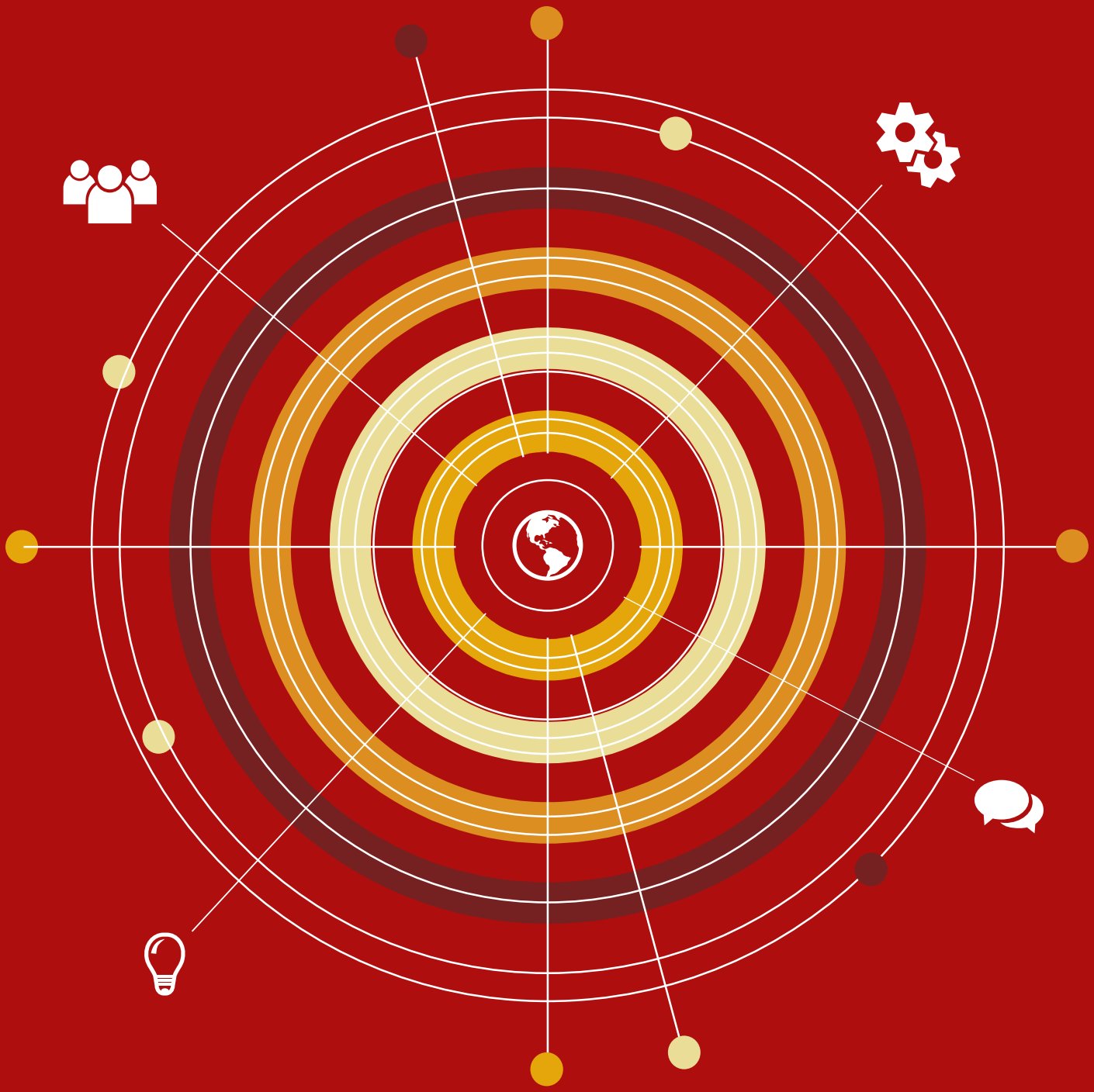

YEAR 12 BIOLOGY NOTES

Biology n noun 1 the scientific study of living organisms. 2 the plants and animals of a particular area. 3 the features of a particular organism or class of organisms.

