Science Stage 5 (Year 9) – sample program of learning

Disease

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This program of learning refers to other resources designed to support the delivery of the Disease focus area. This includes Teacher resource book 1 **(TRB1)**, Teacher resource book 2 **(TRB2)**, Teacher resource book 3 **(TRB3)** and the Disease slide deck **(DIS PPT)**.

# Rationale

This sample program of learning has been developed by the NSW Department of Education. NSW Education Standards Authority (NESA) defines [programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) as the process of ‘selecting and sequencing learning experiences which enable students to engage with syllabus outcomes and develop subject-specific skills and knowledge’ (NESA 2022).

This program has been developed to assist teachers in NSW Department of Education schools in creating learning experiences contextualised to their classroom. The program has suggested timeframes that may need to be adjusted by the teacher to align with the school calendar and meet the needs of their students. The program may provide links to webpages not part of the department’s website. These links are provided as a source of information or activities that may be suitable for delivering the course content. These sites are managed by organisations, companies or individuals outside of our control, and the department is not responsible for the information or subsequent links on these web pages.

# Overview

In this program of learning, students will gain a deep understanding of how the body responds to environmental changes and the mechanisms that maintain homeostasis and prevent disease. Through practical and secondary-sourced investigations, students will learn how to prevent diseases, including the use of immunisation and traditional Aboriginal and Torres Strait Islander People’s practices. Students will also learn about the causes of infectious and non-infectious diseases and how this impacts the strategies to prevent, manage or treat the diseases. Students will hone their skills in analysing scientific data and effectively communicating their findings, backed by evidence.

**Prior learning**

**The following content is foundational for learning about the concepts in the Disease focus area:**

* **recognise that the human brain detects information about the surroundings using sense organs, and that it controls and coordinates body functions (**Stage 1 Science and Technology K–6)
* **identify the main organs and their functions in the human digestive, respiratory and circulatory systems (**Stage 3 Science and Technology K–6)
* **how body systems work together to maintain a healthy organism. If a part of the body is not functioning correctly or is removed, this can cause disease (**Stage 4 Science Living systems)
* **the structure and function of various cells, tissues, and organs (**Stage 4 Science Cells and classification)
* **various types of models and how they can be used to make predictions (**Stage 4 Science Data science 1).

**Future learning**

**After completing the Disease focus area, students will be able to apply their learning to the following content:**

* **some non-infectious diseases may be caused by defective genes (**Stage 5 Science Genetics and evolutionary Change)
* genetic testing can be used to reduce the incidence of genetic diseases **(**Stage 5 Science Genetics and evolutionary Change).

**Transfer of learning**

Students will be able to use their learning developed in this focus area to:

* make informed and evidence-based decisions to maintain good health or prevent disease (for example, hygiene and vaccination)
* reduce the spread of infectious disease (by maintaining personal habits that reduce the spread of disease)
* understand how scientific modelling can be used by institutions to make decisions or test ideas (for example, health, weather, seismology)
* use reliable secondary sources to make informed, evidence-based decisions.

Table 1 – overview of the Disease program of learning

|  |  |
| --- | --- |
| Feature | Details |
| **Outcomes** | **A student:**   * explains how an understanding of the causes of disease can be used to prevent and manage the spread of disease **SC5-DIS-01** * follows a planned procedure to undertake safe, ethical, valid and reliable investigations **SC5-WS-04\*** * selects and uses a range of tools to process and represent data **SC5-WS-05\*** * analyses data from investigations to identify trends, patterns and relationships, and draws conclusions **SC5-WS-06** * selects suitable problem-solving strategies and evaluates proposed solutions to identified problems **SC5-WS-07\*** * communicates scientific arguments with evidence, using scientific language and terminology in a range of communication forms **SC5-WS-08**   [Science 7–10 Syllabus](https://curriculum.nsw.edu.au/learning-areas/science/science-7-10-2023/overview) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2023.  \*Additional outcomes have been included in this program of learning. |
| **Assessment** | [Investigating the use of antiseptics in preventing disease](https://education.nsw.gov.au/teaching-and-learning/curriculum/science/science-curriculum-resources-k-12/science-7-10-curriculum-resources/science-s5-disease) |
| **Duration** | **10 weeks** |
| **Special materials and equipment** | * **See the assessment task for this unit to determine material requirements based on the chosen mode (demonstration or secondary source)** * **Clear plastic cups with a 1 mm hole drilled in the bottom** – one per group of students(Modelling homeostasis) * **Temperature probes – one per group of students** * **Data logger with heart rate monitor (optional)** * **Blindfolds – one per pair** * **Different coloured circle-shaped stickers** * **Transparency film** |

**Risk management:** teachers are advised to undertake a risk assessment before conducting any classroom investigation or experiment. For more information on developing risk assessments, see [Risk Assessment – a pre-requisite for risk control](https://education.nsw.gov.au/inside-the-department/facilities-assets-and-equipment/school-infrastructure-nsw/knowledge/directorates/operations/technical-services/compliance-and-environment/chemical-safety-in-schools/section-1--general-information-for-all-staff/1-7-risk-assessment---a-pre-requisite-for-risk-control).

## Navigating the resources

This document provides information for teachers to navigate the teacher resource books and the supporting PowerPoint for Disease. All content in these resources is aligned with the topics in the sample program. For example, the topic '1 What do you know?’ in the Disease program is aligned with '1.1 What do you know?’ activities in Teacher Resource Book 1 and supporting PowerPoint documents.

