# Sample Unit – Biology – Year 11

***Sample unit for implementation for Year 11 from 2018***

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| **Module 1: Cells as the Basis of Life** | **Duration** | 22 hours (including initial part of a 15 hour Depth Study) |
| **Content Focus**Cells are the basis of life. They coordinate activities to form colonial and multicellular organisms. Students examine the structure and function of organisms at both the cellular and tissue levels in order to describe how they facilitate the efficient provision and removal of materials to and from all cells in organisms. They are introduced to and investigate biochemical processes through the application of the Working Scientifically skills processes.**Module Focus**Students are introduced to the study of microbiology and the tools that scientists use in this field. These tools will be used throughout the course to assist in making predictions and solving problems of a multidisciplinary nature. Students should be given the opportunity to design their own investigations and practice efficient information and data collection strategies, as well as developing skills in communicating their findings using appropriate scientific language.**Working Scientifically**In this module, students focus on conducting investigations to collect, process and analyse data and identify trends, patterns and relationships related to cell structure and function. Students should be provided with opportunities to engage with all Working Scientifically skills throughout the course. |
| **Outcomes**A student:* 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
* describes single cells as the basis for all life by analysing and explaining cells’ ultrastructure and biochemical processes BIO11-8
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| **Resources*** Light microscopes
* Mini-grids or wet-mount slides of 1mm grid paper
* A range of prepared slides including plant tissue, blood cells, protists, bacteria, fungi
* Physical materials to construct a cell membrane including: Styrofoam balls, plasticine, straws, glue, cardboard, pipe-cleaners etc or recycled materials
* Access to computer and internet or printed materials
* Text resources and digital resources
 | **Formal assessment of learning****Practical investigation**Students plan and conduct practical investigations to determine the effect of an enzyme on the rate of a biological reaction when the following reaction conditions are changed:* temperature
* pH
* concentration of substrate
* concentration of enzyme
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| **Inquiry questions**1. What distinguishes one cell from another?
2. How do cells coordinate activities within their internal environment and the external environment?
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| **Working Scientifically Skills****Questioning and Predicting - BIO11/12-1**A student develops and evaluates questions and hypotheses for scientific investigationStudents:* develop and evaluate inquiry questions and hypotheses to identify a concept that can be investigated scientifically, involving primary and secondary data (ACSBL001, ACSBL061, ACSBL096)
* modify questions and hypotheses to reflect new evidence

**Planning Investigations - BIO11/12-2**A student designs and evaluates investigations in order to obtain primary and secondary data and informationStudents:* assess risks, consider ethical issues and select appropriate materials and technologies when designing and planning an investigation (ACSBL031, ACSBL097)
* justify and evaluate the use of variables and experimental controls to ensure that a valid procedure is developed that allows for the reliable collection of data (ACSBL002)
* evaluate and modify an investigation in response to new evidence

**Conducting Investigations - BIO11/12-3**A student conducts investigations to collect valid and reliable primary and secondary data and informationStudents:* employ and evaluate safe work practices and manage risks (ACSBL031)
* use appropriate technologies to ensure and evaluate accuracy
* select and extract information from a wide range of reliable secondary sources and acknowledge them using an accepted referencing style

**Processing Data and Information - BIO11/12-4**A student selects and processes appropriate qualitative and quantitative data and information using a range of appropriate mediaStudents:* select qualitative and quantitative data and information and represent them using a range of formats, digital technologies and appropriate media (ACSBL004, ACSBL007, ACSBL064, ACSBL101)
* apply quantitative processes where appropriate
* evaluate and improve the quality of data

**Analysing Data and Information - BIO11/12-5**A student analyses and evaluates primary and secondary data and informationStudents:* derive trends, patterns and relationships in data and information
* assess error, uncertainty and limitations in data (ACSBL004, ACSBL005, ACSBL033, ACSBL099)
* assess the relevance, accuracy, validity and reliability of primary and secondary data and suggest improvements to investigations (ACSBL005)

**Problem Solving - BIO11/12-6**A student solves scientific problems using primary and secondary data, critical thinking skills and scientific processesStudents:* use modelling (including mathematical examples) to explain phenomena, make predictions and solve problems using evidence from primary and secondary sources (ACSBL006, ACSBL010)
* use scientific evidence and critical thinking skills to solve problems

