Year 10 ACARA Biology – Science B Unit 2: HUMAN HEALTH AND DISEASE Science B

How does the human body fight disease and sustain good health?

The program includes the SCSA (School Curriculum and Standards Authority) content, 21CLD elements (self-regulation, knowledge construction, ICT and skillful communication), study skills and 'Habits of Mind' skills.

Science Understanding

Biological sciences

Multi-cellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment (ACSSU175)

1. Investigating the response of the body to changes as a result of the presence of micro-organisms
2. Describing mutations as changes in DNA or chromosomes
3. Investigating the effects on humans of exposure to electromagnetic radiations such as X-rays and microwaves

Science as a Human Endeavour

Use and influence of science

People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions (ACSHE194)

1. Using knowledge of science to test claims made in advertising.

Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities (ACSHE195)

1. Investigating the applications of gene technologies such as gene therapy and genetic engineering (in the context of health)

The values and needs of contemporary society can influence the focus of scientific research (ACSHE230)

1. Considering the use of genetic testing for decisions such as genetic counselling, embryo selection, identification of carriers of genetic mutations and the use of this information for personal use or by organisation such as insurance companies or medical facilities.

Science Inquiry Skills

Questioning and predicting

Formulate questions or hypotheses that can be investigated scientifically (ACSIS198)

1. Developing hypotheses based on well-developed models and theories.
2. Using internet research to identify problems that can be investigated.
3. Formulating questions that can be investigated within the scope of the classroom or field with available resources.

4. Developing ideas from students own or others' investigations and experiences to investigate further.
5. Evaluating information from secondary sources as part of the research process

Planning and conducting

Plan, select and use appropriate investigation methods, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSIS199)

1. Using modelling and simulations, including using digital technology, to investigate situations and events.
2. Deciding how much data are needed to produce reliable measurements.

Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data (ACSIS200)

1. Identifying where human error can influence the reliability of data.

Processing and analysing data and information

Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSIS203)

1. Using spreadsheets to present data in tables and graphical forms and to carry out mathematical analyses on data.

Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS204)

1. Constructing a scientific argument showing how their evidence supports their claim.

Evaluating

Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data (ACSIS205)

1. Identifying alternative explanations that are also consistent with the evidence.

Communicating

Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS208)

1. Constructing evidence based arguments and engaging in debate about scientific ideas .
2. Using a range of representations, including mathematical and symbolic forms, to communicate science ideas

LINKS TO SENIOR BIOLOGICAL / HUMAN BIOLOGICAL SCIENCE COURSES

1. Understand the cellular processes and mechanisms that ensure the continuity of life, and how these processes contribute to unity and diversity within a species
2. Understand the processes and mechanisms that explain how life on Earth has persisted, changed and diversified over the last 3.5 billion years
3. Understand how models and theories have developed over time; and the ways in which biological knowledge interacts with social, economic, cultural and ethical considerations in a range of contexts
4. Use science inquiry skills to design, conduct, evaluate and communicate investigations into heredity, gene technology applications, and population gene pool changes
5. Infectious disease differs from other disease in that it is caused by invasion by a pathogen and can be transmitted from one host to another
6. Zoonoses, such as influenza, can be transmitted between vertebrate species
7. The major groups of organisms that cause disease are bacteria, fungi, protists and viruses; each group can be distinguished by its structural characteristics
8. Understand that gene therapy can be used to treat a range of diseases, including diabetes mellitus.
9. Know that hormones and vaccines are developed using recombinant DNA and associated biotechnological techniques.
10. Understand the decision to participate in immunisation programs can be influenced by the social, economic and cultural context in which it is considered.
11. Appreciate that cell replacement therapy has the potential to treat nervous system disorders including Alzheimer's and Parkinson's diseases

Year 10 ACARA Science B: Sustainable Systems of Health and Energy Module Two: Biology/Human Biology – Health and Disease

Big Picture:

The mammalian body is made of several systems working together. Each system is specialised to carry out specific functions. A body's immune system prevents or responds to invading pathogens that cause disease. When our body is unable to fight off infections we may need medical technologies to help us, for example the use of vaccinations. Vaccinations can result in immunity to infection by exposure to attenuated versions of invading pathogens. In this way, the bodies' health can be sustained. To improve our ability to reduce the spread of disease scientists need to improve their understanding of the biology of pathogens.

