

MODULE: *Cells*

Module Teaching Guide

Learning objectives

The students will be able to:

- Explain that living things are made of cells that carry out life functions and undergo cell division
- Identify major cell structures (cell wall, cell membrane, nucleus, chloroplast, and vacuole) and describe the primary functions of these structures
- Recognize that cell walls and chloroplasts differentiate plant cells from animal cells
- Explain how chemicals move in and out of the cells
- Investigate the factors affecting the growth of cells

Curriculum Links

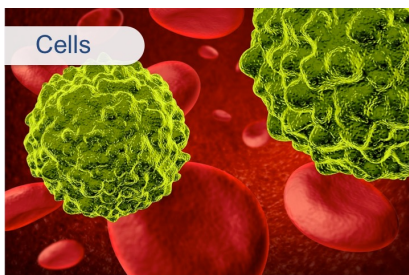
THEME: Man and the variety of living things

Learning Area: 1. Cell as a Unit of Life

1.1 Understanding cells

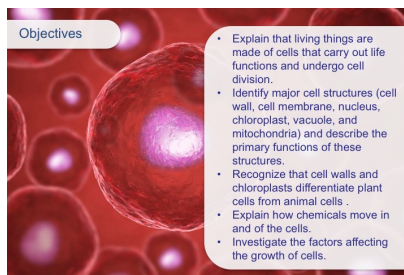
Running the activity

Period 1



Cells

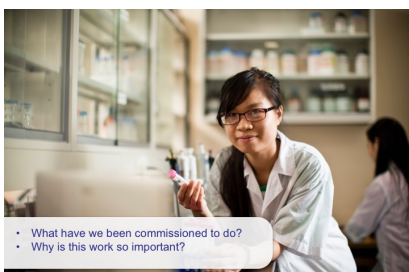
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Objectives

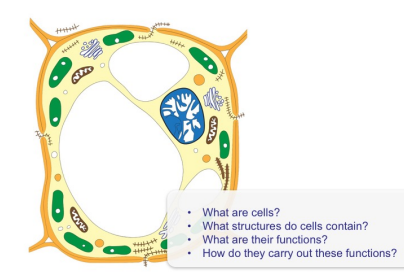
- Explain that living things are made of cells that carry out life functions and undergo cell division.
- Identify major cell structures (cell wall, cell membrane, nucleus, chloroplast, vacuole, and mitochondria) and describe the primary functions of these structures.
- Recognize that cell walls and chloroplasts differentiate plant cells from animal cells.
- Explain how chemicals move in and out of the cells.
- Investigate the factors affecting the growth of cells.

2



- What have we been commissioned to do?
- Why is this work so important?

4



- What are cells?
- What structures do cells contain?
- What are their functions?
- How do they carry out these functions?

5

Activity Sheet 1.1: Your brief

- Introduce the students to the module and the learning objectives for the module
- Give the students Activity Sheet 1.1 and introduce them briefly to the context and what they will be doing by using the “setting the scene”, “route through the Brief” and “Outcome checklist”
- Show the introductory video clip that helps to further introduce the context and set the scene for the module
- Introduce the students to the Memorandum. They should read it and then discuss the questions on slide 4.

Answers to questions on slide 4

- carrying out a scientific inquiry to find the best growth conditions for yeast
- the clients are using yeast in their research on cancer.

Activity Sheet 1.2: What do we already know about cells?

- Give the students the activity sheet, which asks them to create a mind map on what they know about cells. Remind them how to draw a mind map using the structure provided in the activity sheet. They should create them on poster paper. The questions are designed to stimulate their thinking. The students should carry out this activity in their group. Groups should then pair up and share their mind maps. They can then update their mind maps.
- Ask different groups to present their mind maps.
- Debrief the activity by emphasising key points and sensitively correcting any misconceptions.
- The questions on slide 5 test the students’ ideas

Answers to questions on slide 5

- Building blocks of life

| Organelle | Function | How do they carry out the function? |
|---------------|--|---|
| Nucleus | control the activities of the cell | DNA |
| Cytoplasm | provides a medium through which chemicals can move around the cell | diffusion |
| Cell membrane | control what enters and leave the cell | semi-permeable |
| Vacuole | stores water | water passes through membrane to fill vacuole when water is plentiful |
| Chloroplast | make food | photosynthesis |
| Mitochondria | produce energy | respiration |

Period 2



- What discoveries have been made?
- Who has made these discoveries?
- How has technology contributed to the development of the ideas?
- How have our ideas changed?
- Why have they changed?
- What do animal and plant cells have in common?
- How do they differ?
- Why do they differ?

6

1.3



Activity Sheet 1.3: Important discoveries

- Give the students Activity Sheet 1.3. They should read the article and then answer the questions.
- The students then carry out research to enable them to produce a timeline of the four discoveries.
- The students discuss the important role microscopes have played in the development of our understanding of the structure of the cell. They draw and label a diagram of the cell showing the structures observed using an electron microscope - they refer to a text book for labels.
- They finally put a tick (/) in the box next to the ideas they think are correct and put a cross (x) next to the ideas that they think are incorrect in the table and write a sentence to provide evidence for one idea they think is correct and one idea they think is incorrect.
- Use the questions on slide 6 to debrief the activity. All the answers are in the activity sheet answers apart from the last three with regard the differences between plant and animal cells. These are designed to further develop the thinking of the students.

Answers to last three questions on slide 6

- Nucleus, cytoplasm, vacuoles, mitochondria and cell membrane
- Plant cells also have chloroplasts (for photosynthesis), cell wall and large central vacuole (for support)

Answers to questions on Activity Sheet 1.3

- Robert Hooks
- Cork
- Antony van Leeuwenhoek
- Sperm and freshwater organisms
- Schlieden and Schwann
- 1953
- Watson and Crick

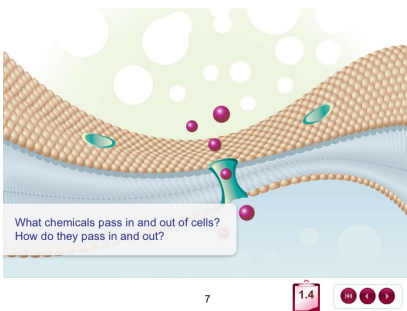
| Idea | Correct or incorrect |
|---|----------------------|
| All living things are made of tiny units called cells | ✓ |
| All cells contain a cell wall | X |
| A cell divides again and again to make an organism | ✓ |
| Every cell contains a nucleus | X |
| Some cells can be more than a metre long | ✓ |
| The nucleus is part of the cell wall | X |
| Cells come in all shapes and sizes – some are long and thin | ✓ |
| New cells are formed like crystals inside a cell | X |

- For their sentences accept sensible answers with correct evidence

Out of school activity

The students could carry out further research to produce a more detailed timeline of key discoveries about cells, cell division and DNA.

Period 3



Activity Sheet 1.4: On the move

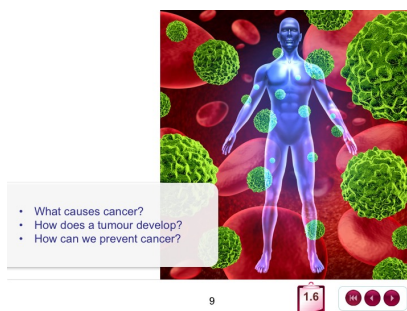
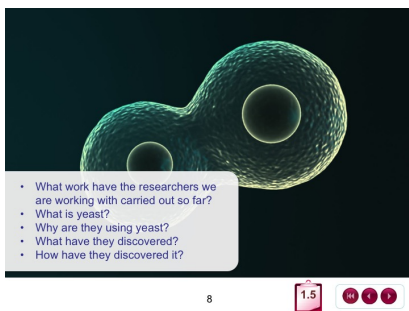
- Give the students the activity sheet. They read the text about membranes, label the animal cell to show which chemicals they think pass in and which pass out of the cell by thinking about the chemicals needed for growth and respiration or the chemicals produced as waste products (IN – oxygen, glucose, OUT – water, carbon dioxide) and then answer the questions by selecting an appropriate chemical to demonstrate their understanding that small molecules such as water and glucose can pass through the pores in the membrane, and large molecules such as starch cannot.

