 Cells as the basis of life

Year 11 biology

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Duration: 8 weeks

Description of unit

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.

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.

Inquiry questions

1. What distinguishes one cell from another?
2. How do cells coordinate activities within their internal environment and the external environment?

Working scientifically skills

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:

* develops and evaluates questions and hypotheses for scientific investigation BIO11/12-1
* designs and evaluates investigations in order to obtain primary and secondary data and information BIO11/12-2
* conducts investigations to collect valid and reliable primary and secondary data and information BIO11/12-3
* selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media BIO11/12-4
* analyses and evaluates primary and secondary data and information BIO11/12-5
* solves scientific problems using primary and secondary data, critical thinking skills and scientific processes BIO11/12-6
* communicates scientific understanding using suitable language and terminology for a specific audience or purpose BIO11/12-7
* describes single cells as the basis for all life by analysing and explaining cells’ ultrastructure and biochemical processes BIO11-8

While all Working Scientifically outcomes have been presented in this sample unit of work, teacher judgement should be used about which skill descriptors students will be working towards and engaging with.

In the sample unit of work, Working Scientifically outcomes are placed after content descriptors.

Assessment:

* Formal - Depth Study
* Informal - teacher and peer evaluation.

| Outcomes/Content | Teaching and Learning | Feedback |
| --- | --- | --- |
| Inquiry question 1  Cell Structure: What distinguishes one cell from another?  Students:   * investigate different cellular structures, including but not limited to:   + examining a variety of prokaryotic and eukaryotic cells (ACSBL032, ACSBL048)   + describe a range of technologies that are used to determine a cell’s structure and function   Working Scientifically – BIO11/12-5   * investigate a variety of prokaryotic and eukaryotic cell structures, including but not limited to:   + drawing scaled diagrams of a variety of cells (ACSBL035)   + comparing and contrasting different cell organelles and arrangements   + modelling the structure and function of the fluid mosaic model of the cell membrane (ACSBL045)   Working Scientifically – BIO11/12-1, BIO11/12-3 | * Introduction to course structure and assessment for year 11 Biology. * Student research and teacher directed discussion on technologies used to view cells e.g. light microscope, electron microscope, Synchrotron. Students to create a timeline. * Watch clip to distinguish between eukaryotic and prokaryotic cells (e.g. Ricochet Science video) Review microscopy skills. Labelling of cells – students work in groups to put labels on cells in worksheet and discuss the function of each cellular structure. * Students to create “flashcards” for new vocabulary (e.g. eukaryotic) throughout the Biology course. These will be used to test each other intermittently throughout the course. * Use an interactive cell website (e.g. “Cells Alive”) or similar app to help practice cellular organelles and functions. * Students to use microscopes to view cells and draw scaled diagrams with teacher assistance. Teacher to provide a print scaffold to assist students to review experimental method and good microscopy technique. Students work in groups and report back as a class to compare and contrast organelles. * Ensure students understand terminology for experimental method including dependant variable, independent variable, control, controlled variables. Note taking explaining good experimental methodology needed for future applications including depth study. * Research using the internet/texts the fluid mosaic model. Students to create a role play to explain the structure and function of the model from their research (teacher to monitor group progress and guide understanding). | * Teacher feedback * Worksheet answers * Peer review * Online review test * Peer feedback * Teacher to check printed worksheet. * Teacher to review role play either as a written play or as an acted role play if time permits. |
| Inquiry question 2  Cell Function: How do cells coordinate activities within their internal environment and the external environment?   * investigate 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)   + relating the exchange of materials across membranes to the surface area to volume ratio,   + concentration gradients and characteristics of the materials being exchanged (ACSBL047)   Working Scientifically – BIO11/12-6, BIO11/12-7   * 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)   Working Scientifically – BIO11/12-6, BIO11/12-7 | * Review practical investigation skills. Provide students with information to explain the terms “osmosis” and “diffusion”. Check for student understanding. * Students to research and design practical investigations for diffusion, and osmosis. * Students to be shown an example of surface area to volume ratio (e.g. YouTube clip or slide show). Practical investigation and discussion of findings and data as a class. * Students to watch YouTube clip “Transport in cells” then they are to conduct their own experimental investigation to clarify their understanding of this concept. * Students work in groups to create a cartoon that illustrates cell requirements based on their own research. Can be created using ICT technologies if available or hand drawn/written. Display of student work, peers to provide suggestions for improvement. | * Teacher feedback * Peer feedback. |
| * investigate the biochemical processes of photosynthesis, cell respiration and the removal of cellular products and wastes in eukaryotic cells (ACSBL049, ACSBL050, ACSBL052, ACSBL053)   Working Scientifically – BIO11/12-6, BIO11/12-7 | * Students to summarise notes from provided text. Teacher to assess student understanding. * Students to participate in a given practical investigation on plant photosynthesis and respiration and review and report back to the class on the given experimental methodology to ascertain if the experiment was well planned and executed. * Introduction to the depth study and requirements. Teacher to discuss task and give students an opportunity to clarify understanding for task completion. | * Teacher review of student summaries. * Peer discussion |
| * conduct a practical investigation to model the action of enzymes in cells (ACSBL050)   Working Scientifically – BIO11/12-2, BIO11/12-6 | * Students to participate in depth study formal assessment task as outlined in task. * Students may choose to investigate the action of an enzyme which is different from one performed as a class and compare the differences and similarities. Examples include, catalase, diastase, pectinase, pepsin, rennin. * Students have the opportunity to research an enzyme which is important in human cell biology. Students may use journal articles such as [the central role of enzymes as biological catalysts](https://www.ncbi.nlm.nih.gov/books/NBK9921/) https://www.ncbi.nlm.nih.gov/books/NBK9921/ as stimulus. | * Formal assessment task * Review of student work to be ongoing by individual student conferencing, teacher feedback and guidance for task completion. * Data from assessment. * Teacher feedback |
| * investigate the effects of the environment on enzyme activity through the collection of primary or secondary data (ACSBL050, ACSBL051)   Working Scientifically – BIO11/12-2, BIO11/12-4 BIO11/12-6 | * Students to collect their own data from practical investigations they have designed for depth study. * Students undertake research to investigate an enzyme important in human cell biology. | * Formal assessment task * Review of student work to be ongoing by individual student conferencing, teacher feedback and guidance for task completion. * Data from assessment. * Teacher feedback |

Reflection and evaluation: