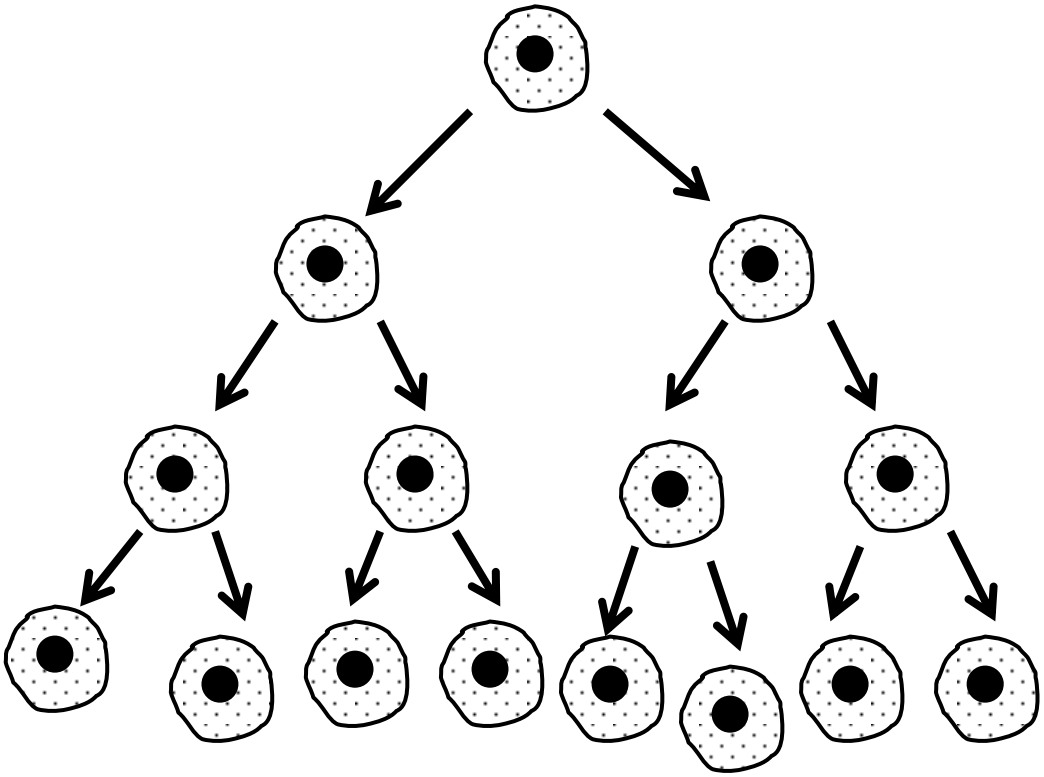
National 5 Biology

Unit 2 Multicellular Organisms

2.1 Producing new cells



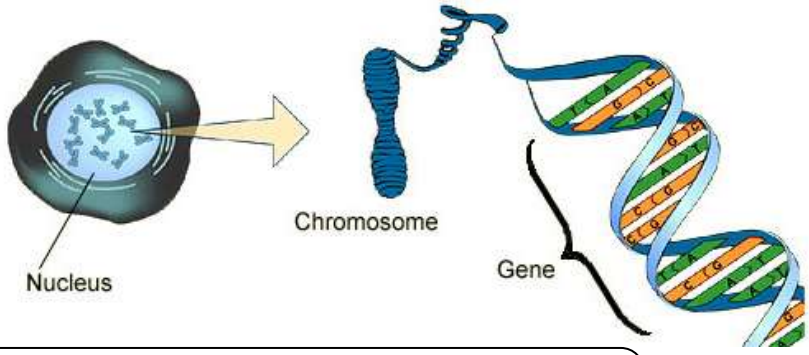
Name _____

Class _____

Teacher _____

Producing new cells

To allow organisms to grow, repair and reproduce they must produce new cells. A cell must be able to divide and make more cells without losing any of its genetic information. The nucleus contains all of the genetic information held in chromosomes. Each chromosome is made up of genes that are composed of a substance called deoxyribonucleic acid (**DNA**). DNA has the genetic information of the cell coded into its large complex molecules.



