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PHYSICAL WORLD

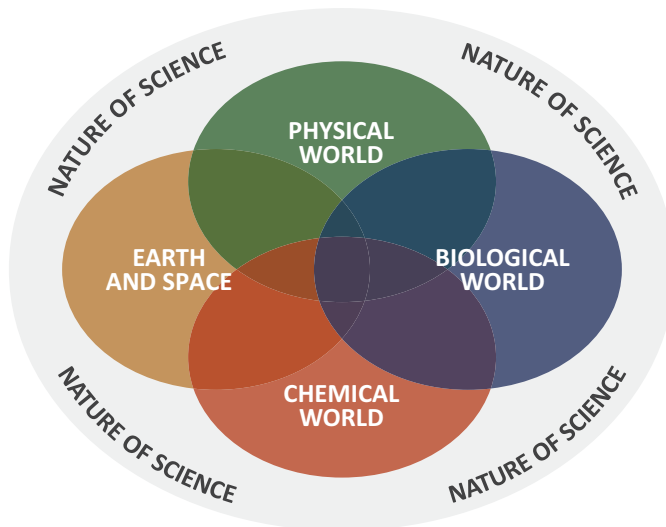
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Overview of Junior Cycle Science

Junior Cycle Science consists of the study of five strands:

1. Nature of Science
2. Physical World
3. Chemical World
4. Biological World
5. Earth and Space



There are three assessment components in Junior Cycle Science:

- **Two Classroom-Based Assessments**, the Extended Experimental Investigation (EEI) and the Science in Society Investigation (SSI), included on JCPA certificate with relevant descriptor. *
- **The Assessment Task** (based on SSI) assessed by the State Examinations Commission, which is worth 10% of the final grade.
- **The State Examination** – a two-hour Common Level exam worth 90% of final grade.

These components assess the 46 Learning Outcomes from the five different strands of the course.

*There are four levels of descriptors of achievement for each Classroom-Based Assessment: 'Exceptional', 'Above Expectations', 'In Line with Expectations' and 'Yet to Meet Expectations'.

The Classroom-Based Assessments

Classroom-Based Assessments	Format	Student Preparation	Completed	Grade
Extended Experimental Investigation (EEI)	A report may be presented in a wide range of formats.	A student will, over a three-week period, formulate a scientific hypothesis, plan and conduct an experimental investigation to test their hypothesis, generate and analyse primary data, and reflect on the process, with support/guidance from the teacher.	End of second year.	Descriptor given by teacher.
Science in Society Investigation (SSI)	A report may be presented in a wide range of formats.	A student will, over a three-week period, research a socio-scientific issue, analyse the information/secondary data collected, evaluate the claims and opinions studied, and draw evidence-based conclusions about the issues involved, with support/guidance from the teacher.	End of first term or early in the second term in third year.	Descriptor given by teacher.

The Assessment Task

The Assessment Task is a written task completed by students during class time. It is not marked by the class teacher; it is sent to the State Examinations Commission (SEC) for marking. The Assessment Task is related to the Learning Outcomes for the Science in Society Investigation.

Format	Student Preparation	Completed	Grade
Students complete a specified written task, which is sent to the SEC for marking.	The Assessment Task will link to the Science in Society Investigation.	Following completion of the second Classroom-Based Assessment in third year.	10% of final grade.

The Final Assessment

Junior Cycle Science has one Common Level exam paper, set by the State Examinations Commission. The exam is two hours in duration and takes place at the end of third year. During this exam students are required to engage with, demonstrate comprehension of and provide written responses to the material provided. The content and format of the final examination may vary from year to year. Every year this exam will assess a sample of the various Learning Outcomes on the course.

Format	Student Preparation	Completed	Grade
Two-hour Common Level exam paper.	Over the course of Junior Cycle, students engage with the 46 Learning Outcomes and a sample of these are assessed on the final exam paper.	June of third year.	90% of the final grade.

4

Cell Structure and Function

→ Learning Outcome

1. Investigate* the structures of animal and plant cells and relate them to their functions.

*Investigate: observe, study, or make a detailed and systematic examination, in order to establish facts and reach new conclusions.

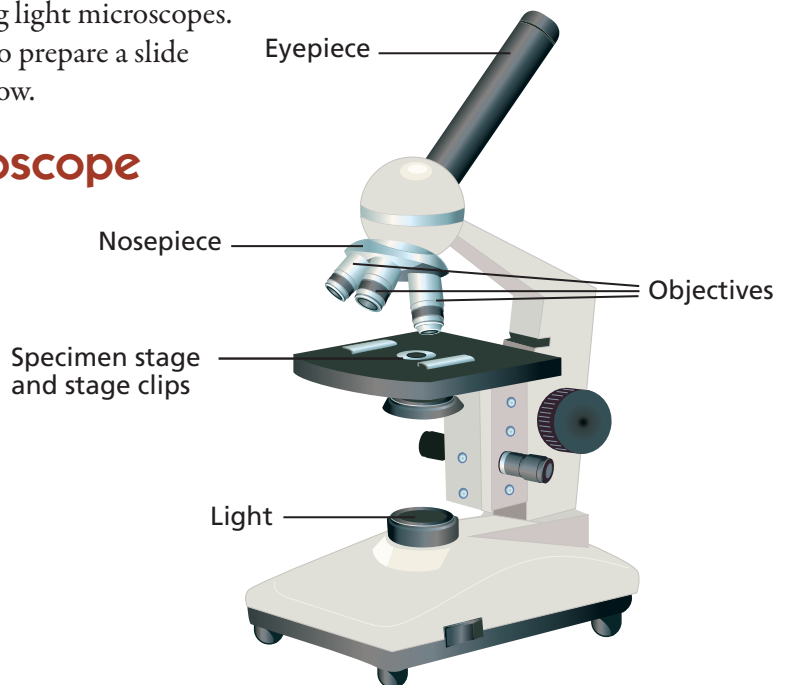
aims

By the end of this chapter you should:

- be able to draw and label a plant and animal cell
- know their components, functions and differences
- be able to describe an experiment to prepare a cell
- be able to describe the diversity of cell functions
- be able to describe cell organisation
- be able to describe stem cells and their potential medical use
- be able to describe ethical issues regarding stem cells

Biologists study cells using light microscopes. Relevant labels and how to prepare a slide for viewing are shown below.

The Light Microscope



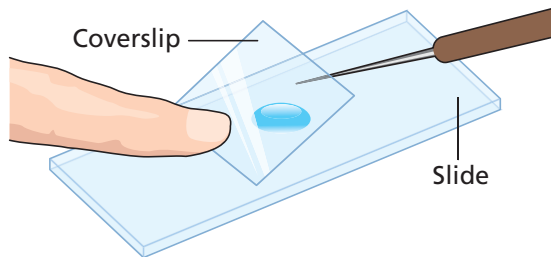
A light microscope

Parts of the microscope

Part of Microscope	Function
Eyepiece lens	Magnifies the specimen
Coarse adjustment knob	To get a rough image
Fine adjustment knob	To get a precise image
Objective lens	Magnifies the specimen
Nosepiece	Allows the objective lens to be changed
Stage clips	Hold the slide in place on the stage
Light source	Projects light through the microscope

Preparing a slide

1. Place a drop of water in the centre of the slide and position the sample on the water, using tweezers. Then add a stain to the sample.
2. At an angle, place one side of the cover slip against the slide, making contact with outer edge of the liquid drop.
3. Lower the cover slowly, avoiding air bubbles.
4. Remove excess water with the paper towel.



Preparing a sample on a slide

Cells

Cell: Basic functional unit of living organisms.

Animal Cell	
Cell membrane: Semi-permeable; controls entry and exit of substances	
Cytoplasm: Jellylike substance (90% water) which contains all the cell organelles	
Nucleus: Contains DNA; controls cell structure and activity	
Mitochondria: Site of aerobic respiration	

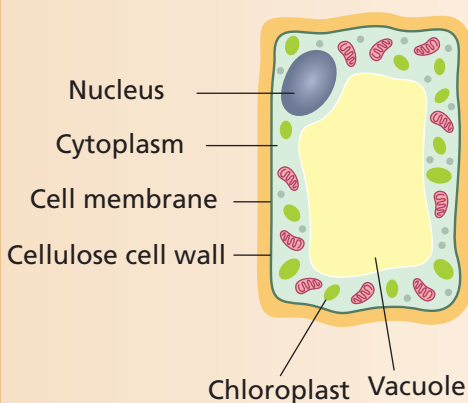
An animal cell

Plant Cell

Cell wall: Made of cellulose; permeable; involved in support and protection

Chloroplast: Contains chlorophyll; the site of photosynthesis

Vacuole: Used for storage of food and waste; involved in cell elongation



A plant cell

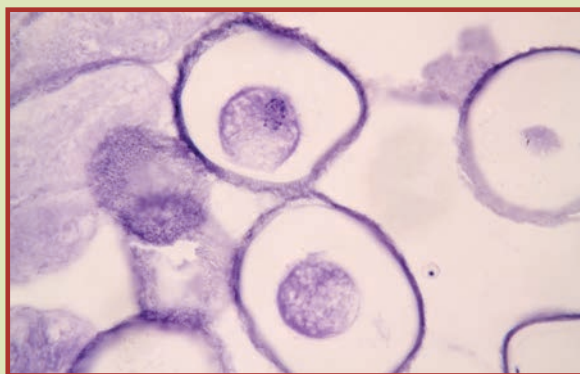
Differences between a plant and an animal cell

Plant	Animal
✓ Chloroplast	✗ No chloroplast
✓ Cell wall	✗ No cell wall
✓ Large vacuoles	✗ Small/no vacuoles

Investigate: preparing slides of plant and animal cells

Method for viewing animal cells (human cheek cells):

- Using a cotton wool bud, rub the inside of your mouth and smear the bud on the glass slide.
- Place a drop of methylene blue on top of the smear and allow to soak in for 5 minutes.
- Lower a coverslip slowly using a mounted needle from a 45° angle to avoid trapping air bubbles.
- View slide under the light microscope at (low power) 40X, focus and then move to higher powers and sketch field of view at (medium power) 100X and (high power) 400X.

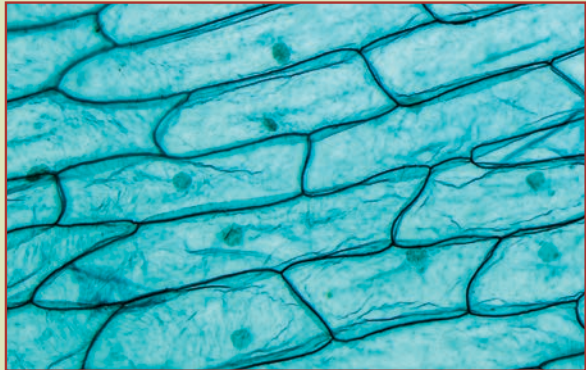


Animal cells viewed through a microscope

Method for viewing plant cells (onion cells):

Cut a piece of onion and remove a single layer of cells and place on the glass slide.

1. Place a few drops of iodine onto the onion layer and allow to soak in.
2. Lower a coverslip slowly using a mounted needle from a 45° angle to avoid trapping air bubbles.
3. View slide under the light microscope at 40X, focus and then move to higher powers and sketch field of view at 100X and 400X.



Plant cells viewed through a microscope

Cell Functions

Cell continuity: All cells come from other cells.

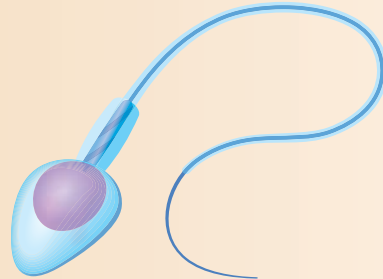


Cells generally have the same structure, but different cells have different features to suit the functions that they carry out.

