

Biology

Key Stage 4

Module 1

Cells



Tutorial	Topic
Tutorial 1.1	Cell Structure
Tutorial 1.2	The Cell Cycle
Tutorial 1.3	Stem Cells
Tutorial 1.4	Lifestyle and Disease

Knowledge Check #1

You can complete this online, by going to: <https://forms.office.com/r/PMwqFk95cU>



1. These three organelles are found only in plant cells

- a) Cell wall, Chloroplast, Vacuole
- b) Flagellum, Cell membrane, Chloroplast
- c) Mitochondria, Cell membrane, Ribosome

2. Select the incorrect comparison between Diffusion and Osmosis

- a) Both move down concentration gradients
- b) Both require energy
- c) Both Osmosis is water only, diffusion can be movement of any particles
- d) Osmosis involves the semi-permeable membrane, this is not required for diffusion

Knowledge Check #1



3. Select the incorrect info of embryonic stem cells for medical treatment

- a) No need for stem cell removal from adults
- b) Cells can differentiate into any cell type (pluripotent)
- c) There is an ethical consideration involved in the process
- d) High risk of viral transmission (as would be with adult stem cells)

4. A short section of DNA encoding a protein which determines a characteristic is known as

- a) Ribosome
- b) Guanine
- c) Gene
- d) Cytosine

Learning objectives



At the end of this module, you will be able to:

- Explain the differences in animal, plant, and bacterial cells and how substances move in and out of them.
- Understand how to complete calculations relating to the cell cycle and magnification.
- Explain mitosis, meiosis, and how stem cells are derived and used.
- Explain the causes and risk factors of cancer, the impacts of smoking, and how Coronary Heart Disease is treated.