Resource list

1. Human Perspectives Units 3 and 4 (Nelson) Chapter 10
2. WA Biology Units 3 and 4 (Nelson) Chapter 12
3. Biozone Year 12 Biology Chapter: 'The Nature of Pathogens' AND 'Defence and the Immune System'. (NOTE there is a separate answer booklet)

Wk	Theme	Concepts / Content	Student objectives	Skills T = taught for 1st time R = reinforced	RESOURCES / ASSESSMENT/ PRACTICALS
1	Micro-organisms that cause disease	1. Structural features of micro-organisms	1. List the four micro-organisms that cause disease (bacteria, viruses, protists and fungi). NOTE viruses are not technically living (non-cellular) because they do not share the common traits of living things (homeostasis, reproduction, metabolism (respiration), growth, response to stimuli). 2. Describe the main structural features (cellular/ non-cellular, prokaryotic/eukaryotic, unicellular/multicellular, type of cell membrane/wall) of the four main micro-organisms that cause disease. Compare similar structures and contrast differences. Organise the features into a comparison table. 3. Differentiate between types of bacteria spherical (coccus), rod-shaped (bacillus), or curved (spirillum and vibrio). State an example of an infectious disease caused by bacteria such as tuberculosis. 4. Compare DNA with RNA viruses simply. 5. Explain how viruses can **replicate** (not reproduce).	R Study skill: Use tables to organise information eg Structural features of 4 micro-organisms	Experiment- Compare the pathogens found on different fomites (S drive) WA Biology Units 3 and 4 (Nelson) Chapter 12. Structural features of four micro-organisms, Pages 410-422 'Key Concepts'. Plus virus life cycle. Vocabulary sheet: S Drive- students can use the hard copy/app/website to practice terminology eg App: Flashcards or website: studystack.com BioNinja: Types of Pathogens https://ib.bioninja.com.au/standard-level/topic-6-human-physiology/63-defence-against-infectio/pathogens.html Lumen Learning: Types of Bacteria https://courses.lumenlearning.com/microbiology/chapter/types-of-microorganisms/ STILE- The Immune System, 2.1 lessons: Pathogens- basics

2	Disease /Infectious disease	1. Types of infectious diseases 2. Infectious versus non-infectious	1. State a disease caused by a protist such as malaria. Describe protist pathogens as unicellular eukaryotes that are not classified as plants, animals, or fungi but may have some plant, animal or fungi features. For example, the protist that causes malaria is animal-like. 2. State a disease caused by a fungus such as candidiasis of the mouth or throat. 3. Define the term pathogen. Differentiate between infectious, contagious and non-infectious diseases 4. Distinguish between health, disease, disorder. 5. Define the terms micro-organism, infection, virulence, endemic, epidemic, pandemic, outbreak. 6. Investigate the biology of the virus that causes COVID-19; SARS-CoV-2 (formal name). Relate its structure to its function (ability to penetrate host cells to cause infection). • Identify structural components of SARS-CoV-2. • Describe the steps in the SARS-CoV-2 replication cycle. • Describe how a virus can change over time due to mutations. • Relate the concept of a 'zoonotic disease' to COVID 19 and make a justified conclusion about classifying COVID 19 as zoonotic/ not zoonotic. 7. Discuss a common infectious disease, its causes, symptoms and treatment. **(CAT)** **Extension** 1. HIV (Human Immunodeficiency Virus) can cause AIDS (Acquired Immune Deficiency Syndrome). The virus enters a type of T lymphocytes to reproduce. Consequently the T cells lose their normal immune function. • Find out the symptoms of HIV → AIDS • Find out the management of the disease. • Consider how HIV impacts different areas of the world. • Write a report of your findings. **Enrichment** 1. Plants can be affected by disease too. Study a disease that affects plants, e.g. *Phytophthora cinnamomi* (Dieback) or *Phytophthora infestans* (Potato blight) or one of your choice. Write a report on the prevalence of the disease. What is being done to prevent its spread. 2. Find out what prions are. What do they do? Why is there ongoing debates about them?	R Use ICT interactives to add value to learning R 21CLD/ Habits Creating, imagining, innovating and Thinking and communicating with clarity and Precision Visible learning: Ask students to reflect on their progress and work out what they need to do to improve understanding and achievement	Human Perspectives Units 3 and 4 (Nelson) Chapter 10. Pages 129-131 (only has bacteria and virus) WA Biology Units 3 and 4 (Nelson) Chapter 12. Pages 410-422 'Key Concepts' Biointeractive Virus Explorer https://www.biointeractive.org/classroom-resources/virus-explorer?utm_source=BioInteractive+News&utm_campaign=aa74eb0be9-EMAIL_CAMPAIGN_2020_090220_General&utm_medium=email&utm_term=0_98b2f5c6ba-aa74eb0be9-69336645&mc_cid=aa74eb0be9&mc_eid=aeed19e209 ASSESSMENT • Worksheets and homework as part of teacher mark. (5%) • 21CLD/ICT/Habits of Mind CAT PowerPoint presentation: Identify an infectious disease and then write a 5 minute PPT looking at what it is, where it occurs, prevalence, symptoms, treatment or management, bibliography. (15%) Centre for disease Control and prevention Fungal Infections https://www.cdc.gov/fungal/diseases/candidiasis/index.html Bioninteractive The Biology of SARS-CoV-2 Animations and interactive https://www.biointeractive.org/classroom-resources/biology-sars-cov-2?utm_source=BioInteractive+News&utm_campaign=aa74eb0be9-EMAIL_CAMPAIGN_2020_090220_General&utm_medium=email&utm_term=0_98b2f5c6ba-aa74eb0be9-