DERIVATIVES biologist noun ORIGIN C19: coined in German, via French from Greek bios 'life' + -logy.

“Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world.” Louis Pasteur

Module 5: Heredity

Outcomes

A student:

- selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media BIO11/12-4
- analyses and evaluates primary and secondary data and information BIO11/12-5
- solves scientific problems using primary and secondary data, critical thinking skills and scientific processes BIO11/12-6
- explains the structures of DNA and analyses the mechanisms of inheritance and how processes of reproduction ensure continuity of species BIO12-12

Content Focus

Life continues through the processes of reproduction and heredity. Students expand their knowledge of evolution by understanding the cellular processes involved in increasing genetic diversity. They investigate reproduction and inheritance patterns in both plants and animals as well as the role of DNA in polypeptide synthesis and the uses of technologies in the study of inheritance patterns.

Students also learn about contemporary research and the work of geneticists across a variety of industries, including medical applications and agriculture. They explore the effects on society and the environment through the application of genetic research.

Working Scientifically

In this module, students focus on processing and representing data in appropriate formats to analyse and evaluate trends, relationships and patterns. Students derive and justify valid conclusions about the processes involved in heredity. Students should be provided with opportunities to engage with all Working Scientifically skills throughout the course.

Content

Reproduction

Inquiry question: How does reproduction ensure the continuity of a species?

Students:

- explain the mechanisms of reproduction that ensure the continuity of a species, by analysing sexual and asexual methods of reproduction in a variety of organisms, including but not limited to:
  - animals: advantages of external and internal fertilisation
  - plants: asexual and sexual reproduction
  - fungi: budding, spores
  - bacteria: binary fission (ACSBL075)
  - protists: binary fission, budding

Students:

- analyse the features of fertilisation, implantation and hormonal control of pregnancy and birth in mammals (ACSBL075)

Students:

- evaluate the impact of scientific knowledge on the manipulation of plant and animal reproduction in agriculture (ACSBL074)

Cell Replication

Inquiry question: How important is it for genetic material to be replicated exactly?

Students:

- model the processes involved in cell replication, including but not limited to:
  - mitosis and meiosis (ACSBL075)
  - DNA replication using the Watson and Crick DNA model, including nucleotide composition, pairing and bonding (ACSBL076, ACSBL077)

Students:

- assess the effect of the cell replication processes on the continuity of species (ACSBL084)

DNA and Polypeptide Synthesis

Inquiry question: Why is polypeptide synthesis important?

Students:

- construct appropriate representations to model and compare the forms in which DNA exists in eukaryotes and prokaryotes (ACSBL076)

Students:

- model the process of polypeptide synthesis, including: (ACSBL079)
  - transcription and translation
  - assessing the importance of mRNA and tRNA in transcription and translation (ACSBL079)
  - analysing the function and importance of polypeptide synthesis (ACSBL080)
  - assessing how genes and environment affect phenotypic expression (ACSBL081)

Students:

- investigate the structure and function of proteins in living things

Genetic Variation

Inquiry question: How can the genetic similarities and differences within and between species be compared?

Students:

- conduct practical investigations to predict variations in the genotype of offspring by modelling meiosis, including the crossing over of homologous chromosomes, fertilisation and mutations (ACSBL084)

Students:

- model the formation of new combinations of genotypes produced during meiosis, including but not limited to:
  - interpreting examples of autosomal, sex-linkage, co-dominance, incomplete dominance and multiple alleles (ACSBL085)
  - constructing and interpreting information and data from pedigrees and Punnett squares

Students:

- collect, record and present data to represent frequencies of characteristics in a population, in order to identify trends, patterns, relationships and limitations in data, for example:
  - examining frequency data
  - analysing single nucleotide polymorphism (SNP)

Inheritance Patterns in a Population

Inquiry question: Can population genetic patterns be predicted with any accuracy?

Students:

- investigate the use of technologies to determine inheritance patterns in a population using, for example: (ACSBL064, ACSBL085)
  - DNA sequencing and profiling (ACSBL086)

Students:

- investigate the use of data analysis from a large-scale collaborative project to identify trends, patterns and relationships, for example: (ACSBL064, ACSBL073)
  - the use of population genetics data in conservation management
  - population genetics studies used to determine the inheritance of a disease or disorder
  - population genetics relating to human evolution

Module 6: Genetic Change

Outcomes

A student:

- solves scientific problems using primary and secondary data, critical thinking skills and scientific processes BIO11/12-6
- communicates scientific understanding using suitable language and terminology for a specific audience or purpose BIO11/12-7
- explains natural genetic change and the use of genetic technologies to induce genetic change BIO12-13

Content Focus

Students learn about natural and human-induced causes and effects of genetic change, including mutations, environmental pressure and uses of biotechnology. Students investigate how the processes of inheritance and evolution are applied.

The work of scientists in various fields of work, including agriculture, industry and medicine, can be explored within the context of biotechnology. The impact of biotechnology on biological diversity is also explored in this module.

Working Scientifically

In this module, students focus on analysing trends and patterns and solving problems using evidence from data and information. Students also focus on communicating ideas about genetic change for a specific purpose. Students should be provided with opportunities to engage with all Working Scientifically skills throughout the course.

Content

Mutation

Inquiry question: How does mutation introduce new alleles into a population?

Students:

- explain how a range of mutagens operate, including but not limited to:
  - electromagnetic radiation sources
  - chemicals
  - naturally occurring mutagens

Students:

- compare the causes, processes and effects of different types of mutation, including but not limited to:
  - point mutation
  - chromosomal mutation

Students:

- distinguish between somatic mutations and germ-line mutations and their effect on an organism (ACSBL082, ACSBL083)

Students:

- assess the significance of ‘coding’ and ‘non-coding’ DNA segments in the process of mutation (ACSBL078)

Students:

- investigate the causes of genetic variation relating to the processes of fertilisation, meiosis and mutation (ACSBL078)

Students:

- evaluate the effect of mutation, gene flow and genetic drift on the gene pool of populations (ACSBL091, ACSBL092)

Biotechnology

Inquiry question: How do genetic techniques affect Earth's biodiversity?

Students:

- investigate the uses and applications of biotechnology (past, present and future), including: (ACSBL087)
  - analysing the social implications and ethical uses of biotechnology, including plant and animal examples
  - researching future directions of the use of biotechnology
  - evaluating the potential benefits for society of research using genetic technologies
  - evaluating the changes to the Earth's biodiversity due to genetic techniques

Genetic Technologies

Inquiry question: Does artificial manipulation of DNA have the potential to change populations forever?

Students:

- investigate the uses and advantages of current genetic technologies that induce genetic change

Students:

- compare the processes and outcomes of reproductive technologies, including but not limited to:
  - artificial insemination
  - artificial pollination

Students:

- investigate and assess the effectiveness of cloning, including but not limited to:
  - whole organism cloning
  - gene cloning

Students:

- describe techniques and applications used in recombinant DNA technology, for example:
  - the development of transgenic organisms in agricultural and medical applications (ACSBL087)

Students:

- evaluate the benefits of using genetic technologies in agricultural, medical and industrial applications (ACSBL086)

Students:

- evaluate the effect on biodiversity of using biotechnology in agriculture

Students:

- interpret a range of secondary sources to assess the influence of social, economic and cultural contexts on a range of biotechnologies

Module 7: Infectious Disease

Outcomes

A student:

› develops and evaluates questions and hypotheses for scientific investigation BIO11/12-1
› designs and evaluates investigations in order to obtain primary and secondary data and information BIO11/12-2
› conducts investigations to collect valid and reliable primary and secondary data and information BIO11/12-3
› selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media BIO11/12-4
› analyses infectious disease in terms of cause, transmission, management and the organism's response, including the human immune system BIO12-14

Content Focus

This module examines the treatment, prevention and control of infectious disease both locally and globally. It includes study of the human immune system and its response to an infectious disease.