**Communicating - BIO11/12-7**A student communicates scientific understanding using suitable language and terminology for a specific audience or purposeStudents:* select and use suitable forms of digital, visual, written and/or oral forms of communication
* select and apply appropriate scientific notations, nomenclature and scientific language to communicate in a variety of contexts (ACSBL008, ACSBL036, ACSBL067, ACSBL102)
* construct evidence-based arguments and engage in peer feedback to evaluate an argument or conclusion (ACSBL034, ACSBL036)
 | **Depth Study Orientation**A 15 hour Depth Study is to be conducted over the first half of the course requiring students to use information gathered during their studies of Modules 1 and 2.**Microorganisms and macroorganisms in water**Carry out a fieldwork exercise to collect water samples from freshwater and marine water sources. The collection of water is to be determined by the class with respect to location and depth of samples. Students observe samples under dissecting and light microscopes to classify a range of microorganisms and macroorganisms found in each water source.**In class investigation**Students develop their own questions for investigation and hypotheses to investigate relating to the microorganisms and the stream water. They develop an investigation plan and carry out the investigation in class. A written report is produced and feedback provided as an assessment for learning activity. Investigation plans are submitted for peer review in the assessment for learning activity.**Assessment component of the Depth Study** (following the completion of Module 2) Oral presentation about the question, methodology and findings of the Depth Study |

| **Topic: Cell Structure** |
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| **Inquiry Question**: What distinguishes one cell from another? |
| **Content** | **Teaching, learning and assessment** | **Differentiation** |
| **Students:*** investigate different cellular structures, including but not limited to:
* examining of a variety of prokaryotic and eukaryotic cells (ACSBL032, ACSBL048)  Information and communication technology capability icon
* examining a range of technologies that are used to determine a cell’s structure and function  Information and communication technology capability icon
 | * review cell structure, organelles and cell shape and size
* use a light microscope and digital images produced from light microscopes or electron micrographs to compare the structure of prokaryotic and eukaryotic cells  Information and communication technology capability icon
* compare the sizes of a prokaryotic cell with a eukaryotic cell
* use secondary sources to find and compare cell size Numeracy icon
* compare a range of digital technologies available to observe microscopic samples including light microscopes and electron microscopes. Assess their effectiveness in different applications, eg fieldwork, laboratory analysis  Information and communication technology capability icon
* investigate a range of new technologies available to examine microscopic images and how these advances can influence other areas of science  Information and communication technology capability icon Literacy icon
 | **Extension** Use a microscope and a mini-grid to estimate cell size**Structured**Compare sizes of cells (larger or smaller) |
| **Students:*** investigate a variety of prokaryotic and eukaryotic cell structures, including but not limited to:
* drawing scaled diagrams of a variety of cells (ACSBL035)  Information and communication technology capability icon Numeracy icon
* comparing and contrasting different cell organelles and arrangements Critical and creative thinking icon
* modelling the structure and function of the fluid mosaic model of the cell membrane (ACSBL045)  Information and communication technology capability icon
 | * examine wet mounts, prepared slides and photomicrographs of plant and animal tissues to identify cell wall, cell membrane, vacuole, nucleus and cytoplasm in plant and animal cells as appropriate
* draw and label a scale drawing of cells and organelles Numeracy icon
* relate organelle structure to function and include additional organelles: golgi apparatus, ribosomes, nucleolus, chloroplasts, mitochondria
* examine methods of locomotion in protists including flagella and cilia
* investigate the structure and function of cell membranes
* construct a physical model of the fluid mosaic model of a cell membrane in workgroups
* explain how the fluid mosaic model of the cell membrane accounts for the movement of some substances into and out of cell
* provide constructive feedback of another model in the class in a peer review exercise
* prepare an answer to the inquiry question and submit for teacher feedback Literacy icon
* students are able to start planning their depth study by locating available water sources and planning investigative techniques.
 | **Extension** Collect images, name cells, identify organelles, and describe structure and function of the cells including the distribution of organelles. Represent the information in a digital form.**Structured** Collect images and name the cells. Represent the material in a spread sheet. |