Additional information for the activities in the program, such as practical investigation instructions, student worksheets and more, will be found in the corresponding teacher resource books **(TRB1, TRB2** and **TRB3**). The supporting PowerPoint slide deck (**DIS PPT**) contains student-facing information, such as learning intentions and success criteria and checks for understanding for each topic in the program.

Table 2 – resource coding for cross-referencing between the program and supplementary resources

|  |  |
| --- | --- |
| **Coding in this resource** | **Document that it is referring to** |
| **TRB1** | [Disease Teacher resource book 1 – Disease](https://education.nsw.gov.au/teaching-and-learning/curriculum/science/science-curriculum-resources-k-12/science-7-10-curriculum-resources/science-s5-disease) |
| **TRB2** | [Disease Teacher resource book 2 – Disease](https://education.nsw.gov.au/teaching-and-learning/curriculum/science/science-curriculum-resources-k-12/science-7-10-curriculum-resources/science-s5-disease) |
| **TRB3** | [Disease Teacher resource book 3 – Disease](https://education.nsw.gov.au/teaching-and-learning/curriculum/science/science-curriculum-resources-k-12/science-7-10-curriculum-resources/science-s5-disease) |
| **DIS PPT** | [Slide deck – Disease](https://education.nsw.gov.au/teaching-and-learning/curriculum/science/science-curriculum-resources-k-12/science-7-10-curriculum-resources/science-s5-disease) |