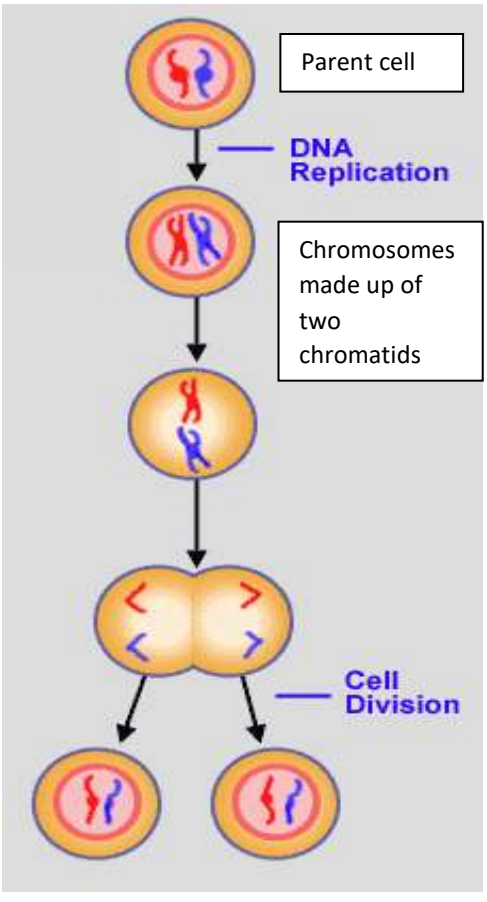
Learning intention

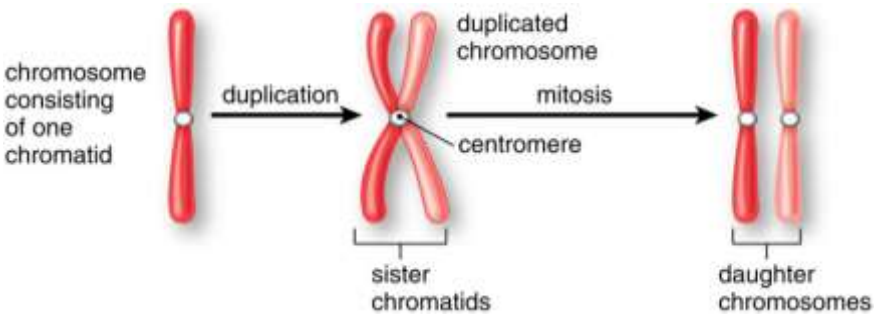
We are learning how to describe mitosis and cell division.

Mitosis and Cell Division

Every cell in your body started from just one cell. To grow living organism need to produce new cells.

Through cell division the number of cells is _____. Cells divide by a process called _____. Before mitosis, the DNA in a parent cell is copied exactly in a process called _____. Following replication each chromosome appears as a double structure made up of two _____ - each chromatid is a replicated chromosome. During mitosis, a structure called the _____ appears in a dividing cell and pulls the chromatids apart.

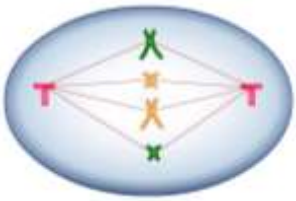
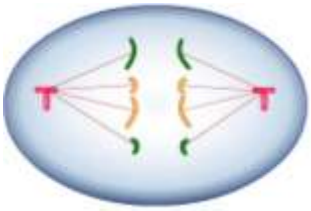
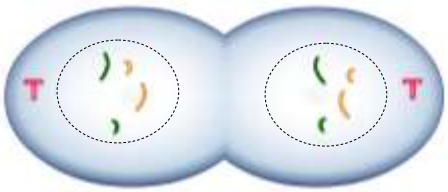
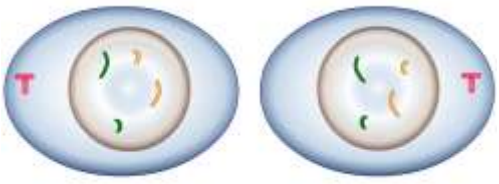




Learning intention

We are learning how to describe the stages of mitosis.

Stages of Mitosis

Stage 1 	The parent cell. The nucleus contains uncoiled single stranded chromosomes. There are _____ sets of chromosomes (one from each parent), so the cell is said to be _____.
Stage 2 	Chromosomes shorten and thicken, they coil up to become visible. Each chromosome _____ to form two identical chromatids. The nuclear membrane _____ _____.
Stage 3 	The chromosomes line up at the _____ of the cell and _____ fibres attach to each chromatid.
Stage 4 	The spindle fibres shorten, pulling the chromatids _____, to form new chromosomes, which move towards opposite poles.
Stage 5 	The new chromosomes gather at opposite ends of the cell. The cytoplasm begins to _____ and new nuclear membranes start to _____.
Stage 6 	Two new daughter cells are formed, each _____ to the parent cell.

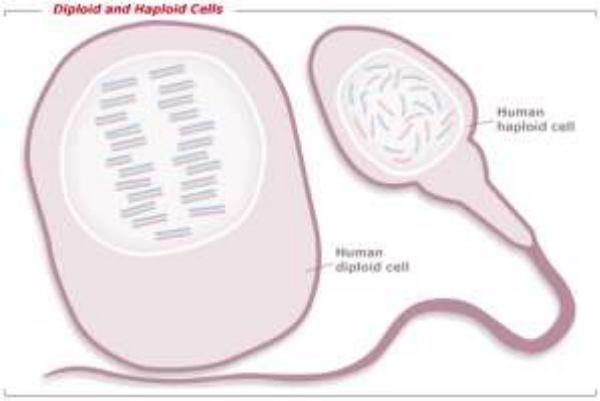
Remember: The number of stages shown in diagrams will vary. Make sure you know what you are looking at and can describe what is happening.

Learning intention

We are learning how to explain the importance of mitosis.