- They confirm this understanding by completing the cloze activity. The missing words are pore, water, glucose, starch, large.
- They then read about the Visking tubing experiment carried out by Sharyn and produce a flow chart summarising each stage in her method. Using this they carry out the experiment themselves, make their own observations and explain what happened by answering the questions.

Answers to questions on Activity Sheet 1.4

- To ensure no glucose was on the outside before starting the experiment.
- Yes
- It passed through the tiny pores. They may even describe the process of osmosis – the glucose passed from an area of high concentration to an area of low concentration of glucose molecules through the semi-permeable membrane.
- The starch did not pass through the membrane because the molecules were too large.
- Use the questions on slide 5 to debrief the activity. The answers are in the activity sheet answers.

Period 4



Activity Sheet 1.5: The story so far

- Give the students Activity Sheet 1.5 and introduce the article about the research carried out by Paul and the other researchers to the students. They should read it and then discuss and answer the questions.

Answers to questions

- When a cell splits into two to form two new cells.
- The nucleus controls all the activities of the cell. The nucleus contains structures called genes. Genes are sections of DNA. This is a chemical that contains the instructions needed for a healthy cell to grow. These instructions tell the cell to divide, stop dividing and eventually die.
- Paul added a substance, a mutagen, to the yeast cells. The mutagen damaged the DNA. After he had treated the cells he left them to grow.
- He had produced mutant yeast cells.
- The section of DNA he had damaged must control how the yeast cell divides. By doing this he discovered a particular gene. This gene controls how the yeast cell divides. This gave him an idea. He thought that the same gene might be found in all living cells.
- Scientists were carrying out similar experiments on other living things. They compared their results and agreed - all living things, including humans, control cell division in the same way.
- It can be grown easily and quickly in a laboratory.
- Labels starting top right and moving clockwise are cytoplasm, cell membrane, and nucleus.
- Missing words are yeast, nucleus, microscope, big, quickly.

Out of school activity

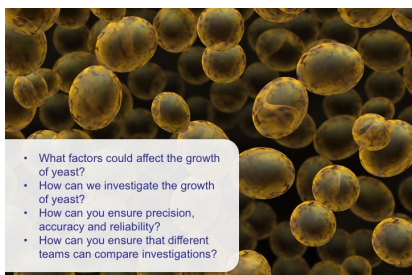
The students should do Activity Sheet 1.6 Cancer. A fact sheet is presented giving a scientific explanation about the causes of cancer. Pupils then consider the evidence to support the link between smoking and cancer. Use slide 9 to debrief this activity at the beginning of the next period.

Answers to questions on slide 9

- A cancer cell is a cell 'out of control'. The DNA that makes up the genes inside the nucleus of a cancer cell is damaged.
- The cell starts to divide and does not stop dividing. Eventually it may grow into a tumour.
- Scientists think that 80% of cancers could be avoided each year if:
 - people took care in the sun
 - stopped smoking
 - followed a healthy diet
 - were screened regularly and were aware of the facts.