# Lesson sequence

## 1 How and why does the body respond to a changing environment?

Table 3 – content and teaching and learning activities for lesson sequence 1

|  |  |  |
| --- | --- | --- |
| Content | Teaching and learning activities | Registration and evaluation notes |
| **This lesson revises** Stage 4 contentfrom Cells and classification and Living systems. | 1.1 What do you know? – write the room (approximately 45 minutes) Revise prior learning relevant to understanding the Disease focus area from Stage 4 using the ‘What do you know? – write the room activity **(TRB1).** Image prompts are provided in the **DIS PPT slide ‘1.1 What do you know about living things and disease?’**   * Single-celled organisms (focusing on bacteria and fungi) * Specialised cells in multicellular organisms * Body systems and their interrelated functions * Organs and their functions * Models in science   The teacher leads a discussion about the content of the butcher's papers to clarify student understanding, including identifying alternate conceptions, misconceptions or gaps in knowledge. |  |
| **Homeostasis**   * Identify the importance of maintaining stable internal conditions of the body   **Problem-solving**   * Use cause-and-effect relationships and models to explain ideas and make predictions | 1.2 Maintaining a balance (approximately 1.5 hours) **Modelling homeostasis (practical investigation) TRB1**  Define ‘homeostasis’ **(DIS PPT)** as ‘the ability of an organism to maintain stable internal conditions despite external changes’. Explore the etymology of the terms ‘homeo’ and ‘stasis’.  Conduct a practical investigation to model homeostasis **(TRB1)**.   * Relate the model to the human body processes that maintain health (for example, body temperature, water levels, blood sugar). * Explain the cause-and-effect relationships in the model. * Evaluate the model, including strengths and limitations.   Describe how the body's inability to maintain homeostasis can lead to illness. In contrast, the proper regulation of homeostasis is essential for normal bodily function.  **Checkpoint**: use a hinge question to ascertain students understanding after the activity, for example:  What happens to your body’s internal temperature if you are exposed to a cold environment for an extended period? **(TRB 1)** and **(DIS PPT)**. |  |
| **Homeostasis**   * Investigate examples of an organism’s observable response to a stimuli   **Processing data and information**   * Select and use a range of representations to organise data and information, including graphs, keys, models, diagrams, tables and spreadsheets.   **Analysing data and information**   * Assess the validity and reliability of first-hand data * Describe relationships between variables * Synthesise data and information to develop evidence-based arguments | 1.3 Response to stimuli (approximately 2 hours) Determineprior knowledge about how the body responds to stimuli using a [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645?clearCache=d92f75b2-bc9c-325a-938c-821c8243e3f2) activity with images as stimulus material for students **(DIS PPT)**.  **Reliability and validity of investigations (TRB1 and DIS PPT)**  Use the ‘Student resource – reliability and validity text’ to teach students what reliability and validity are in practical investigations. Students assess examples of data as reliable and valid with supporting questions.  **Investigate the heart’s response to a stimulus (practical investigation) (TRB1 and DIS PPT)**  **Note:** students need access to a safe outdoor space to walk, jog and run to conduct this activity. Use an alternate safe indoor space if no safe outdoor space is available.  **Note:** this investigation will concentrate on precision (internal reliability) and validity.  Revise with students how to construct a suitable table and use quality criteria to provide peer feedback using a strategy such as [guided feedback chat](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549?clearCache=a8c3ff71-86dc-e65e-3aa2-188e6c52930).  Students conducta first-hand investigation to determine how exercise type impacts heart rate in humans. Students construct a table to collect data and calculate the mean. Students draw a suitable graph and provide peer feedback on the graph using the quality criteria using a strategy such as [guided feedback chat](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549?clearCache=a8c3ff71-86dc-e65e-3aa2-188e6c52930).As a class, assess the validity and reliability of this investigation and teach students how to provide suggestions for improvement.  **Differentiation:** varied levels of scaffolding have been provided in the **DIS PPT** to support students in drawing tables (see slides ‘1.3 Table scaffold 1’ and ‘1.3 Table scaffold 2’). Scaffolding should be removed once students have grasped this skill so they can practice constructing suitable tables independently.  As a class, co-construct responses to the discussion questions related to the first-hand investigation.  **Differentiation:** support students in defining ‘stimulus’ by providing keywords or a fill-in-the-blanks sentence **(DIS PPT)**.  Link the heart rate activity to the previous homeostasis activity (**TRB1**), focusing on oxygen uptake and carbon dioxide removal related to increased heart rate and breathing rate.  **Interpreting data about sweating and temperature (TRB1 and DIS PPT)**  Use the [Slow Reveal Graphs](https://slowrevealgraphs.com/introduction/) technique to guide students in interpreting a graph to describe the relationships between the variables (Internal body temperature, skin temperature and sweating rate) and synthesise a conclusion about the homeostatic responses in the given scenario. Students describe the experiment's results and explain why the changes occurred.  **Checkpoint**: ask students the following questions and discuss them as a class **(TRB 1 and DIS PPT)**.   1. Distinguish between stimulus and response. 2. Outline the importance of an organism responding to stimuli in its internal and external environment. |  |
| **Homeostasis**   * Identify the role of feedback loops in maintaining homeostasis   **Analysing data and information**   * Synthesise data and information to develop evidence-based arguments | 1.4 Feedback mechanisms (approximately 1 hour) **Prior knowledge**  Tell students they will link what they learned from previous activities to this lesson. The teacher leads a discussion to recall information about temperature changes in the homeostasis model and heart rate activity (1.2 and 1.3). Ask students how they think the body regulates temperature to maintain homeostasis.  **The role of feedback loops (TRB1 and DIS PPT)**  Watch [Homeostasis and Negative/Positive feedback (6:23)](https://www.youtube.com/watch?v=Iz0Q9nTZCw4). Students extract and summarise key points to answer the questions about negative and positive feedback loops.  Using the [’What Makes You Say That?](https://pz.harvard.edu/resources/what-makes-you-say-that)’ thinking routine, students use information from the video and a representation of a temperature regulation feedback loop to identify whether the regulation of internal body temperature in the heart rate activity would be classified as a negative or positive feedback loop.  **Differentiation**: to extend students, ask them to construct a negative feedback loop for changes in internal body temperature if they were above and below the normal internal body temperature range.  **Checkpoint (DIS PPT and TRB1)**: provide students with an image of a feedback loop. Ask students questions to check their understanding of feedback loops and their role in maintaining homeostasis. |  |