Animal Cell

Sperm cell:

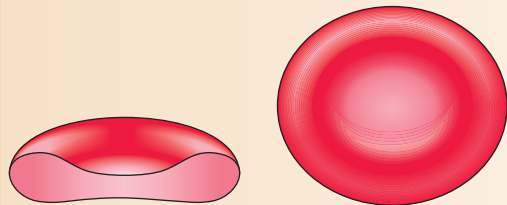
- Tail called a flagellum that allows it to swim
- Contains mitochondria in its collar



A sperm cell

Red blood cell:

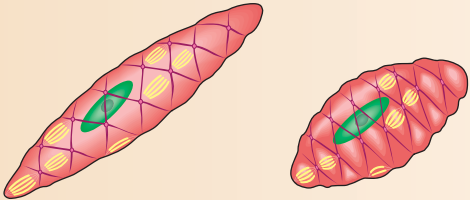
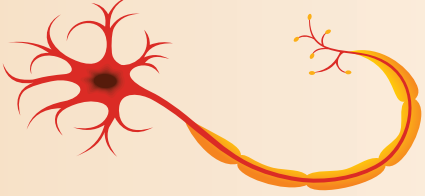
- Contains haemoglobin to allow transport of oxygen
- Does not contain a nucleus



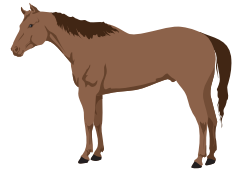
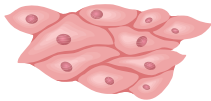
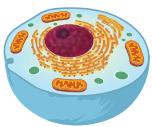
Side view

Top view

A red blood cell

Animal Cell	
<p>Muscle cell:</p> <ul style="list-style-type: none"> ● Contains many mitochondria to provide it with energy ● Can contract and relax 	 <p>Relaxed Contracted</p> <p><i>A muscle cell</i></p>
<p>Nerve cell:</p> <ul style="list-style-type: none"> ● Can carry electric impulses that allow us to taste, smell, see, hear, etc. 	 <p><i>A nerve cell</i></p>

Cell Organisation



Cells

Tissues

Organ

Organ System

Organism

Cell organisation

Cell: Basic functional unit of living organisms.

Tissue: Group of similar cells performing a specific function.

Organ: Two or more tissues working in co-operation.

Organ system: Two or more organs working in co-operation.

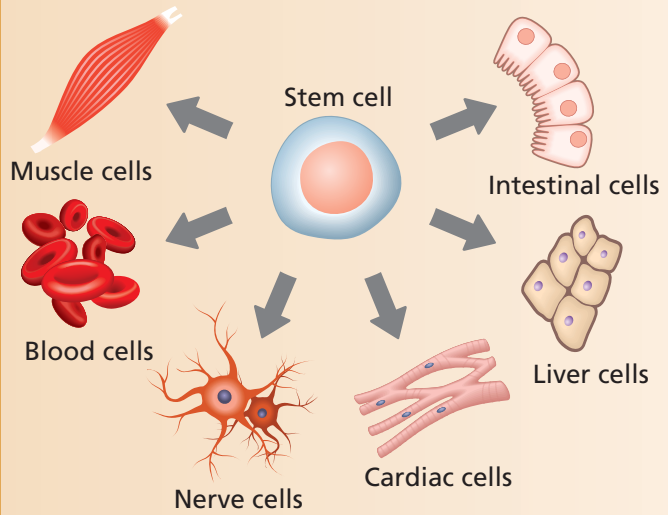
Organism: An individual animal, plant, or single-celled life form.

Stem Cells

- An undifferentiated cell of a multicellular organism that has the ability to differentiate into all types of cells

Found in:

- Embryos
- Umbilical cords
- Adult bone marrow
(note: adult stem cells are not as flexible)



What can a stem cell become?