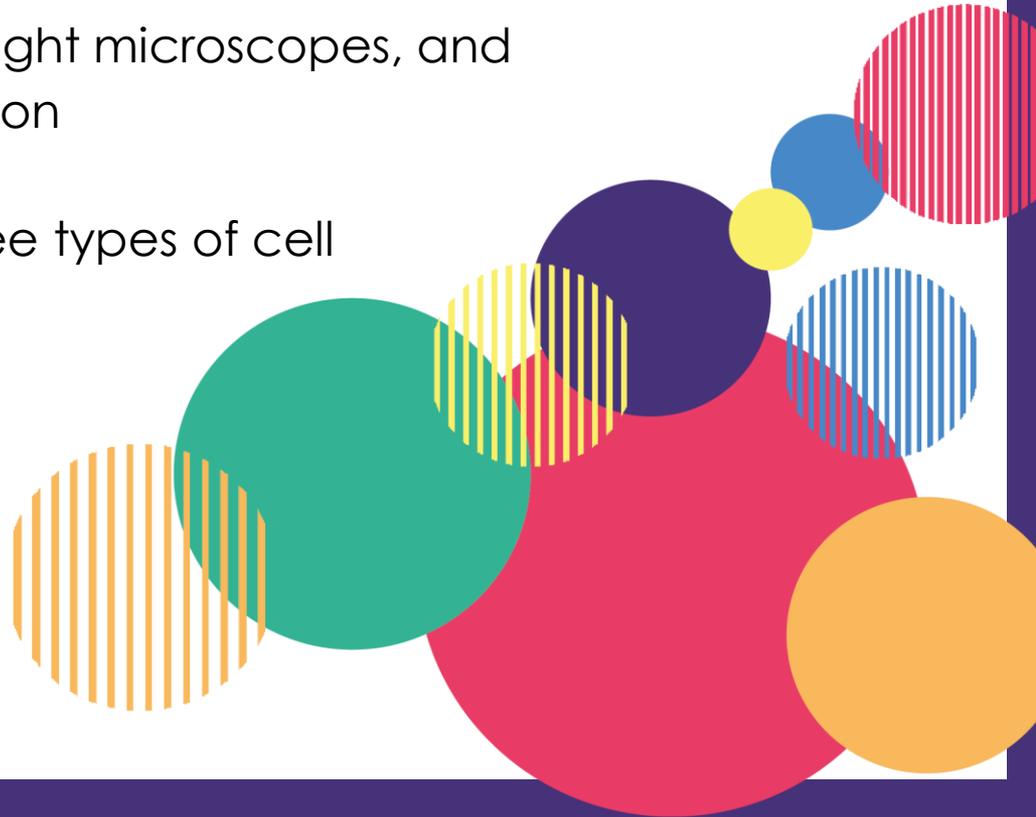
Tutorial 1.1

Cell Structure



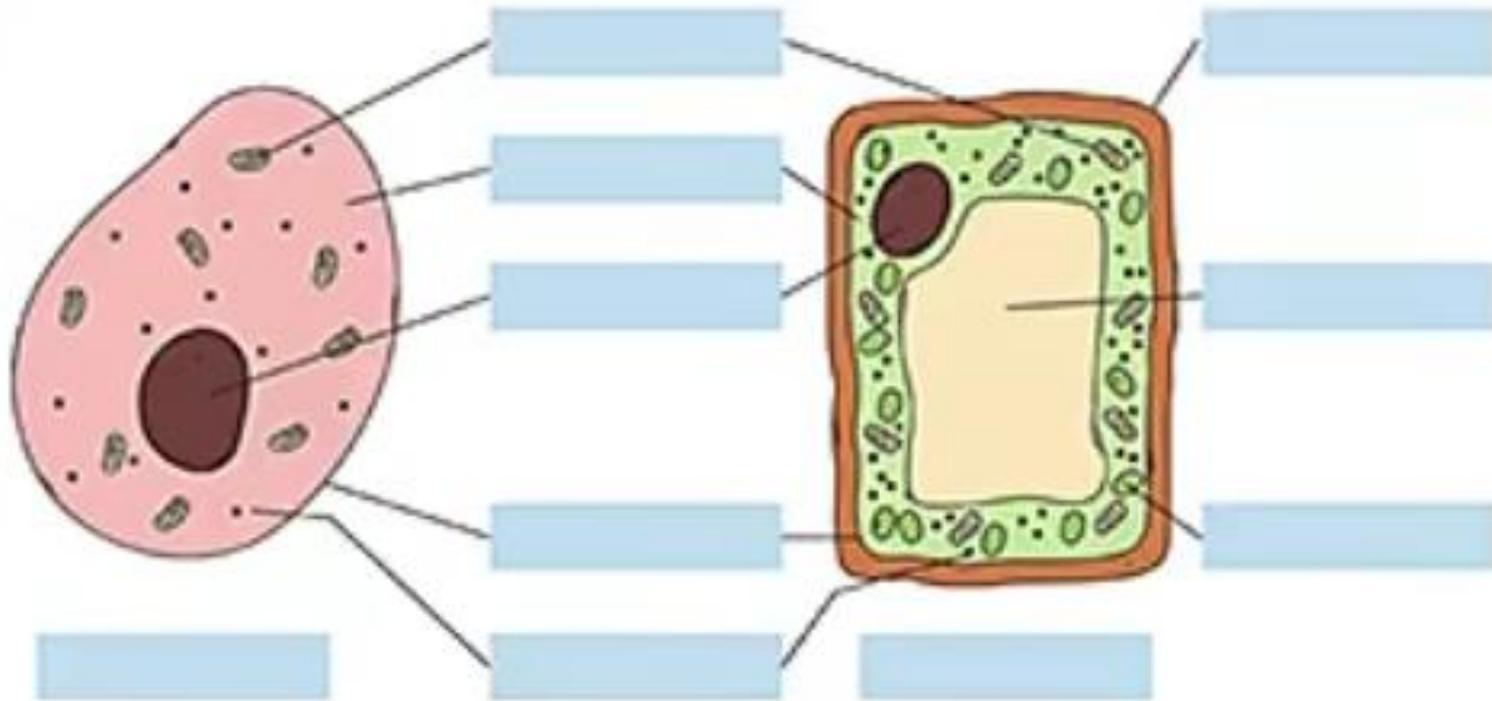
In this tutorial we will look at:

- The structures in animal, plant, and bacteria cells
- How cells are viewed under light microscopes, and how to calculate magnification
- The differences between three types of cell transport



Starter Task:

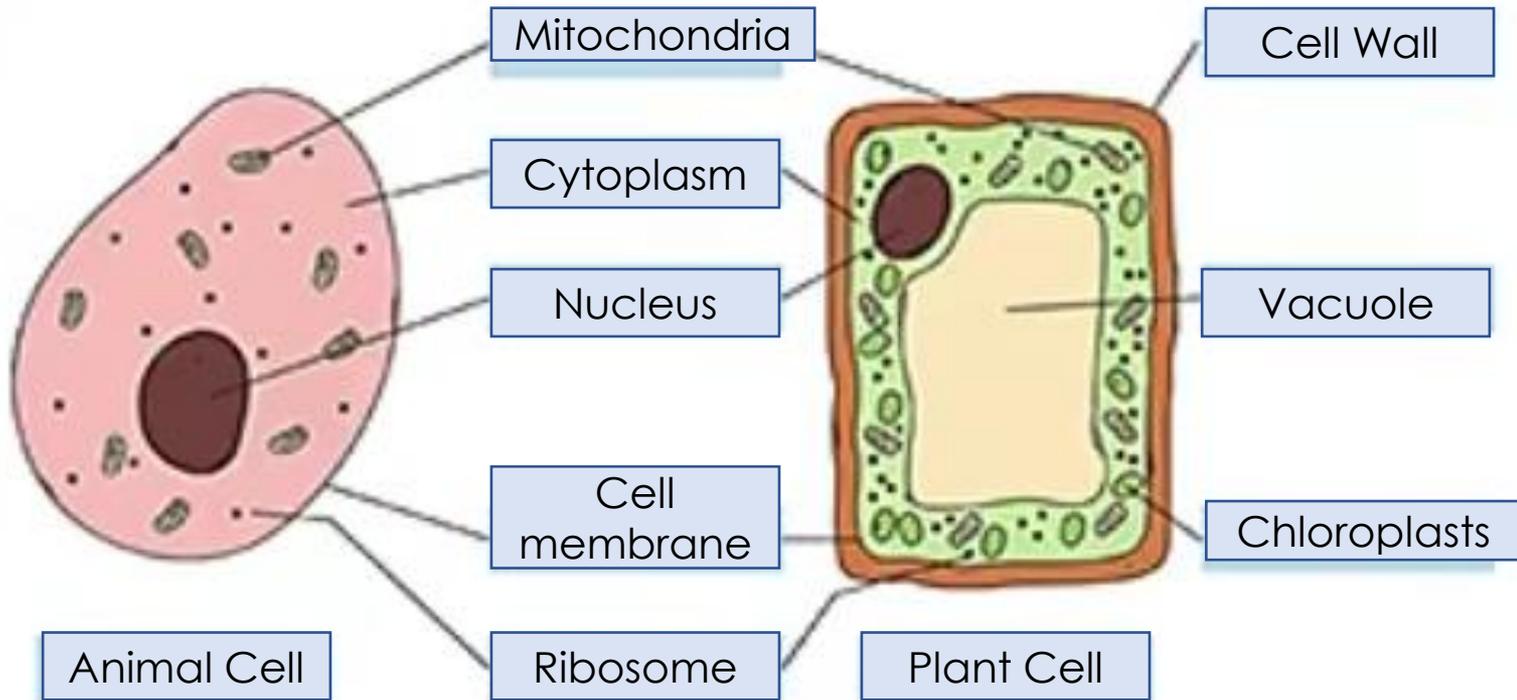
How many parts of these cells can you name?



Challenge: Can you also say what each part's function is?

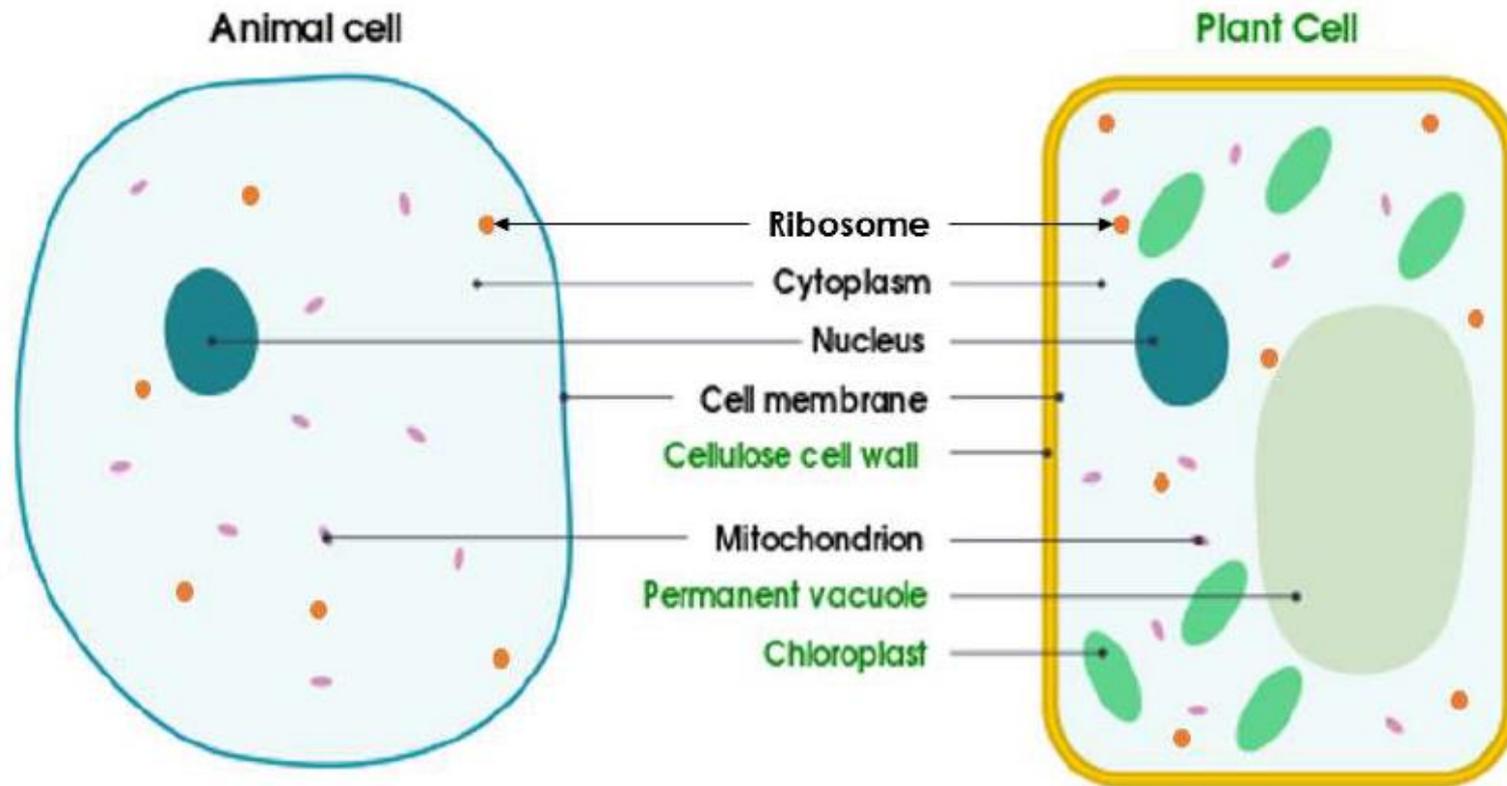
Starter Task:

How many parts of these cells can you name?



All living organisms are made of cells. Humans, animals, and plants are multicellular organisms meaning they are made of more than one cell, while bacteria are unicellular organisms and exist as single cells.

Animal and plant cells are eukaryotes – this means their cells contain a nucleus. Most animal and plant cells are between 0.01 and 0.1mm in size. The diagrams below show the components of each cell type.



The organelles shown above can all be seen when using an electron microscope. If you were using a light microscope at school, you would not be able to see the ribosomes or mitochondria as they are too small to be seen with these microscopes.

The cell components listed in green are only found in plant cells.

Handbook Activity 1



Use your prior knowledge to match the cell component with their function below:

Mitochondria

Semi-permeable structure that controls the movement of substance in and out of the cell

Nucleus

Made from Cellulose; acts to strengthen the cell and support the plant

Cell Membrane

Jelly-like substance containing cell organelles. Where chemical reactions take place

Chloroplast

Where protein synthesis takes place

Cell Wall

The site of respiration in the cell

Ribosome

Contains the genetic material (DNA) of the cell and controls the cell's activities

Permanent Vacuole

Filled with cell sap to maintain cell turgor (pressure)

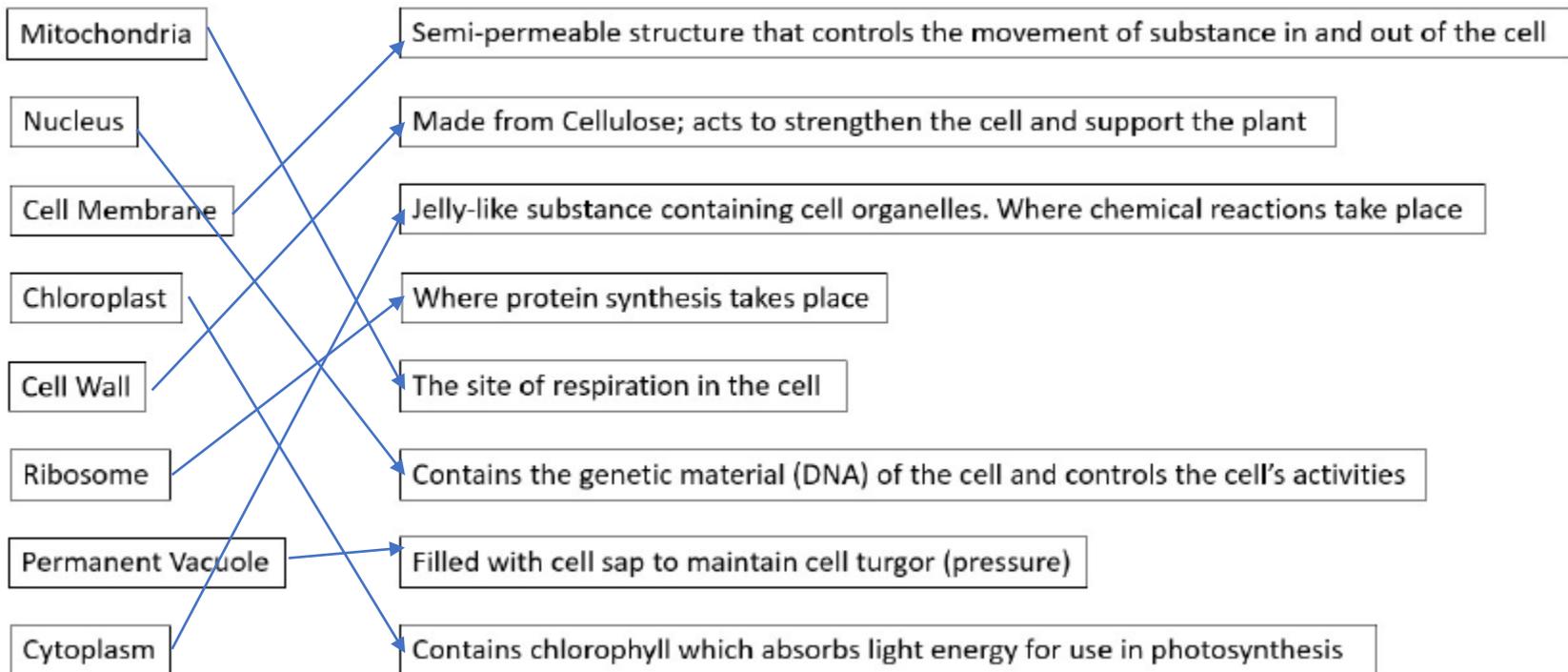
Cytoplasm

Contains chlorophyll which absorbs light energy for use in photosynthesis

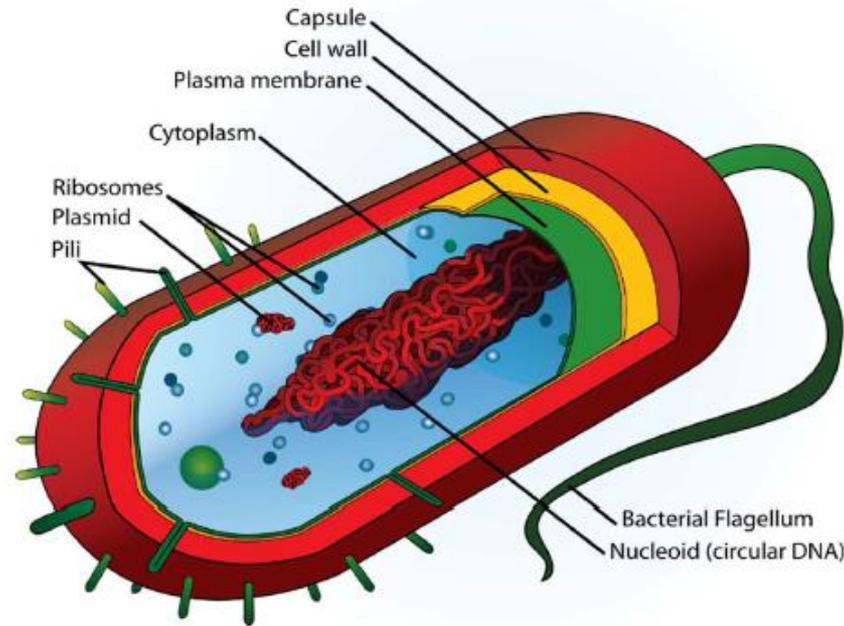


Handbook Activity 1

Use your prior knowledge to match the cell component with their function below:



Bacteria cells are prokaryotes: this means they do not contain a nucleus, so all their chromosomal DNA is loose in the cytoplasm. This DNA is wound up tightly and called the Nucleoid; but they can have extra loops of DNA called Plasmids as well.



The functions of the structures that bacteria have in common with eukaryotes (cell wall, ribosomes etc) are the same, but bacteria have some extra components too.

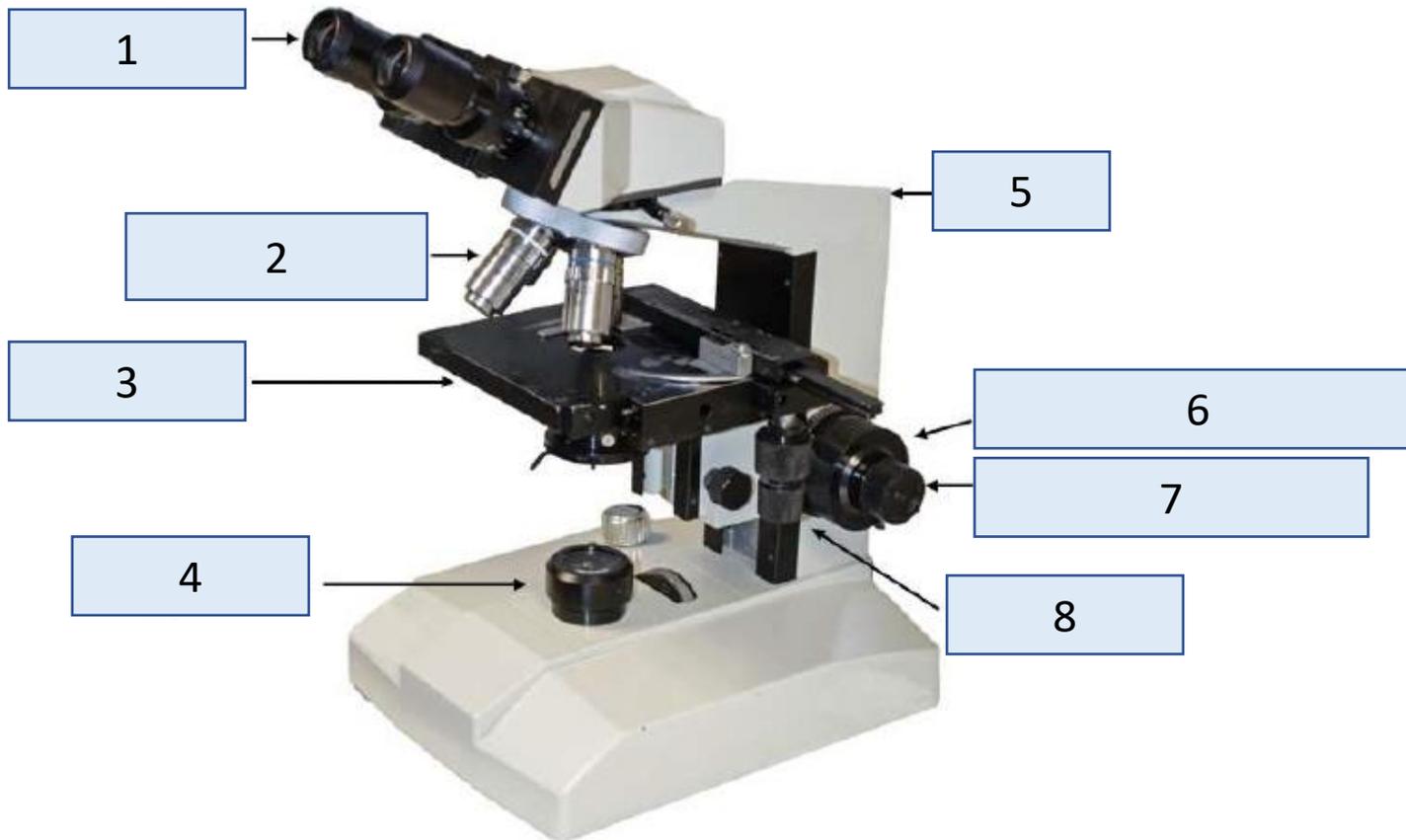
- Pili – help bacteria stick to surfaces so they can survive and reproduce
- Plasmid – carries extra genes which give the bacteria a survival advantage e.g. antibiotic resistance genes are often found on plasmids. Plasmids can also be used to transport genes between different cells.
- Capsule – helps bacterial cells stick together to form a colony, and prevents the cells from dehydrating
- Flagellum – helps bacteria swim (acts like a tail)