| **Homeostasis**   * Describe how the nervous and endocrine systems coordinate the body’s response to stimuli   **Analysing data and information**   * Describe patterns and trends, including inconsistencies in data and information * Use knowledge of scientific concepts to draw conclusions that are consistent with evidence   **Communicating**   * Create written texts to communicate scientific investigations, explain scientific theories and principles, structure a scientific argument, and evaluate findings in light of scientific knowledge   **Processing data and information**   * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs, and multimedia resources | 1.5 Coordinating the response to stimuli (approximately 5 hours) **Structure and function of the endocrine system (secondary-source investigation) (TRB1 and DIS PPT)**  Explicitly teach students and model how to extract and summarise **key points from the** [Endocrine System text](https://my.clevelandclinic.org/health/body/21201-endocrine-system) **using** [Stage 5 reading - Literal comprehension](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/literacy/teaching-strategies/stage-5/reading/stage-5-literal-comprehension) **and** [Comprehension strategies - summarising](https://cer.schools.nsw.gov.au/professional-learning/middle-years.html#:~:text=%C2%A0Summarising%20(PDF%2082KB)) **to answer questions that define endocrine system and hormone, and outline the function of the endocrine system.**  **Differentiation:** give students a cloze passage with a word bank to support them in constructing responses using the summarised information from the text (**DIS PPT** ‘1.5 Endocrine system cloze passage’).  **Checkpoint:** use a hinge question to ascertain students' understanding of the primary role of the endocrine system **(TRB1)**.  **Endocrine system simulation (DIS PPT)**  Students engage with **the** [Bioman Endocrine Ed simulation](https://biomanbio.com/HTML5GamesandLabs/Physiologygames/endocrine_edhtml5page.html) **(DIS PPT)** to:   * compare the relative speed of the response coordinated by the endocrine system * **explain** how hormones and feedback loops work to maintain homeostasis * use an example to **describe** how the endocrine system coordinates the body’s response to stimuli.   **Differentiation:**  To support students in extracting information, provide the [cloze passage worksheet](https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fbiomanbio.com%2FHTML5GamesandLabs%2FPhysiologygames%2FEndocrine%2520Ed%2520worksheet.docx&wdOrigin=BROWSELINK) related to the ‘Endocrine Ed’ simulation above to support student understanding.  Construct and interpret negative feedback loops for blood glucose levels to enhance student understanding. Relate this to the stimulus-response model. Explain how the endocrine system coordinates these responses.  **Observing the body’s response to stimuli (practical investigation) (TRB1 and DIS PPT)**  Students conduct a first-hand investigation for a given inquiry question to observe the body’s response coordinated by the nervous system in catching a ruler when exposed to different stimuli. Students construct the results, discussion, and conclusion components of a scientific report to communicate their findings.  **Differentiation:** varied levels of scaffolding can be provided to students to support them in drawing tables **(DIS PPT)**.  **Structure and function of the nervous system (secondary-source investigation) (TRB1) and (TRB1 and DIS PPT).**  **Note:** this activity applies skills learned in the previous activity on the endocrine system. Use principles of [gradual release of responsibility](https://education.nsw.gov.au/teaching-and-learning/curriculum/explicit-teaching/explicit-teaching-strategies/gradual-release-of-responsibility) to determine the best mode of delivery for this lesson.  Define the nervous system and describe the general structure of the nervous system to students using the image in the **DIS PPT.**  Students participate in a [jigsaw activity](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/546?clearCache=4db962a-815b-2933-acc4-8578b016c66f) to extract information from a given text to outline:   * the structure of the nervous system, including the central and peripheral nervous system * the function of the nervous system, including the central and peripheral nervous system * the stimulus-response pathway, including applying it to the previous catching a ruler and heart rate activities * how the nervous system coordinates the body’s response to stimuli.   Use student information to jointly construct a response to the question ‘Describe how the nervous system coordinates the body’s response to different stimuli’, using examples.  **Differentiation:** give students key concepts and terms to include in responding to the final question **(DIS PPT)**. |  |
| **Homeostasis**   * Compare and contrast the responses of the nervous and endocrine systems   **Communicating**   * Create written texts to communicate scientific investigations, explain scientific theories and principles, structure a scientific argument, and evaluate findings in light of scientific knowledge | 1.6 Comparing the endocrine and nervous systems (approximately 45 minutes) **Similarities and differences between responses of the nervous and endocrine systems (DIS PPT)**  Using knowledge from the previous activities and the mind map, students complete a [double Venn diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599?clearCache=b211e76c-d4ab-d373-a0d4-c6e8adc4ce7) to compare the responses of the nervous and endocrine systems, considering the speed of action, nature of the message, duration of the effects and area of the effects.  **Checkpoint:** give students mini whiteboards and ask them to write features of the responses of the nervous and endocrine systems. We need to ensure they understand the features to construct a response to the next question.  **Preparing to write a response (TRB1 and DIS PPT)**  **Teach students how to deconstruct examination-style questions using a strategy such as Verb-Content-Focus-Singular (V-C-F-S).**  **Examination style question:** compare and contrast how the human nervous and endocrine systems respond to stimuli.  **Model how to plan a response based on the deconstructed question.** Provide marking criteria to the class and annotate the given sample responses with feedback, considering whether all components of the question have been addressed and whether connectives (cohesive words) for comparing and contrasting have been used. [Jointly construct](https://schoolsnsw.sharepoint.com/sites/WiSresourcehub/SitePages/Joint-Construction.aspx) an improved response for sample 2 using the annotated feedback.  **Differentiation**: students improve using correct and precise scientific terminology by completing the level-up activity **(TRB1)**. |  |