The value of studying infectious disease and its causes and effects is highlighted by the cost to humans in terms of losses in productivity and production and the impact on overall health. The module also considers medical and agricultural applications that draw on the work of a variety of scientists.

Working Scientifically

In this module, students focus on developing and evaluating questions and hypotheses when planning and conducting investigations to analyse trends, patterns and relationships in data about infectious diseases. Students should be provided with opportunities to engage with all Working Scientifically skills throughout the course.

Content

Causes of Infectious Disease

Inquiry question: How are diseases transmitted?

Students:

- describe a variety of infectious diseases caused by pathogens, including microorganisms, macroorganisms and non-cellular pathogens, and collect primary and secondary-sourced data and information relating to disease transmission, including: (ACSBL097, ACSBL098, ACSBL116, ACSBL117)
  - classifying different pathogens that cause disease in plants and animals (ACSBL117)
  - investigating the transmission of a disease during an epidemic
  - design and conduct a practical investigation relating to the microbial testing of water or food samples
  - investigate modes of transmission of infectious diseases, including direct contact, indirect contact and vector transmission

Students:

- investigate the work of Robert Koch and Louis Pasteur, to explain the causes and transmission of infectious diseases, including:
  - Koch's postulates
  - Pasteur's experiments on microbial contamination

Students:

- assess the causes and effects of diseases on agricultural production, including but not limited to:
  - plant diseases
  - animal diseases

Students:

- compare the adaptations of different pathogens that facilitate their entry into and transmission between hosts (ACSBL118)

Responses to Pathogens

Inquiry question: How does a plant or animal respond to infection?

Students:

- investigate the response of a named Australian plant to a named pathogen through practical and/or secondary-sourced investigation, for example:
  - fungal pathogens
  - viral pathogens

Students:

- analyse responses to the presence of pathogens by assessing the physical and chemical changes that occur in the host animals cells and tissues (ACSBL119, ACSBL120, ACSBL121, ACSBL122)

Immunity

Inquiry question: How does the human immune system respond to exposure to a pathogen?

Students:

- investigate and model the innate and adaptive immune systems in the human body (ACSBL119)

Students:

- explain how the immune system responds after primary exposure to a pathogen, including innate and acquired immunity

Prevention, Treatment and Control

Inquiry question: How can the spread of infectious diseases be controlled?

Students:

- investigate and analyse the wide range of interrelated factors involved in limiting local, regional and global spread of a named infectious disease ⚖ 🌐

Students:

- investigate procedures that can be employed to prevent the spread of disease, including but not limited to: (ACSBL124)
  - hygiene practices
  - quarantine
  - vaccination, including passive and active immunity (ACSBL100, ACSBL123)
  - public health campaigns
  - use of pesticides
  - genetic engineering

Students:

- investigate and assess the effectiveness of pharmaceuticals as treatment strategies for the control of infectious disease, for example:
  - antivirals
  - antibiotics

Students:

- investigate and evaluate environmental management and quarantine methods used to control an epidemic or pandemic

Students:

- interpret data relating to the incidence and prevalence of infectious disease in populations, for example:
  - mobility of individuals and the portion that are immune or immunised (ACSBL124, ACSBL125)
  - Malaria or Dengue Fever in South East Asia

Students:

- evaluate historical, culturally diverse and current strategies to predict and control the spread of disease (ACSBL125)

Students:

- investigate the contemporary application of Aboriginal protocols in the development of particular medicines and biological materials in Australia and how recognition and protection of Indigenous cultural and intellectual property is important, for example:
  - bush medicine
  - smoke bush in Western Australia

Module 8: Non-infectious Disease and Disorders

Outcomes

A student:

› analyses and evaluates primary and secondary data and information BIO11/12-5
› solves scientific problems using primary and secondary data, critical thinking skills and scientific processes BIO11/12-6
› communicates scientific understanding using suitable language and terminology for a specific audience or purpose BIO11/12-7
› explains non-infectious disease and disorders and a range of technologies and methods used to assist, control, prevent and treat non-infectious disease BIO12-15

Content Focus

Students engage with the study of non-infectious disease and disorders, including their causes and effects on human health. They explore technologies and their uses in treating disease and disorders as well as the epidemiology of non-infectious disease in populations.

This module examines the practical applications of STEM. It looks at the importance of understanding the multidisciplinary nature of science applications. It also examines physiology and engineered solutions to problems related to the management of human disorders.

Working Scientifically

In this module, students focus on collecting and processing data to analyse trends and patterns and solve problems. They also focus on communicating ideas about non-infectious disease and disorders. Students should be provided with opportunities to engage with all Working Scientifically skills throughout the course.

Content

Homeostasis

Inquiry question: How is an organism's internal environment maintained in response to a changing external environment?

Students:

- construct and interpret negative feedback loops that show homeostasis by using a range of sources, including but not limited to: (ACSBL101, ACSBL110, ACSBL111)
  - temperature (ACSBL098)
  - glucose

Students:

- investigate the various mechanisms used by organisms to maintain their internal environment within tolerance limits, including:
  - trends and patterns in behavioural, structural and physiological adaptations in endotherms that assist in maintaining homeostasis (ACSBL099, ACSBL114)
  - internal coordination systems that allow homeostasis to be maintained, including hormones and neural pathways (ACSBL112, ACSBL113, ACSBL114)
  - mechanisms in plants that allow water balance to be maintained (ACSBL115)

Causes and Effects

Inquiry question: Do non-infectious diseases cause more deaths than infectious diseases?

Students:

- investigate the causes and effects of non-infectious diseases in humans, including but not limited to:
  - genetic diseases
  - diseases caused by environmental exposure
  - nutritional diseases
  - cancer

Students:

- collect and represent data to show the incidence, prevalence and mortality rates of non-infectious diseases, for example:
  - nutritional diseases
  - diseases caused by environmental exposure

Epidemiology

Inquiry question: Why are epidemiological studies used?

Students:

- analyse patterns of non-infectious diseases in populations, including their incidence and prevalence, including but not limited to:
  - nutritional diseases
  - diseases caused by environmental exposure

Students:

- investigate the treatment/management, and possible future directions for further research, of a non-infectious disease using an example from one of the non-infectious diseases categories listed above

Students:

- evaluate the method used in an example of an epidemiological study

Students:

- evaluate, using examples, the benefits of engaging in an epidemiological study

Prevention

Inquiry question: How can non-infectious diseases be prevented?

Students:

- use secondary sources to evaluate the effectiveness of current disease-prevention methods and develop strategies for the prevention of a non-infectious disease, including but not limited to:
  - educational programs and campaigns
  - genetic engineering

Technologies and Disorders

Inquiry question: How can technologies be used to assist people who experience disorders?

Students:

- explain a range of causes of disorders by investigating the structures and functions of the relevant organs, for example:
  - hearing loss
  - visual disorders
  - loss of kidney function

Students:

- investigate technologies that are used to assist with the effects of a disorder, including but not limited to: (ACSBL100)
  - hearing loss: cochlear implants, bone conduction implants, hearing aids
  - visual disorders: spectacles, laser surgery
  - loss of kidney function: dialysis

Students:

- evaluate the effectiveness of a technology that is used to manage and assist with the effects of a disorder (ACSBL100)