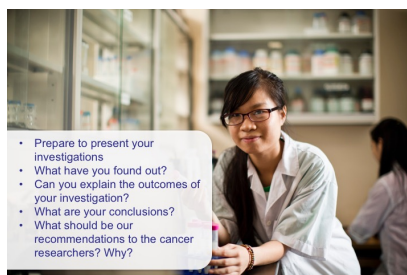
Periods 5 – 7

Activity Sheet 1.7: Growth conditions of yeast inquiry



10

1.7



11



- Use Activity Sheet 1.7 to introduce the inquiry and emphasise key points using the slide 10 questions
- Demonstrate the equipment to the students
- You could use the generic inquiry help sheet and suggest that the students use the questions to help them plan and carry out their enquiry.
- Emphasise the suggestions with regard carrying out a fair test etc.
- Clarify expected outcomes and timescale for the inquiry, and respond to student queries.
- In pairs students following an open approach draft a plan for the inquiry. Provide students with support as necessary.
- In fours students peer assess their plans and agree the group approach. Students carry out their inquiries and collect data.
- You could collate class data. Students analyse, interpret and draw conclusions from their results. Encourage the students to explain their results.
- The students should produce their posters using the guidance in the Memorandum.
- Use the questions on slide 11 to emphasise key points to address.
- The outcomes will be dependent on the inquiries that the students carry out.

Period 8



Activity Sheet 1.8: The Evaluation Wheel

Activity Sheet 1.9: How well did you work as a team?

- Introduce the students to the evaluation wheel
- They should use it to firstly evaluate their own enquiry and then to evaluate the enquiry poster of another group
- The each group should give feedback to the other group based on their evaluation of their poster
- Finally the students should use Activity Sheet 1.10 to assess how well they worked as a team

Resources

Period 1

Learning resources

- PowerPoint presentation
- Prezi presentation
- Activity Sheet 1.1: Your brief
- Activity Sheet 1.2: What do we already know about cells?

Equipment

- Computer and projector
- Poster paper and pens

Period 2

Learning resources

- PowerPoint presentation
- Prezi presentation
- Activity Sheet 1.3: Important discoveries

Equipment

- Computer and projector
- Poster paper
- Access to computers for internet

Period 3

Learning Resources

- PowerPoint presentation
- Prezi presentation
- Activity Sheet 1.4: On the move

Equipment

- Computer and projector

Per group

- Visking tubing
- Cotton
- 20% starch solution
- 20% glucose solution
- 100 ml beaker
- Distilled water
- Dropper pipettes
- Test for glucose (Benedicts or clinistix/diastix)
- Iodine (test for starch)

Period 4

Learning Resources

- PowerPoint presentation
- Prezi presentation
- Activity Sheet 1.5: The story so far
- Activity Sheet 1.6: Cancer

Equipment

- Computer and projector

Period 5 -7

Learning Resources

- PowerPoint presentation
- Prezi presentation
- Activity Sheet 1.7: Growth conditions of yeast inquiry
- Inquiry Help Sheet (Generic sheet)

Equipment

- Computer and projector
- Poster paper and pens

Per group

- Two test tubes, with bungs and delivery tubes as shown in the diagram on Activity Sheet 1.7
- Dried yeast (it would be good to try different types if you have it)
- Glucose (the students could make own solutions or you could provide different concentrations)
- Fructose (the students could make own solutions or you could provide different concentrations)
- Sucrose (the students could make own solutions or you could provide different concentrations)
- Water baths set at 30°C, 40°C, and 50°C
- Spatulas
- 10, 50 and 250 ml measuring cylinders
- 2 x 250 ml beakers
- Test tube rack

Period 8

Learning Resources

- PowerPoint presentation
- Prezi presentation
- Activity Sheet 1.8: The Evaluation Wheel
- Activity Sheet 1.9: How well did you work as a team?

Equipment

- Computer and projector

Safety

Some students may be allergic to the yeast

Preparation

Set up the water baths and make up the sugar solutions in advance.

Interactive

Please refer to the Intervention Session Teaching Guide.

Alternative strategies

Activity Sheet 1.5 :The story so far

More support

To reinforce pupils understanding of cell division, provide pupils with a ball of plasticene to represent a single cell. Ask pupils to divide the 'cell' into two new 'cells', then again to produce four new 'cells', The new cells will, of course, be smaller than the original cell. There is now an opportunity to direct open-ended questions to the whole group to reinforce ideas and identify misconceptions about cell division. For example, to explain that new cells are not half the size of the original cell because new cellular components are synthesised before division.

More challenge

Pupils could predict how many cells would be produced after 10 'cell divisions', plot results and carry out background research to find out how a cell is able to synthesis new cellular components.