## 2 How do we effectively manage and treat infectious diseases?

Table 4 – content and teaching and learning activities for lesson sequence 2

|  |  |  |
| --- | --- | --- |
| Content | Teaching and learning activities | Registration and evaluation notes |
| **Infectious and non-infectious diseases**   * Distinguish between infectious and non-infectious disease * Identify causes of non-infectious and infectious diseases   **Note:** this essential question focuses on infectious disease. The non-infectious disease content is covered in essential question 3.  **Conducting investigations**   * Extract information from a wide range of reliable secondary sources and acknowledge these sources using an accepted referencing style   **Processing data and information**   * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs and multimedia resources   **Analysing data and information**   * Analyse the validity of information from secondary sources | 2.1 Causes of infectious diseases (approximately 1.5 hours) **Disease concept map (TRB2)**  **In groups, students construct a concept map to demonstrate their prior knowledge about infectious and non-infectious diseases.**  **Note:** the prior knowledge activity broadly identifies students’ prior understanding, alternate conceptions and misconceptions about infectious and non-infectious diseases, giving the teacher an overview of their students’ current level of knowledge and understanding. Students should have learned how disorders and diseases affect body systems in Stage 4 Living systems. Students will revisit this concept map after learning the content and skills related to infectious and non-infectious diseases, so students can determine their growth in understanding. Teachers can also look at the students’ pre and post work to ascertain their growth.  **Defining infectious disease (DIS PPT)**  Provide the definition and an outline of disease and infectious disease, including examples from the concept map (see slide ‘2.1 Defining disease and infectious disease’ in the **DIS PPT**). Outline the types of pathogens and examples of diseases they cause (see slide ‘2.1 What are pathogens?’ **DIS PPT**).  Facilitate a class discussion about how infectious diseases are transmitted. Draw on students' prior understanding and describe additional examples to close knowledge gaps. Co-construct a table to collate information on the modes of transmission **(**see slide ‘2.1 Disease transmission’ in the **DIS PPT)**.  **Checkpoint**: check for understanding by asking the students to identify the non-infectious disease in a list **(DIS PPT)**.  **Investigating the causes of infectious disease (secondary-source investigation) (TRB2 and DIS PPT)**  Teach students to do research online, focusing on finding reliable and valid sources by modelling a search for information about chickenpox. Teach students how to analyse the reliability, accuracy and validity of secondary sources using the [Chickenpox and Shingles fact sheet](https://www.health.nsw.gov.au/Infectious/factsheets/Pages/chickenpox.aspx).  Students conduct a secondary-source investigation to extract and summarise information related to the cause (including type of pathogen) and transmission of various infectious diseases. Jointly construct a response using the information to identify that infectious diseases are caused by pathogens (such as bacteria, viruses, fungi and parasites) and that transmitting pathogens is crucial to spreading the infectious disease.  **Checkpoint: give students** a multiple-choice question to check their understanding of the causes of infectious diseases **(DIS PPT)**. |  |
| **Infectious and non-infectious disease**   * Use modelling to investigate how infectious diseases can be spread   **Problem-solving**   * Use cause-and-effect relationships and models to explain ideas and make predictions | 2.2 Disease transmission (approximately 1 hour) **Checkpoint (DIS PPT):** students respond to a multiple-choice question on modes of disease transmission and classify a range of scenarios as direct, indirect and vector transmission using mini whiteboards.  **Modelling the spread of disease (practical investigation) TRB2**  Conduct a practical investigation to model the spread of disease**.** Students exchange an unknown solution in their test tube with 5 peers. Outline how scientific models can be used to predict outcomes. Discuss the strengths and limitations of the model in showing how infectious diseases can be spread. |  |
| **Infectious and non-infectious diseases**   * Identify how the body prevents the entry of pathogens and describe how it responds to pathogens that enter the body * Outline how a vaccination stimulates the body to produce antibodies to fight infection   **Conducting investigations**   * **Extract information from a wide range of reliable secondary sources and acknowledge these sources using an accepted reference style**   **Communicating**   * Recognise that scientific texts develop arguments by encouraging the reader to adopt a specific perspective and positioning them to accept the authority of a text | 2.3 Preventing the entry of and responding to pathogens (approximately 1.5 hours) **Prior knowledge (DIS PPT)**  **Recall the definition of a pathogen. Brainstorm how the body responds when it is sick.** Remind students that they have learnt about what causes infectious diseases and how they are spread, and now, they will focus on what happens when a person encounters a pathogen.  **The 3 lines of defence (secondary-source investigation) (TRB2 and DIS PPT)**  As a class, extract and summarise key points from [The Three Lines of Defense Against Pathogens | Biology (4:04)](https://www.youtube.com/watch?v=davUbXFEEl0)to complete an information organiser to:   * **identify whether each line of defence is specific or non-specific** * **describe how** each of the lines **prevents entry of pathogens into the body or responds to pathogens in the body.**   Unpack key components of the first, second and third lines of defence using the **DIS PPT**.  **Differentiation:** two options have been provided to enhance student understanding using analogies of the immune response **(TRB2 and DIS PPT).** Option 1: Building a house analogy. Option 2: Your body is a fortress analogy.  **How do vaccinations work? (DIS PPT)**  Introduce vaccines to reduce the incidence and spread of disease by displaying the Canva slide deck [Vaccinations and Antibodies](https://www.canva.com/design/DAGYMWyV9PY/Ralvvk7HAxP5xj-PPgFoIg/edit?utm_content=DAGYMWyV9PY&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton)?  