			• http://www.hhmi.org/biointeractive/explore-infectious-diseases http://www.sbs.com.au/shows/secretsofthehumanbody/tab-listings/page/i/5/h/Kuru-The-Science-and-the-Sorcery/ (SBS film on Kuru)		69336645&mc_cid=aa74eb0be9&mc_eid=aeed19e209 **Extension** Bacterial ID Lab https://media.hhmi.org/biointeractive/vlabs/bacterial_id/index.html Three types of viruses, mathematics, 3D printing. Biointeractive https://www.biointeractive.org/classroom-resources/viral-geometry-and-structural-diversity **Teacher Resource** WHO coronavirus-2019
3	Non-specific defence against infectious disease	External non-specific defence mechanisms	1. Compare briefly, the innate (non-specific) and adaptive (specific) immune systems to defend ourselves from pathogens. 2. Describe external non-specific defences (1st line of defence including skin, mucous membranes, hairs and acids) and internal non-specific defences (2nd line of defence including phagocytosis, inflammation and fever). 3. Describe four protective reflexes (external/non-specific defence) and give an example of each. 4. Discuss three ways that infectious diseases are spread: • Direct or close contact (transmission within 1-2m such as Ebola and COVID 19) • Indirect contact (transmission outside of 1-2m such as measles or on a fomite surface eg table) • Vectors (organisms that transmit pathogens from an infected host to a susceptible host eg mosquito. Diseases such as malaria and Ross River virus spread via mosquito vectors).		https://ib.bioninja.com.au/standard-level/topic-6-human-physiology/63-defence-against-infectio/lines-of-defense.html The Immune System https://courses.lumenlearning.com/wm-biology2/chapter/immune-system/ Human Perspectives Units 3 and 4 (Nelson) Chapter 11 WA Biology Units 3 and 4 (Nelson) Chapter 13. (Modes of Transmission). Biozone 'The Body's Defences', 'The action of Phagocytes', 'inflammation', 'fever', 'The immune system', 'Acquired immunity'. Innate and adaptive immunity videos Immune system https://artofsmart.com.au/hsctogether/immune-system/