Importance of Mitosis

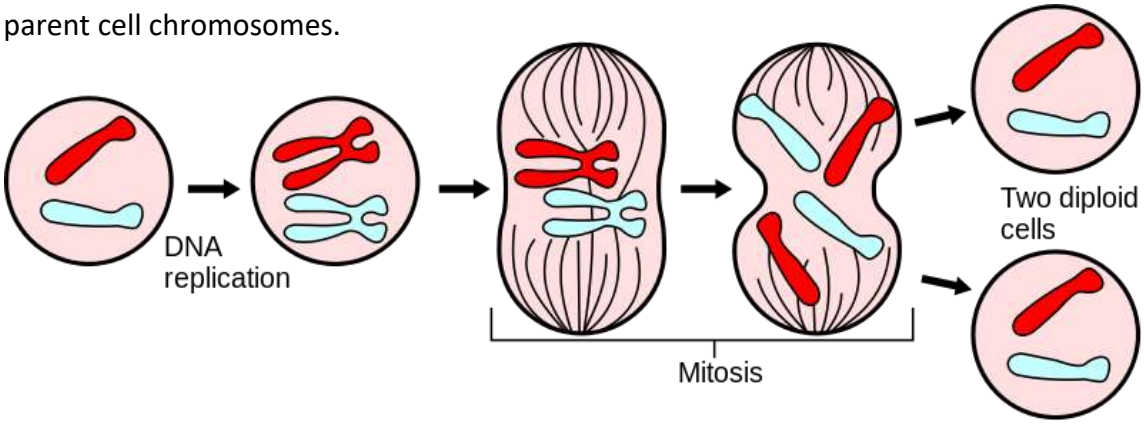
The nucleus of most cells contain two matching sets of chromosomes (one set from each parent). A cell with two matching sets of chromosomes is said to be _____.



In humans a diploid cell has _____ chromosomes.

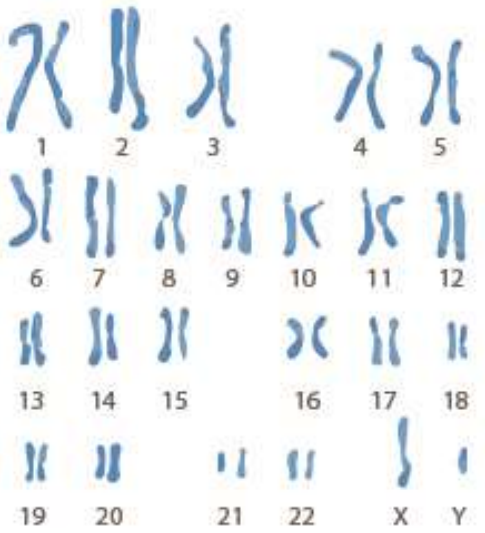
During mitosis diploid cells are replicated. Mitosis provides the new cells need for the _____ of an organism and new cells required for the _____ of damaged cells.

Mitosis is important because it ensures that each daughter cell contains a copy of each of the parent cell chromosomes.



This means that each daughter cell will be genetically _____ to the parent cell and contain all the genetic information needed to carry out all of its activities and functions.

The number of chromosomes found in an organism is called the chromosome _____. In humans the chromosome complement is 46.



The chromosome complement is different in different _____.

Species	**Chromosome complement**
Human	46
Fruit flies	8
Sheep	54
Pea plants	14
Maize	20

Mitosis ensures that a diploid chromosome complement is maintained, so that the cells of an individual organism are _____ identical to each other and contain a _____ chromosome complement.

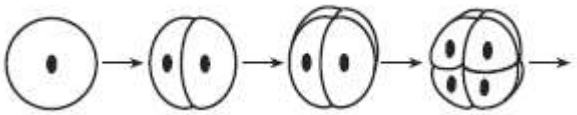
Stem Cells

Learning Intention

We are learning how to define stems cells and describe their role in animals.

What are stem cells?

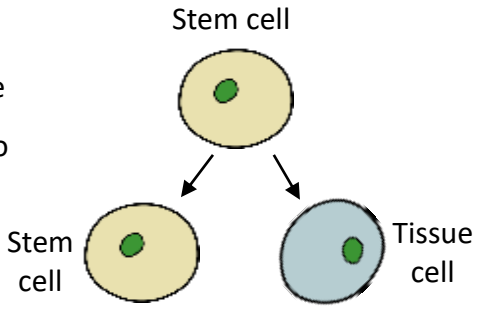
For the first week after fertilisation the _____ (fertilised egg cell) splits in two every day to make a bundle of smaller cells.

Fertilised egg  Multicellular organism

After about 1 week, the zygote is called an _____. The first cells formed are called_____.

These are _____ cells capable of developing into many different types of cell. Stem cells found in embryos are called _____ _____ _____ and develop into all the different types of cell in the body.

