YEAR 11 Biology – Term 2

Year 11 : Unit 1: Cells and multicellular organisms
Unit 2: Maintaining the internal environment

Unit descriptions

In Unit 1, students explore the ways biology is used to describe and explain how the structure and function of cells and their components are related to the need to exchange matter and energy with their immediate environment. An understanding of the structure and function of cells is essential to appreciate the processes vital for survival. Students investigate the structure and function of cells and multicellular organisms. They examine the structure and function of plant and animal systems at cell and tissue levels in order to analyse how they facilitate the efficient provision or removal of materials. Contexts that could be investigated in this unit include stem cell research, animal ethics, organ and tissue transplantation, bio-artificial organs and photosynthesis productivity. Through the investigation of these contexts, students may explore the ethical considerations that apply to the use of living organisms in research.

In Unit 2, students explore the ways biology is used to describe and explain the responses of homeostatic mechanisms to stimuli and the human immune system. An understanding of personal and communal responses is essential to appreciate personal lifestyle choices and community health. Students develop scientific skills and conceptual understanding in homeostasis, the immune system and the relationships between global, community and individual immunity. They examine geographical and population data to analyse strategies that may have personal and communal consequences. Contexts that could be investigated in this unit include historical and current epidemics and pandemics. Through the investigation of these contexts, students may explore immunisation, quarantine, management strategies and travel preparation (both local and international).

Participation in a range of experiments and investigations will allow students to progressively develop their suite of science inquiry skills while gaining an enhanced appreciation of the relationship between structure and function of cells and multicellular organisms. Collaborative experimental work also helps students to develop communication, interaction, character and management skills.

Throughout the unit, students develop skills in conducting real or virtual laboratory work and carrying out microscopic examination of cells and tissues. They use these skills to construct and use models to describe and interpret data about the functions of cells and organisms and to explain cellular processes.

Unit objectives

Unit objectives are drawn from the syllabus objectives and are contextualised for the subject matter and requirements of the unit. Each unit objective must be assessed at least once.

Students will:

1. describe and explain cells as the basis of life, and multicellular organisms
2. apply understanding of cells as the basis of life, and multicellular organisms
3. analyse evidence about cells as the basis of life, and multicellular organisms
4. interpret evidence about cells as the basis of life, and multicellular organisms
5. investigate phenomena associated with cells as the basis of life, and multicellular organisms
6. evaluate processes, claims and conclusions about cells as the basis of life, and multicellular organisms
7. communicate understandings, findings, arguments and conclusions about cells as the basis of life, and multicellular organisms.

Unit Assessment

FIA2 – Student Experiment

Timing: Handed out week 1 and is due week 8.

Week	Topic	Unit Goals	Resources
W1	Day 1 **Lesson 22** Cell differentiation and specialisation	-understand that stem cells differ from other cells by being unspecialised, and have properties of self-renewal and potency • recognise that stem cells differentiate into specialised cells to form tissues and organs in multicellular organisms • recognise that multicellular organisms have a hierarchical structural organisation of cells, tissues, organs and systems. -The interdependence of organ systems should focus on how they facilitate the efficient provision or removal of materials to and from all cells of the organism.	**OBI Chapter** 5.1; 5.2; 5.3; 5.5; 5.6 **Important Vocabulary** Multicellular organisms p.132 Tissue p.132, p.150 Organ p.150 System p.150 Cell cycle p.134 Interphase p.134 Mitosis p.134 Cytokinesis p.134 Stem cells p.140 Differentiated p.141 Cell specialisation p. 146 Self-renewal p.141 Potency p.141 Totipotent p.141 Pluripotent p.141 Multipotent stem cells p.142 Oligopotent stem cells p. 142 Unipotent stem cells p. 142 Embryonic Stem cells p.142 Cancer Case study 5.2 p.132 Ectoderm p.146 Endoderm p.146 Mesoderm p.146 **Important Diagrams** Fig 1 Multicellular development stages p. 133 Fig 1 Cell Cycle p.135 Fig 1 Stem cell differentiation p.140 Fig 2 Changes in embryonic cells p.147
	Day 2 **Lesson 23** Use of stem cells SHE lesson links to FIA3	**SHE - Stem cell research:** Embryonic stem cells have the potential to be grown into specialised cells and could enable the repair or replacement of ailing organs and tissues. **SHE:** Discuss the use of adult and embryonic stem cells in medical technology. Analyse data and evaluate a range of alternative perspectives on the use of stem cell research by considering a range of scientific media and texts. **SHE**: **Bioartificial organs:** Cells from a patient or a stem cell bank can be used to produce bioartificial tissues and organs as an alternative to donor tissues and organs.	
	Day 3 **Lesson 24** Infectious disease and pathogens	• identify the difference between infectious diseases (invasion by a pathogen and can be transmitted from one host to another) and non-infectious diseases (genetic and lifestyle diseases) • identify the following pathogens: prions, viruses, bacteria, fungi, protists and parasites • describe the following virulence factors that aid in pathogenesis:	