| **Topic: Cell function** |
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| **Inquiry Question:** How do cells coordinate activities within their internal environment and the external environment? |
| **Content** | **Teaching, learning and assessment** | **Differentiation** |
| **Students:*** examine the way in which materials can move into and out of cells, including but not limited to:
* conducting a practical investigation modelling diffusion and osmosis (ACSBL046)  Information and communication technology capability icon
* examining the roles of active transport, endocytosis and exocytosis (ACSBL046)
* relating the exchange of materials across membranes to the surface area to volume ratio, concentration gradients and characteristics of the materials being exchanged (ACSBL047)  Information and communication technology capability icon Numeracy icon
 | * conduct a practical investigation to model the processes of diffusion and osmosis
* using information and data obtained compare the processes of diffusion and osmosis Numeracy icon
* investigate the conditions under which substances move into and out of cells by means of:
* active transport
* endocytosis
* exocytosis
* produce a flow diagram to show the sequence and mechanisms involved in the ways molecules pass into the cell and are excreted Critical and creative thinking icon
* carry out a practical investigation to compare the surface area to volume ratio between cells and the effectiveness of diffusion of substances throughout the cell. Using information and data collected:
* identify the trend between surface area to volume ratio and the effectiveness of diffusion Numeracy icon
* outline the mathematical relationship between surface area and volume and the movement of substances into and out of cells Numeracy icon
* use an appropriate mathematical model to make predictions about the surface area-to-volume ratio of objects and organisms of other shapes and sizes Numeracy icon
* plan and carry out a practical investigation to determine the relationship between concentration gradients and the rate of diffusion
* describe the physical and chemical characteristics of materials that can be exchanged across membranes
 | **Structured** Collect mathematical information in relation to the surface area to volume of a variety of geometric shapes |
| **Students:*** investigate cell requirements, including but not limited to:
* suitable forms of energy, including light energy and chemical energy in complex molecules (ACSBL044)
* matter, including gases, simple nutrients and ions
* removal of wastes (ACSBL044)

**Students:*** investigate the biochemical processes of photosynthesis, cell respiration and the removal of cellular products and wastes in eukaryotic cells (ACSBL049, ACSBL050, ACSBL052, ACSBL053)  Information and communication technology capability icon
 | * recall the meaning of the terms autotroph and heterotroph
* relate these definitions to the energy, organic and inorganic nutrient requirements of cells
* recall the chemical reactions that occur in cells describing the reactants and products
* describe ways in which these organic and inorganic nutrients and wastes can be transported into and out of the cell
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| * recall the characteristics of the process of photosynthesis
* plan and conduct practical investigations to test for the products of photosynthesis Critical and creative thinking icon
* plan and conduct practical investigations to determine the effect on the process of photosynthesis in regard to the: Critical and creative thinking icon
* amount of light
* frequencies of light
* presence of chlorophyll
* presence of water
* presence of carbon dioxide
* temperature
* construct a flowchart/diagram showing the major characteristics of photosynthesisCritical and creative thinking icon
* recall the process of cellular respiration
* plan and conduct practical investigations to test for the products of respiration Critical and creative thinking icon
* plan and conduct practical investigations to determine the effect on the process of respiration of the: Critical and creative thinking icon
* presence of oxygen
* presence of glucose
* temperature
* construct a flowchart/diagram showing the major characteristics of cellular respiration Critical and creative thinking icon
 | **Extension** Analyse secondary sourced information about the effects of body gases on respiration in humans and homeostasis |
| **Students:*** conduct a practical investigation to model the action of enzymes in cells (ACSBL050)
 | * recall the function of enzymes
* investigate different models used to describe the action of enzymes  Information and communication technology capability icon
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| **Students:*** investigate the effects of the environment on enzyme activity through the collection of primary or secondary data (ACSBL050, ACSBL051)  Information and communication technology capability icon
 | * plan and conduct practical investigations to determine the effect of an enzyme on the rate of a biological reaction when the following reaction conditions are changed: Critical and creative thinking icon Numeracy icon
* temperature
* pH
* concentration of substrate
* concentration of enzyme
* use the data and information gained in the practical investigation to determine the effectiveness of the different models of enzyme action Critical and creative thinking icon
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| **Resources*** Light microscopes
* Dissecting microscopes
* Digital/electron micrographs (images) of prokaryote and eukaryote cells
* Wet mount slide equipment
* Diffusion demonstration equipment
* Equipment for testing for photosynthesis, and the products of respiration
* Enzyme rate of reaction equipment
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**Reflection and Evaluation**

# TEACHER: CLASS:

**DATE UNIT COMMENCED: DATE UNIT CONCLUDED:**

* **Variations to program:** (List additional resources and outline alternative strategies used.
* **The most effective teaching/ learning strategies and resources in this unit were:** (Please nominate 3 at least)
* **Less effective teaching strategies and resources for this unit were:** (Please nominate 2 at least)

**TEACHER’S SIGNATURE\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**DATED\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_CHECKED\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**