Medical use:

- Can be removed to form new tissues for grafts
- Research to treat illnesses, e.g. Parkinson's disease
- Adult stem cells used to treat leukaemia



Embryonic stem cell use is controversial as it kills the embryo.



Skin tissue graft being prepared



9-10-week-old human embryo



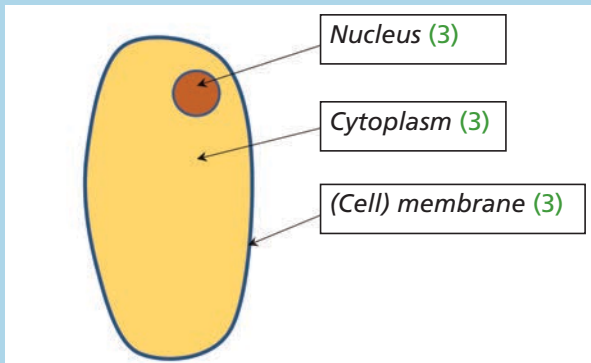
Exam Paper 2019

Question 1

The diagram shows an animal cell.

(a) Use the words listed below to label the parts of the cell.

Cytoplasm Cell membrane Nucleus



(b) Which of the three named parts controls the activities of the cell?

Nucleus. (3)

(c) A student was asked to examine animal cells in the laboratory. Which of the following instruments should the student use? Place a tick (✓) in the correct box.

Telescope	<input type="checkbox"/>
Microscope	✓ (3)
Periscope	<input type="checkbox"/>

Sample Questions

Section A

1. What are the terms used to describe a living organism composed of (a) only one cell and (b) of many cells? Give an example of each.

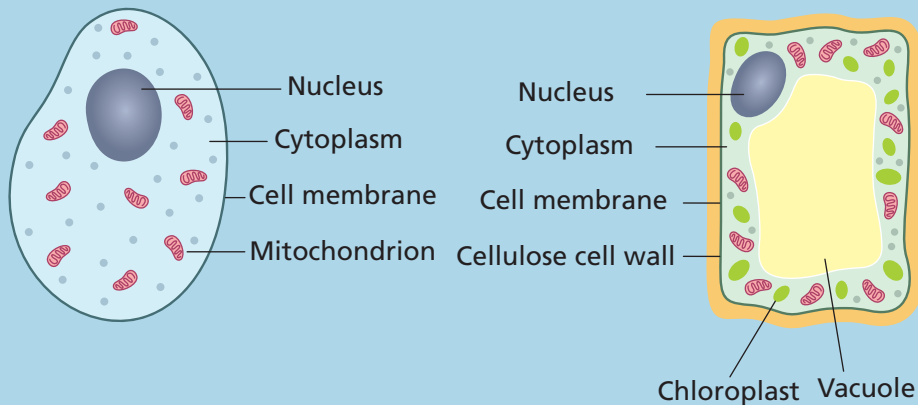
(a) *Unicellular – bacteria.*

(b) *Multicellular – human.*

2. Outline the function of:
 - (a) mitochondria
Site of respiration that produces energy.
 - (b) the nucleus
The control centre of the cell.
 - (c) the cell membrane
Controls what enters and exits the cell.
 - (d) chloroplasts
The site of photosynthesis in a plant.
 - (e) the cell wall
Provides structure in a plant cell.
3. How is a sperm cell adapted to its function?
Contains a tail for swimming.
4. Give an example of a cell with many mitochondria.
Muscle cell.
5. What is a tissue?
Group of similar cells carrying out a function.
6. Give two possible sources of stem cells.
Embryo, bone marrow.

Section B

1. Draw and label both a plant and an animal cell.



2. Give three differences between a plant and an animal cell.

Plant cells have a cell wall, animal cells do not.

Plant cells have chloroplasts, animal cells do not.

Plant cells have large vacuoles, animal cells have small or no vacuoles.