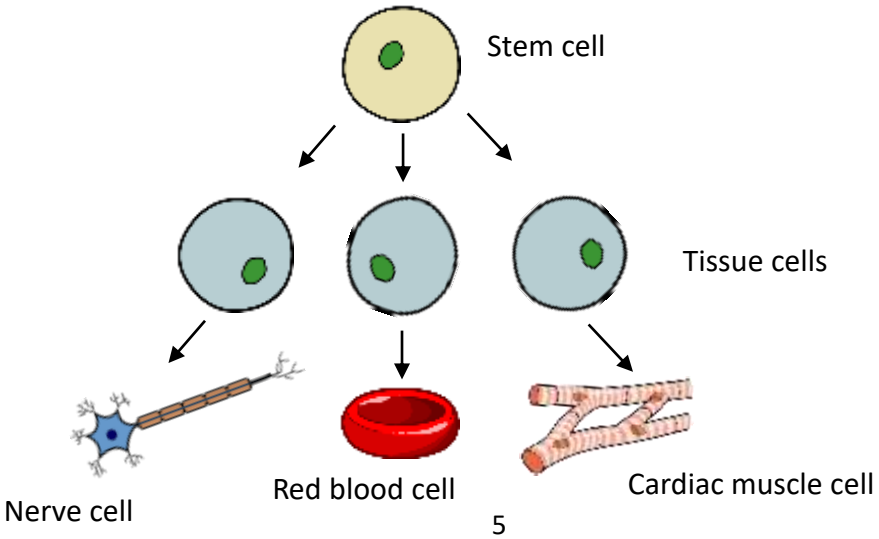
When the embryo contains about 500 cells, the cells stop being the same and they stop getting smaller with each division. They start to _____ into different types of cell. At this point, stem cells no longer form two new stem cells when they divide.



Instead, one of the two daughter cells becomes a _____ cell.

Tissue cells continue to divide and differentiate, each time becoming more and more _____.

Some will become nerve cells, others will become blood cells, muscle cells, bone cells, etc.



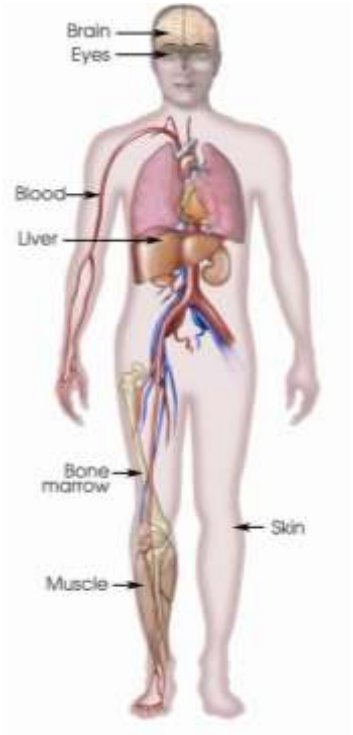
Through embryonic and foetal development the number of stem cells steadily _____ until very few stem cells remain. The remaining stems cells are called tissue stem cells.

Learning Intention
We are learning about the different types of stems cells and where they are found in animals.

Two types of stem cell

Embryonic stem cells

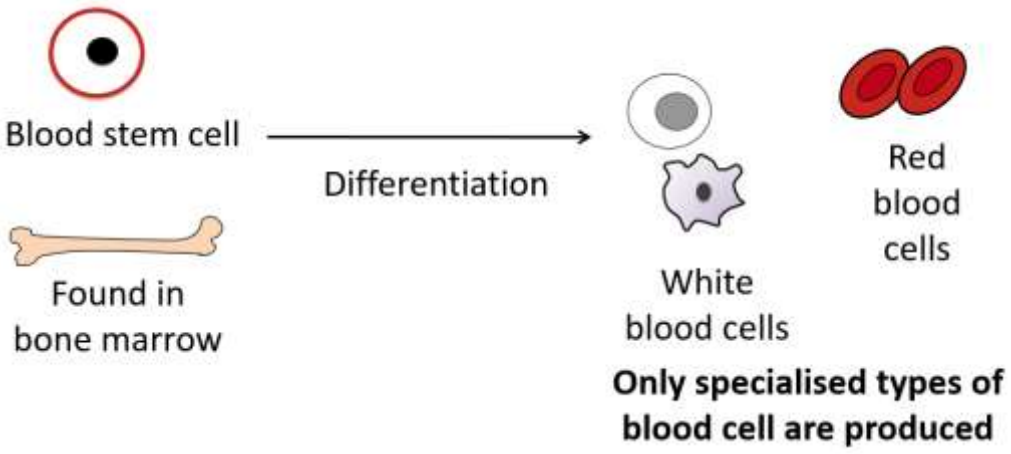
These are _____cells that have the ability to _____and make more stem cells by _____ (cell division) or produce cells that can become different types of cells in multicellular animals.



Tissue (adult) stem cells

These stem cells do not have the same properties as embryonic stem cells. The diagram to the right shows the tissues and organs of the body where tissue stem cells can be found.

Tissue stem cells only have the ability to _____ and form new cells of the _____ or _____ in which they are found. An example of this is seen in the production of blood cells. Blood contains red and white blood cells that are repeatedly _____ by new blood cells produced by stem cells. These stem cells are found in _____ (found in the centre of bones).



Learning Intention
We are learning about the uses of stems cells in medicine.

The uses of stem cells

Stem cells are important because they allow _____ and development of organisms. They also help to _____ dead worn out cells in the body and help the body to heal following damage or disease of tissues.

How are stem cells used in medicine?

Embryonic stem cells can be obtained from embryos at a very early stage, whereas tissue stem cells can be found in the body throughout life.
Stem cells can be _____ (grown) in laboratories. These cells have **huge medical potential,** as they can become any type of specialised cell.

Research scientists hope to develop methods that could use stem cells to **replace** _____ or **worn out parts of tissue** with **new, healthy tissue**. For example, repairing damaged heart tissue; treat diabetes; or to reverse Parkinson's disease and Alzheimer's disease.

Task
Use p125 to complete the table below.

Source of stem cell	**Medical use**

Embryonic stem cells V's Tissue stem cells

Stem cells have been used in medicine for many years – bone marrow transplantation is a form of stem cell therapy using adult stem cells. However, tissue stem cells can only form a _____ _____ of specialised cells, whereas embryonic stem cells can have the potential to make any body cell.

Ethical Issues

Stem cell research is a moral dilemma: the duty to improve medical treatment and also to respect the value of human life.

Objections

- Human life should **never be** _____ as a means to an end.
- Some individual believe that **new life begins** at the moment of _____ and embryos should have full **human rights**.
- Use of embryonic stem cells is not justified when **other sources** of stem cells are **available.**

Researchers argue that it is still not clear which types of stem cells will prove the **best therapeutically**. A **balance** has to be found between the _____ of the embryo against the potentially large _____ that others may gain from research and ultimately stem cell based treatments.

Multicellular organisms

Learning Intention

- We are learning about the specialisation of cells in animals and plants and the hierarchy that leads to the formation of body systems.

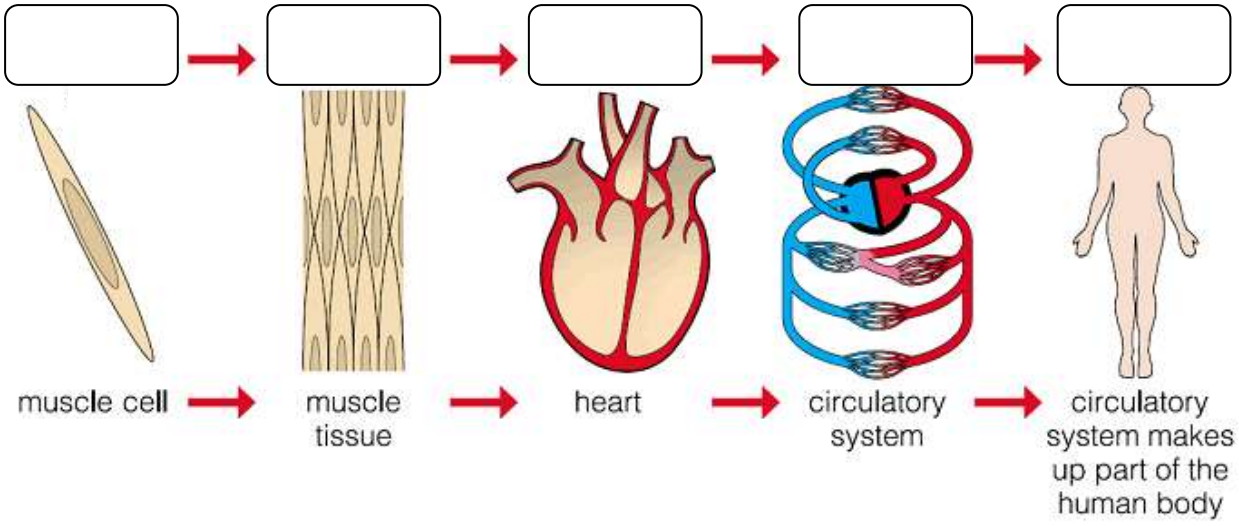
Cell to Organism

Cells whose structure is adapted to carry out a specific function are called **specialised**.

- **Cells** of **one type** group together in the body to form **tissues**. For example, muscle tissue is made up of **only** muscle cells.
- **Organs** are made up of **different tissues** working together to carry out a specific job. An organ can contain different types of tissue. For example, the heart is made up of muscle tissue, blood tissue and nervous tissue (nerves).
- Each tissue is made up of **specialised** cells that allow each tissue and subsequently each organ to carry out a **specialised** job.
- **Organ systems** are made up of two or more organs that work together to provide a common function e.g. Nervous system, circulatory system, reproductive system etc.
- Organ systems join up to make an **organism**.
- Plants have specialised cells, tissues, organs and systems too.

Task

Complete the diagram to show the level of organisation found within multicellular organisms.