Watch the [How do vaccines work? – Kelwalin Dhanasarnsombut (4:35)](https://www.youtube.com/watch?v=rb7TVW77ZCs&t=2s) video about vaccinations up to 3:21. Students extract and summarise key points to answer questions about how vaccines work. D**iscuss student responses as a** class to ascertain student understanding.  Describe the specificity of antibodies and pathogens using a diagram and complete a Think-Pair-Share activity focusing on how a vaccination stimulates the body to produce antibodies.  **Checkpoint: students complete a hinge question:** ‘How do vaccines help protect the body from infectious diseases?’ **(TRB2 and DISPPT).**  **Misinformation about vaccines (TRB2)**  **Note:** exercise due diligence before implementing this activity in your classroom. If there are students in your class for whom the topic below will cause issues, then we recommend that this activity not be implemented.  Tell students about the importance of using valid and reliable scientific texts to verify or gather information about a topic. Introduce students to the idea of the authority of a text.  Read the [The MMR vaccine, autism connection](https://www.naturalnews.com/050092_MMR_vaccine_autism_immunization_dangers.html) text and the [Measles, Mumps, Rubella (MMR) Vaccine Safety](https://www.cdc.gov/vaccine-safety/vaccines/mmr.html?CDC_AAref_Val=https://www.cdc.gov/vaccinesafety/vaccines/mmr-vaccine.html) text as a class. Identify components of each text which attempt to give it authority. Justify which text is scientific and which is non-scientific. Compare how the scientific and non-scientific texts make claims and use evidence and reasoning to support them. |  |
| **Infectious and non-infectious diseases**   * Compare the features and incidences of epidemics, endemics and pandemics   **Processing data and information**   * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs and multimedia resources   **Analysing data and information**   * Use knowledge of scientific concepts to draw conclusions that are consistent with evidence. | 2.4 Endemics, epidemics and pandemics (approximately 1.5 hours) **Recalling the COVID-19 pandemic (DIS PPT)**  As a class, watch [The Spread of Coronavirus in 2 Years (First Case to 260 Million Cases) (5:59)](https://www.youtube.com/watch?v=0hwlvjmVcZo) video. Recall that cases of COVID-19 were first detected in Wuhan, China, at the end of 2019 and spread quickly across China and beyond. COVID-19 caused a pandemic to be declared on 11th March 2020 by the World Health Organisation as it spread around the globe.  Define the terms endemic, epidemic and pandemic and discuss examples of each **(DIS PPT)**.  **Investigating a fictional disease as a potential pandemic (TRB2)**  Introduce students to the fictional Novel Emerging Respiratory Disease (NERD) caused by a virus. In groups, students engage with the ‘What is NERD factsheet?’, outlining who can get it, the symptoms, control measures, how it spreads and what to do if you have been in close contact.  Students will use fictional disease event data to describe disease events, outline the features of endemics, epidemics and pandemics and justify the classification of diseases as epidemic, endemic or pandemic.  As a class, use the scientific evidence available to construct a response using [Claim-Evidence-Reasoning (C-E-R)](https://blossoms.mit.edu/videos/lessons/3_2_1_blast_off_understanding_reaction_rate_better_design_toy_rocket) to justify their declaration of a pandemic.  **Comparing endemics, epidemics and pandemics (TRB2 and DIS PPT)**  Students extract information from a table to construct a [three-way Venn diagram](https://docs.google.com/presentation/d/1ynSLSKO-z7exGkYwM4eaRb1MLx34nWXx_LWEJj59sSA/template/preview?clearCache=c04d7a11-e3a-f5a-2981-9280acb87753) to compare the features and incidences of endemics, epidemics and pandemics.  **Checkpoint**: students write a response to compare epidemics, endemics and pandemics, including an example of each. A sample response has been provided in the **DIS PPT**. |  |
| **Disease control and prevention**   * Analyse data about immunisation programs and the occurrence of infectious diseases to identify trends, patterns and relationships and document conclusions in a written text   **Processing data and information**   * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs and multimedia resources   **Analyse data and information**   * Describe patterns and trends, including inconsistencies in data and information * Describe relationships between variables * Use graphed data from investigations to extrapolate or interpolate information to make predictions * Evaluate conclusions and evidence, including identifying sources of uncertainty and possible alternative explanations   **Communicating**   * Present scientific arguments using evidence, correct scientific language and terminology as appropriate to audience and purpose | 2.5 Using vaccines to prevent diseases (approximately 2.5 hours) **Vaccine effectiveness (TRB2 and DIS PPT)**  Students access the ‘Investigating vaccine effectiveness’ text to set the context for vaccine effectiveness and immunisation programs, starting with the development of the smallpox vaccine. Students respond to a series of questions about vaccine and immunisation program effectiveness.  **Differentiation: a barrier game could be used to promote engagement with the text. This strategy is further unpacked in TRB2.**  **Note:** the question about vaccine effectiveness challenges the idea that vaccines are only effective if you don’t get sick from the disease. This is not true. Vaccine effectiveness is the percentage of disease cases reduced in a vaccinated group compared to an unvaccinated group. To determine how effective a vaccine is, you need to look at data to compare the vaccinated and unvaccinated populations.  Students engage with the[Australian Government’s National Immunisation Program Schedule](https://www.health.gov.au/topics/immunisation/when-to-get-vaccinated/national-immunisation-program-schedule)Australian Government's National Immunisation Program (NIP) Scheduleand extract information to answer questions related to the text. Discuss the importance of following the Australian Government's National Immunisation Program Schedule.  **Measles case study (practical investigation) (TRB2)**  Demonstrate the spread of Measles in an unvaccinated population with a [disease model simulation](https://www.learner.org/wp-content/interactive/envsci/disease/disease.html) and then compare it with its spread in a vaccinated population.  Reiterate that measles is one ofthe diseases on the National Immunisation Program Schedule and explain why it is on the NIP. Teach students about trends, patterns, and relationships. Model how to construct a response to describe the trend, pattern and relationship in graphs.  Observe measles data in graphs and model how to analyse the graph, including describing trends, patterns and relationships and interpolating information. Teach students how to evaluate a given conclusion about how well the MMR vaccine reduced the incidence of measles by comparing the vaccinated and unvaccinated populations.  **Differentiation:** use a [Dictogloss](https://www.aitsl.edu.au/tools-resources/resource/dictogloss-for-eal-d-students-illustration-of-practice) to deliver the information in **TRB2** about measles with the goal of students recreating the text. Dictogloss is a useful strategy for EAL/D students as it improves listening skills and vocabulary.  **Analysing vaccination data (secondary-source investigation) (TRB2)**  Students analyse data related to the incidence and deaths of vaccine-preventable diseases on the National Immunisation Program Schedule to determine trends, patterns and relationships and draw conclusions using the given data.  **Note:** the [Australian Institute of Health and Welfare](https://www.aihw.gov.au/reports/australias-health/infectious-and-communicable-diseases) has data on infectious and communicable diseases. The category of vaccine-preventable disease can be selected to observe the data for diseases on the NIP.  Other sources of infectious disease data include:   * [Data – Infectious diseases](https://www.health.nsw.gov.au/infectious/pages/data.aspx) * [Our World in Data](https://ourworldindata.org/)   **Differentiation:** for students who may still not be confident writing conclusions using C-E-R, provide the scaffold with sentence starters. |  |
| **Disease control and prevention**   * Assess ways to reduce the incidence and spread of infectious disease   **Processing data and information**   * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs and multimedia resources | **2.6 Reducing the incidence and spread of infectious disease** (approximately 2 hours) **Strategies to reduce the incidence and spread of infectious diseases (secondary-source investigation) (TRB2)**  Brainstorm strategies used during the COVID-19 pandemic to reduce the incidence and spread of the disease in Australia and worldwide.  Recall how to conduct a secondary-source investigation, including how to find valid sources and extract and summarise key points from these sources. Students independently conduct a secondary-source investigation to outline strategies to reduce the incidence and spread of infectious diseases. They then apply this understanding to assess each strategy in the context of a chosen infectious disease.  **Checkpoint:** provide students with the stimulus question **(TRB2)**. Students must transfer their knowledge and skills from this learning sequence into this new context. |  |
| **Disease control and prevention**   * Investigate Aboriginal and/or Torres Strait Islander Peoples’ use of plants to prevent or control disease   **Processing data and information**   * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs and multimedia resources | 2.7 Aboriginal and Torres Strait Islander peoples’ use of plants (approximately 45 minutes) **Using plants to prevent or control diseases (secondary-source investigation) (TRB2)**  Recall how to conduct a secondary-source investigation, including how to find valid sources and extract and summarise information. Watch [Learn about how Aboriginal People use Native Plants (10:02)](https://www.youtube.com/watch?v=X0xIApr274k) and extract information to identify plants used by First Nations people to prevent or control diseases.  Students research the 2 plants they identified related to disease control and prevention to describe:   * how First Nations peoples prepared each of the plants * how each of the plants was used to prevent or control disease.   **Checkpoint:** students write a response to the question in their book.How do Aboriginal and Torres Strait Islander peoples’ use plants to prevent or control disease? Describe one specific example and explain how it works. |  |
| **Disease control and prevention**   * Assess ways to reduce the incidence and spread of infectious disease * Investigate Aboriginal and/or Torres Strait Islander Peoples’ use of plants to prevent or control disease   **Communicating**   * Create written texts to communicate scientific investigations, explain scientific theories and principles, structure a scientific argument, and evaluate findings in light of scientific knowledge | 2.8 Assessment task – investigating the use of antiseptics in preventing disease (approximately 3 hours) Introduce students to the techniques used in microbiology by showing them the [Exploring Antibiotic Resistance Video (6:11)](https://www.southernbiological.com/exploring-antibiotic-resistance-video/). Tell students they will be measuring the zones of inhibition of antiseptic substances and how they compare them in preventing the growth of specific bacteria.  This video suggests incubating agar plates at 37°C. In a school laboratory, we must not incubate agar plates at 37°C to minimise the growth of human pathogens. For more information, refer to the NSW Department of Education document, [Section 3: Curriculum support documents](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjl1sinpIWLAxVzwTgGHZDsEjoQFnoECDAQAQ&url=https%3A%2F%2Feducation.nsw.gov.au%2Fcontent%2Fdam%2Fmain-education%2Fasset-management%2Fchemical-safety%2F3._Section_3_Curriculum_Support.pdf&usg=AOvVaw3cCsaoq3DvRci0LJIj3wmR&opi=89978449).  **Antimicrobial susceptibility test**  Access the [antimicrobial susceptibility test simulation](https://learn.chm.msu.edu/vibl/vibl/KirbyBauer/KirbyBauer_HTML5Canvas.html) to teach students how to measure the zone of inhibition **(TRB2)**. Discuss how this measurement can be used to identify the most suitable antibiotic to treat against a pathogen.  **Note:** comprehensive information related to the assessment task appears in the Disease assessment task. Alternative options for extension and possible depth study have been included in the appendix.  **The assessment task**  Unpack the task notification and marking criteria with the students. Further instructions are in the [Disease assessment task document](https://education.nsw.gov.au/teaching-and-learning/curriculum/science/planning-programming-and-assessing-science-7-10#showhide39651264), Appendix B Teacher instructions, unpacking the assessment task with students. There are supporting slides in the **DIS PPT** that can be used when unpacking the assessment.Provide 3 hours for students to get started on the assessment task. |  |