4	Specific Defence	Internal specific defence mechanisms	1. Review (briefly) major Blood components as red blood cells, white blood cells, plasma and platelets. View them under the microscope or at a website. 2. State the main parts of the immune system. 3. List the different types of white blood cells that play a vital role in our immune system (function) (Macrophages and lymphocytes) 4. Define antibody and antigen and explain the function of an antibody and its specificity to an antigen. 5. Define and describe active/specific immunity. Define the terms 'immune' and 'passive immunity'. 6. Explain the role of lymphocytes (white blood cells) in humoral (antibody) mediated immunity and cell-mediated immunity. 7. Compare and contrast the similarities and differences between the humoral and the cell-mediated responses. 8. Discuss the difference between artificially acquired (response to being given an antibody or antigen) and naturally acquired specific immunity (no human intervention). **Extension** 1. Explain what is meant by herd immunity. Evaluate the effectiveness of several herd immunity programs. Why are some more effective than others? Write a report on your findings. 2. Consider blood disorders, such as leukaemia. How could these types of infections/diseases impact on the effectiveness of natural immunity? 3. There is a lot of controversy over whether to vaccinate or not to vaccinate. Reflect on the debate and present both arguments. Then explain what the scientific evidence shows. What concerns do people have about vaccinations? What are the problems with not vaccinating against certain diseases? 4. Hypothesise as to use of nanotechnology in use to administer vaccines. **Enrichment** 1. Design a superbug. Compose the features it would have. Create the mode of transmission of the bug. 2. Research a specific "superbug." Where did it originate from? Hypothesise as to how it developed. 3. Conduct a survey to identify how many people have been immunised. 4. Consider the design of new medical drugs to improve our health. Are there side effects. How concerned should we be?		Biointeractive: The Immune System https://www.biointeractive.org/classroom-resources/immune-system Worksheet in Connect Major blood components, functions and microscopy http://www.funsci.com/fun3_en/blood/blood.htm#16 The learning Hub Use the interactive and watch the videos to learn about the main parts of the immune system and their functions. https://www.sciencelearn.org.nz/image_maps/68-the-immune-system To learn about specific/ active immunity and methods of control: Human Perspectives Units 3 and 4 (Nelson) Chapter 11 The Immune System video summary and quiz http://highered.mheducation.com/sites/0072507470/student_view0/chapter22/animation__the_immune_response.html Biointeractive Immune System Illustrations Power Point saved in Connect

5	Controlling infectious disease Exam Revision	Prevention, medication, vaccination Biology, Chemistry and Physics	1. Discuss three ways infectious diseases can be controlled. • Physical preventative (gloves/nets/handwashing) • Medication (antibiotics/antivirals) • Vaccination (define) 2. Explain why vaccinations were developed, what they consist of (living attenuated micro-organisms, dead micro-organisms, toxoids or sub-units) and discuss the specificity of the antibodies and antigens. 3. Describe the use of nanotechnology to deliver vaccines or genetic sequencing or engineering to produce a vaccine. **Exam outline** Multiple choice questions on essential knowledge and structured questions. Short answer, extended answer.	Study Skills GRAPHING Introduction for Year 9 and 10 science students (R) S:\AdminShared\Teaching Staff\Science\Year 10\1. Science A - Walking in the Footsteps\5. Revision Items Exemplar Study Timetable	Bioninja Vaccination basics https://ib.bioninja.com.au/higher-level/topic-11-animal-physiology/111-antibody-production-and/vaccination.html CSIRO multimedia Showcase of how a potential COVID-19 vaccine is being produced with the help of CSIRO and the University of Queensland (UQ). https://www.csiro.au/en/Showcase/COVID-19-vaccine Epidemic and management simulation (30-45 minutes) http://www.thegreatflu.com/ Assessment: • Common Assessment Task – 15% (Done in week 2) • Teacher mark – 5% Throughout module) • **Exam – 80%**

SOLO Key indicating differentiation

This should help you determine the level of learning required for each objective. The number of 'underlines' indicates level of learning.

Multistructural learning; Several discrete items/ideas of content will be learned eg definitions.
Relational: Relationships/links between items/ideas will be learned. Students will be asked to relate one concept to another eg comparisons.
Extended Abstract: Students will apply principles learned through linking ideas/content and investigating relationships

formative assessment highlighted

Reflection questions
Teacher reflection question for:
1. Student feedback
2. Task improvement (teacher feedback)

a. What concepts do the students understand at a low/high level?
b. Did the order of objectives flow?
c. Where would scaffolding/graphic images be helpful for student progress?
d. During which parts of the topic did students require more extension work?
e. Could students benefit from more diagnostic or formative testing?
f. Based on cohort performance data, was the test degree of difficulty too high or too low?