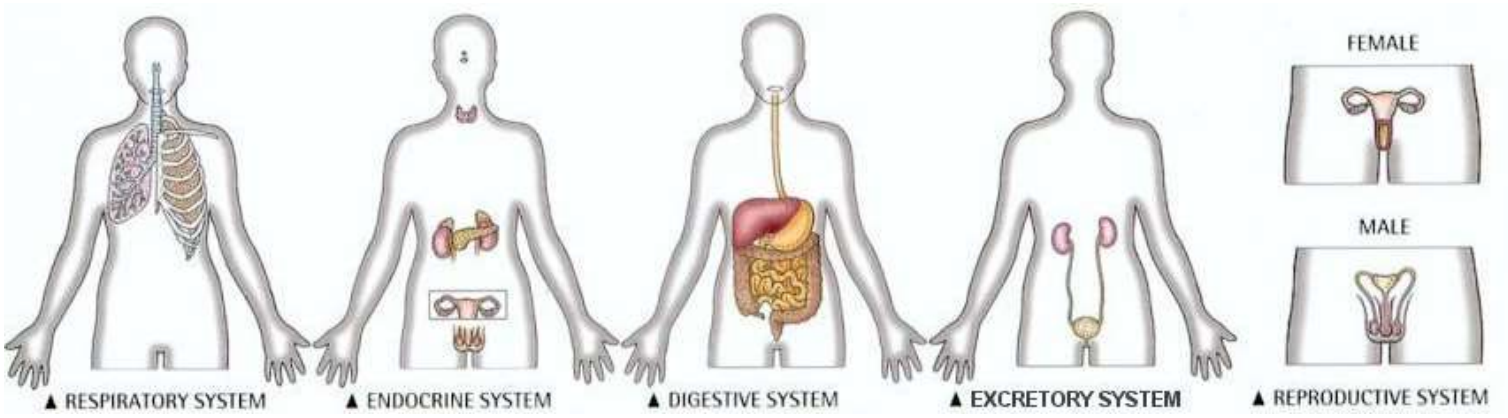


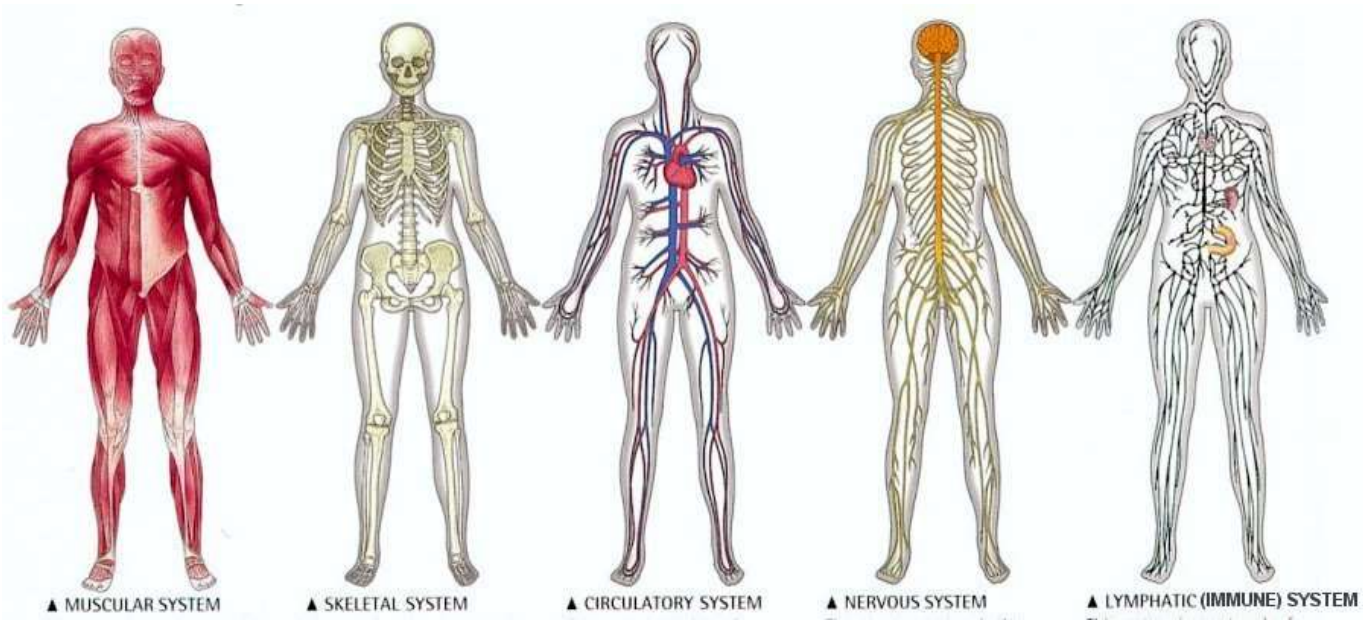
Body Systems

Task

Use the information from the labelled diagrams to complete the table.