## 3 How do we effectively prevent and manage non-infectious diseases?

Table 5 – content and teaching and learning activities for lesson sequence 3

|  |  |  |
| --- | --- | --- |
| Content | Teaching and learning activities | Registration and evaluation notes |
| **Infectious and non-infectious diseases**   * Distinguish between infectious and non-infectious diseases * Identify causes of non-infectious and infectious diseases   **Communicating**   * Create written texts to communicate scientific investigations, explain scientific theories and principles, structure a scientific argument, and evaluate findings in light of scientific knowledge | **3.1** What is a non-infectious disease? (approximately 1 hour) **Disease concept map (TRB3)**  Recall students' prior knowledge about non-infectious diseases by revisiting the concept map from ‘2.1 Causes of Infectious Disease, Disease Concept Map’ **(TRB2)**. Students refine their concept map to include learning from part 2 of the program. Students start to add information about non-infectious disease using the definition for non-infectious disease **(DIS PPT)** and during activities throughout the next few activities.  **Causes of non-infectious diseases (TRB3 and DIS PPT)**  Identify and define the 3 categories of risk factors that may cause non-infectious diseases: genetic, environmental and lifestyle. Students sort examples of risk factors under these categories.  In groups, students select a non-infectious disease, outline its symptoms, causal risk factors and treatment and share their findings with the class.  **Checkpoint (DIS PPT):** students use mini whiteboards to respond to statements about causes of disease and identify with reasoning if they are examples of infectious or non-infectious diseases.  **Distinguish between infectious and non-infectious diseases (TRB3)**  Give students the question, ‘Using examples, distinguish between infectious and non-infectious diseases’. Recall the V-C-F-S strategy or another strategy used to deconstruct questions. As a class, deconstruct the examination-style question.  Recall how to plan a response based on the deconstructed question and jointly construct a plan as a class using the marking guidelines. Students construct a response using the plan, marking guidelines and given connectives (cohesive devices). Students reflect on the response using the marking guidelines.  **Differentiation:** provide the entire response to a student with terms missing. Students use the bank of words to find one that is appropriate and complete the response. |  |
| **Infectious and non-infectious diseases**   * Investigate data relating to a common non-infectious disease affecting Australians today * Describe ways to reduce the incidence of non-infectious diseases   **Conducting investigations**   * Extract information from a wide range of reliable secondary sources and acknowledge these sources using an accepted referencing style   **Processing data and information**   * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs and multimedia resources   **Communicating**   * Present scientific arguments using evidence, correct scientific language and terminology as appropriate to audience and purpose | 3.2 Non-infectious diseases in Australia (approximately 3 hours) **Investigating the leading causes of death in Australia (secondary-source investigation) (TRB3 and DIS PPT)**  **Note:** this activity aims to establish some context around some common non-infectious diseases in Australia. It is to get students to understand that the leading causes of death in Australia are mostly from non-infectious diseases. Although some risk factors, such as genetics, are non-modifiable, other factors, such as lifestyle, are modifiable. Bringing awareness to these diseases and the risk factors that cause them is essential to reduce the incidence of these diseases.  Provide students with the [Leading causes of death](https://www.aihw.gov.au/reports/life-expectancy-deaths/deaths-in-australia/contents/leading-causes-of-death) graph in 2022 on the Australian Institute of Health and Welfare website. Engage with the graph to extract and process data on non-infectious diseases in Australia.  **Current information on non-infectious diseases affecting Australians today should be used. At the time of writing, 2022 data was the most recent published data.**  Show students the website from which the ‘Leading causes of death’ graph was taken – [Australian Institute of Health and Welfare, Deaths in Australia](https://www.aihw.gov.au/reports/life-expectancy-deaths/deaths-in-australia/contents/leading-causes-of-death). Demonstrate how to find the source of the data on the webpage and how to determine if the source is reliable. **Co-construct a reference for this secondary source.** Outline **the importance of using reputable sources of data and the need to verify information.**  **Note: more information about the reliability of secondary sources can be found in ‘2.1 Causes of infectious disease in this program’ and TRB1 and the DIS PPT.**  **Investigating Australian non-infectious disease data (secondary-source investigation) (TRB3)**  Recall how to conduct a secondary-source investigation, ensure that sources used are reliable and valid, and teach what makes a quality presentation. Working in pairs, students conduct a secondary-source investigation on a non-infectious disease by answering guided questions to process and analyse data and create a presentation for the class. Students present to the class, making note of the strategies used to reduce the incidence of this disease for discussion in the next sequence. |  |
| **Disease control and prevention**   * Describe ways to reduce the incidence of non-infectious diseases | 3.3 Reducing the incidence of non-infectious diseases (approximately 1 hour) **Strategies to reduce the incidence of non-infectious diseases (TRB3)**  Inform **students that reducing the incidence of non-infectious diseases is quite complex. It requires a multifaceted approach involving lifestyle changes and public health initiatives, including education and health programs, as well as policy and medical advancements.**  **Give students a range of strategies** to reduce the incidence of non-infectious disease **that can be used** for specific non-infectious diseases. **Students use their prior knowledge to write down the disease they** believe the strategies **relate to using mini whiteboards in groups. Discuss any points of difference as a class to clarify student understanding and ask them for any other strategies they may** know that can help reduce the incidence of that non-infectious disease.  **Students Think-Pair-Share to answer various questions about ways to reduce the incidence of non-infectious and infectious diseases.** Discuss the share component as a class.  **Differentiation**: students create a public health campaign to promote strategies that reduce the incidence of a chosen non-infectious disease in their school. Students can select a sample of students from the school and ask them to complete a survey (using Microsoft forms) that identifies their knowledge of the non-infectious disease and how it can be prevented. This should be done before and after the school health campaign. Students analyse the data and then make changes to their campaign based on the feedback.  **Checkpoint:** provide students with the ‘Student resource – Non-infectious disease stimulus question’ **(TRB** **3)**. Students must transfer their knowledge and skills from this learning sequence into this new context. |  |
| **Disease in context**   * Investigate technological advances developed in Australia to address disease, disorders, or physical trauma in the human body   **Conducting investigations**   * Extract information from a wide range of reliable secondary sources and acknowledge these sources using an accepted referencing style   **Processing data and information**   * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs and multimedia resources | 3.4 Australia’s medical technology (approximately 1.5 hours) **Defining technology (DIS PPT)**  Define technology as ‘applying scientific knowledge for practical purposes or applications’. Ask students to brainstorm as many technologies as they can think of. Inform students that technologies related to detecting, diagnosing, managing and treating diseases, disorders and physical trauma have developed significantly in the last century and continue to develop as scientific knowledge develops.  **Australian technologies to improve health (secondary-source investigation) (TRB3)**  Engage students in medical technologies by showing them the following:   * [Catalyst: Affordable prosthetics made with 3D printing (8:21)](https://www.abc.net.au/education/catalyst-affordable-prosthetics-made-with-3d-printing/13959878) * [Meet Professor Fiona Wood AM – inventor of spray-on skin cells (2:23)](https://www.youtube.com/watch?v=-TQIaGvk8JU).   Students research an Australian medical technology that addresses a disease, disorder or physical trauma. Students reference the secondary sources used to collect their information.  Student groups collaborate to develop and present the information in an infographic and outline the technology for the class.  Discuss each technological advance as a class to clarify student understanding.  Outline the impact of these technologies on quality of life, health care and society and the importance of continued research and development of technologies in healthcare. |  |
|  | 3.5 Consolidating the disease concept map (approximately 45 minutes) **In groups, students** complete their **concept map to** demonstrate **their knowledge about infectious and non-infectious diseases.**  **Note:** this concept map can be compared to the concept map students made in ‘2.1 Causes of infectious disease’. It will allow you to see the shift in student understanding. |  |

# Overall program evaluation

Collating ongoing evaluations and reflecting on the strengths and areas for development within the program creates opportunities to enhance student outcomes. The following prompts can be used to support your evaluation of the program:

* Did the program assist all students to improve in their learning?
* How could the sequencing of the program be improved?
* What did the student evaluations of the program indicate? How can these be actioned to improve the program?
* The strategies and resources that were most effective for student learning were …
* Teaching strategies and resources that would benefit from review and refinement are …

# Evidence base

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[Science 7–10 Syllabus](https://curriculum.nsw.edu.au/learning-areas/science/science-7-10-2023/overview) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2023.

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