		adherence factors, invasion factors, capsules, toxins and lifecycle changes • ~~identify from given data and~~ (later lesson) describe the following modes of disease transmission: direct contact, contact with body fluids, contaminated food, water and disease-specific vectors	
W2	Day 1 **Lesson 25** The immune response	-understand how pathogens (bacterial and viral) can cause both physical and chemical changes in host cells that stimulate the host immune responses (introduction of foreign chemicals via the surface of the pathogen, production of toxins, recognition of self and non-self) • recognise that all plants and animals have innate immune responses (general/non-specific) and that vertebrates also have adaptive (specific) immune responses	
	Day 2 **Lesson 26** The innate immune system and Physical defence strategies	• recognise that all ~~plants and~~ animals have innate immune responses (general/non-specific) and that vertebrates also have adaptive (specific) immune responses • recall that the innate immune response in vertebrates comprises surface barriers (skin, mucus and cilia), inflammation and the complement system ~~• recall examples of physical defence strategies (barriers and leaf structures) and chemical defence strategies (plant defensins and production of toxins) of plants in response to the presence of pathogens~~	
	Day 3 **Lesson 27** The innate immune system and the inflammatory response	• describe the inflammatory response (prostaglandins, vasodilation, phagocytes) and the role of the complement system	
3 FIA2 4/5 Public Holiday	Day 1 **IA2 – EXPERIMENT** (Research, Rationale – L1)		
	Day 2 **IA2 – EXPERIMENT** (Rationale, Method – L2)		
	Day 3 **Lesson 28** The innate immune system and the adaptive response	• explain the adaptive immune responses in vertebrates — humoral (production of antibodies by B lymphocytes) and cell-mediated (T lymphocytes) — and recognise that memory cells are produced in both situations	
4 FIA2	Day 1 **IA2 – EXPERIMENT** (Method, Experiment – L3)		

	Day 2 **IA2 – EXPERIMENT** (Experiment – L4)		
	Day 3 **Lesson 29** Passive vs Active immunity Natural vs Artificial immunity	• analyse the differences and similarities between passive immunity (antibodies gained via the placenta and via antibody serum injection) and active immunity (acquired via natural exposure to a pathogen or through the use of vaccines) for both naturally and artificially acquired immunity.	
5 FIA2	Day 1 **IA2 – EXPERIMENT** (Analysis – L5)		
	Day 2 **IA2 – EXPERIMENT** (Analysis & Evaluation – L6)		
	Day 3 **Lesson 30** Analysing and Interpreting Vaccination data SHE lesson to link to FIA3	**SHE:** Long-term and short-term immunity could be contextualised with current vaccination practices and controversies • **SHE:** Extension of long-term immunity could include comparison of individual and population immunities of different geographical and demographical populations -interpret long-term immune response data	
6 FIA2	Day 1 **Lesson 31** Disease transmission and spread	• identify from given data and describe the following modes of disease transmission: direct contact, contact with body fluids, contaminated food, water and disease-specific vectors • recognise that the transmission of disease is facilitated by regional and global movement of organisms • interpret data for the modelling of the spread of disease using secondary data or computer simulations. • Analysis of the spread and control of disease could include hand hygiene, quarantine, biosecurity measures for the prevention of the spread of polio, smallpox, influenza, Ebola, cholera, bird flu, malaria	
	Day 2 **IA2 – EXPERIMENT** (Evaluation – L7)		
	Day 3 **IA2 – EXPERIMENT** (L8 –Draft due)		
7 FIA2	Day 1 **IA2 – EXPERIMENT**		

	(Drafting - L9)		
	Day 2 **IA2 – EXPERIMENT** (Drafting - L10)		
	Day 3 **Lesson 32** Population immunity	• identify the interrelated factors affecting immunity (persistence of pathogens within host, transmission mechanism, proportion of the population that is immune or has been immunised, mobility of individuals in the affected population) • analyse these factors to predict potential outbreaks	
8 FIA2	Day 1 **FIA2 SUBMISSION**	Catch up lesson	
	Day 2 **Lesson 33** Disease prevention and control	• evaluate strategies to control the spread of disease personal hygiene measures community level: contact tracing and quarantine, school and workplace closures, reduction of mass gatherings, temperature screening and travel restrictions • make decisions and justify them in regard to best practice for the prevention of disease outbreaks based on the critical analysis of relevant and current information	
	Day 3 **Lesson 34** SHE lesson links to FIA3	**SHE** Modelling disease outbreak and spread: Mass vaccination programs are more successful when informed by disease outbreak models	
9	Day 1 **FIA3 Research Report Preparatory Lesson 1:** Handout, Exemplar and Scaffold		
	Day 2 **FIA3 Research Report Preparatory Lesson 2:** Writing Research Questions		
	Day 3 **FIA3 Research Report Preparatory Lesson 3:** Finding 'good' data Rational vs Background Reviewing the literature		
10	Day 1	**Mandatory practical:** Investigate the effect of an antimicrobial on the growth of a microbiological organism (via the measurement of zones of inhibition) — laboratory or virtual	
	Day 2 **FIA3 Research Report Preparatory Lesson 4:**	Review results of practical .	

	Analysing data Determining limitations of data		
	Sports Carnival		