Body System	Description of Body System
	Includes the male and female organs which produce sex cells to allow us to reproduce.
	Breaks down food into simple, soluble materials that can be absorbed into the bloodstream.
	Controls breathing. Oxygen gas is taken from the air into the lungs and carbon dioxide is removed and returned to the air.
	Body processes such as growth and energy production are controlled by the hormones produced by glands.
	Network of vessels that collects fluids from tissues and returns it to the blood.
	Removes waste from the blood and results in the production of urine.
	Consists of the heart and network of blood vessels that carry blood around the body. Oxygen and food are carried to cells. Waste and carbon dioxide are removed from cells.
	Controls and coordinates the body. Consists of the brain, spinal cord and nerves.
	Layers of muscles that cover the bones to relax and contract to produce movement.
	Strong framework of bones to provide support for the body and protection of internal organs.





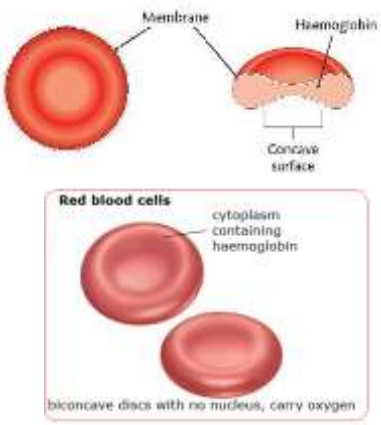
Specialised cells

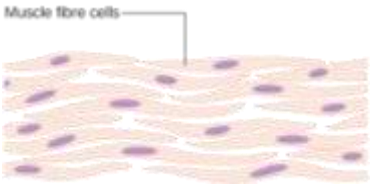
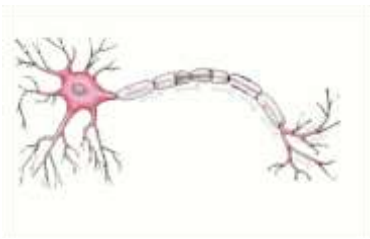
Both animals and plants contain specialised cells. Throughout this unit we will look at a number of different cells present in animals and plants. You need to be able to identify the specialised structures of cells and explain how they are adapted to suit the function of the cell.

Learning Intention

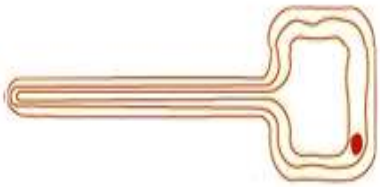
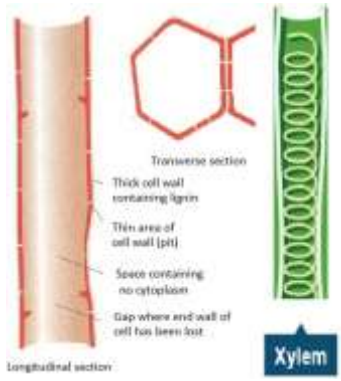
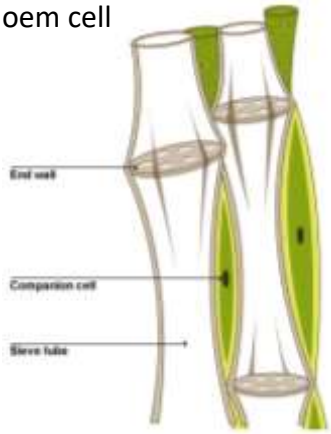
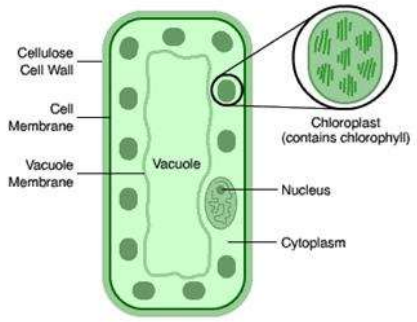
- We are learning about the structure of animal and plant cells and how this relates to their function.

Specialised cells found in Animals

Red blood cell	Describe how its specialised structure is related to its function.
	_____ _____ _____ _____ _____ _____ _____

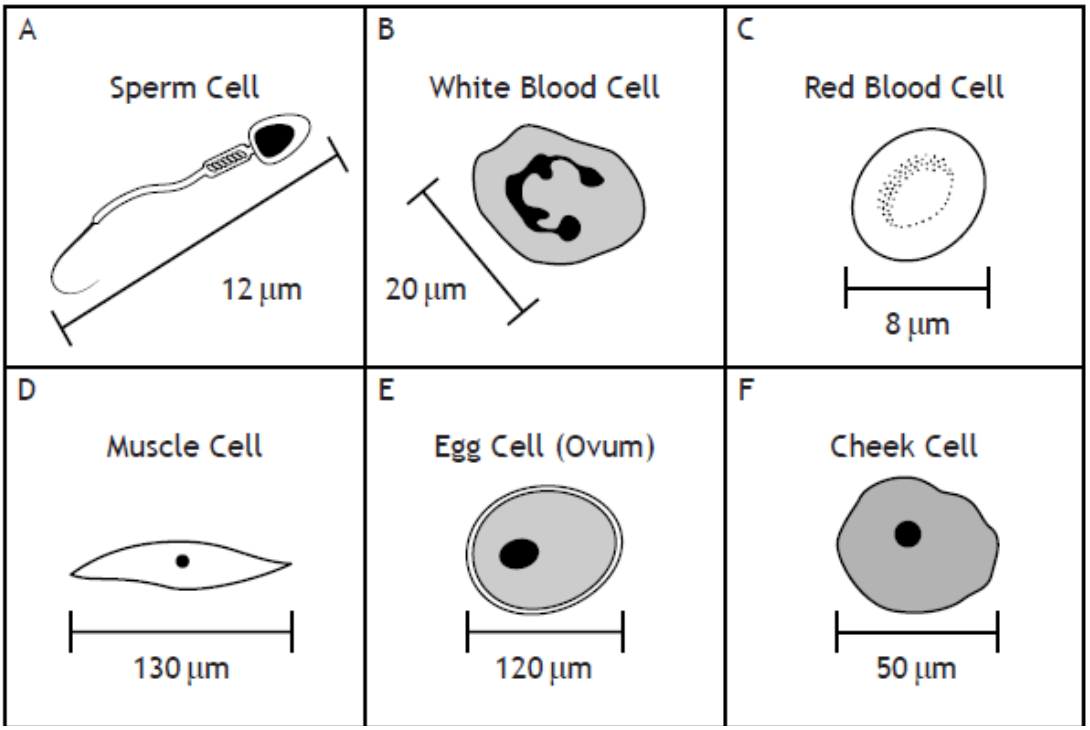
Sperm cell 	Describe how its specialised structure is related to its function. _____ _____ _____ _____
Egg cell 	Describe how its specialised structure is related to its function. _____ _____ _____ _____ _____
Muscle cell 	Describe how its specialised structure is related to its function. _____ _____ _____ _____ _____
Nerve cell 	Describe how its specialised structure is related to its function. _____ _____ _____ _____ _____

Specialised cells found in Plants

Root Hair cell 	Describe how its specialised structure is related to its function. _____ _____ _____ _____ _____ _____
Xylem cell 	Describe how its specialised structure is related to its function. _____ _____ _____ _____ _____ _____
Phloem cell 	Describe how its specialised structure is related to its function. _____ _____ _____ _____ _____ _____
Palisade mesophyll cell 	Describe how its specialised structure is related to its function. _____ _____ _____ _____ _____ _____

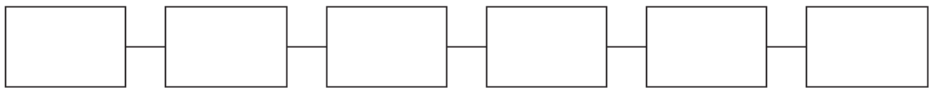
6. The diagrams below show examples of some types of specialised cells from the human body.

N5 2014



(a) Put letters in the boxes below to arrange the cells in order of size. 1

increasing size



(b) Choose one of the following cell types by (circling) it.

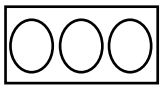
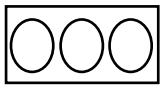
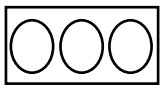
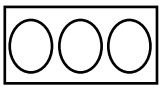
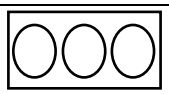
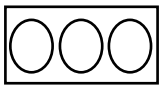
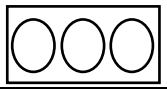
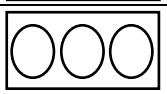
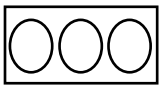
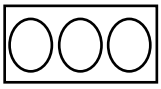
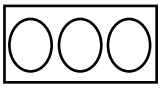
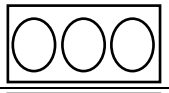
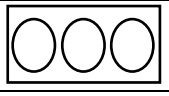
sperm cell egg cell red blood cell

Describe the function of the chosen cell and explain how its specialisation allows it to carry out that function. 2

Function _____

Explanation _____

_____

I can:	
Describe the sequence of events of mitosis (including the terms chromatids, equator and spindle fibres).	
Define the terms chromatids, equator and spindle fibres.	
State that diploid cells have two matching sets of chromosomes, which are replicated during mitosis.	
State that mitosis provides new cells for the growth of organisms and for the repair of damaged cells.	
State that mitosis maintains the diploid chromosome complement.	
State that stem cells in animals are unspecialised cells which can divide in order to self-renew.	
State that stem cells have the potential to become different types of cells.	
State that stem cells are involved in growth and repair.	
State that embryonic stem cells can be obtained from the embryo at a very early stage.	
State that tissue stem cells are found in the body throughout life.	
State that specialisation of cells leads to the formation of a variety of cells, tissues and organs.	
Sate that multicellular organism have more than one cell type and are made up of tissues and organs.	
State that groups of organs which work together form systems.	
State that a hierarchy exists: cells → tissues → organs → systems.	
State that organs perform different functions.	
State that cells in organs are specialised for their function and work together to form systems.