Thinking question: bacteria are unicellular, so the cell above is one whole organism. Why might it be useful for a bacterium not to have a nucleus, but to have their DNA free in the cytoplasm?



Microscopy

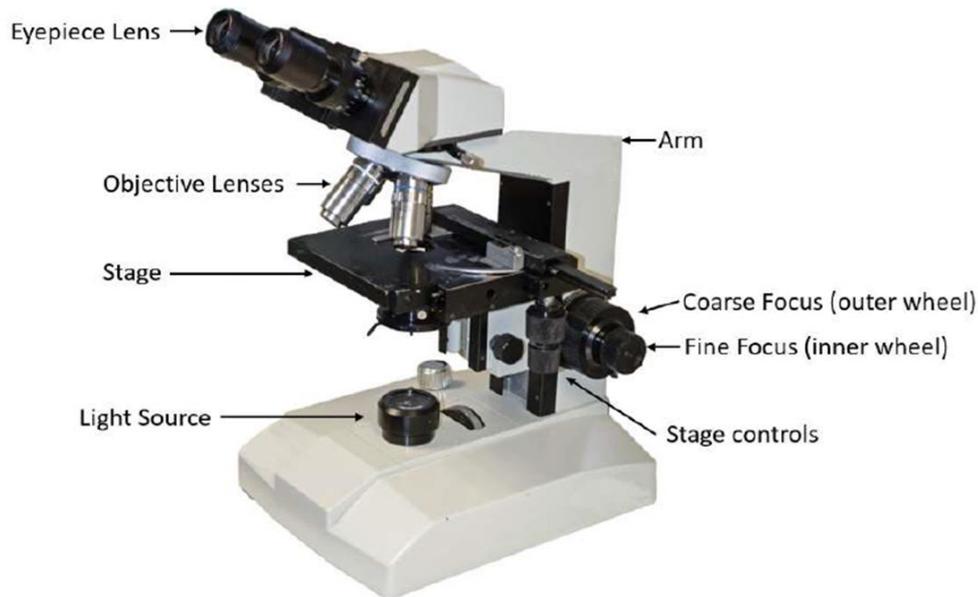
Can you remember all the parts of the microscope?



Microscopy

Cells cannot be seen by the naked eye, so to view them we use microscopes. There are several stages required to prepare biological samples for viewing under the microscope.

1. Water droplets are added to slides first to ensure cells stay hydrated and keep their shape.
2. Cells are then added to the slide.
3. Most cells are colourless, so we stain them with dyes to observe their shape and organelles.
4. Coverslips are placed over the top of the cell sample to protect the microscope and prevent the cell from drying out. Coverslips must be added carefully to prevent air bubbles getting trapped: most scientists use mounted needles to lower the coverslip gently over their samples.



Complete **Activity 4** in your handbooks.

Activity 4:

Number these stages of preparing a microscope slide in the correct order:

2	Place cells on the slide
5	Place slide under the microscope to view the sample
4	Carefully place the coverslip over the top of the cells
3	Stain the cells to help observe their shape and organelles
1	Add water droplets to the slide

Thinking Question: What risks might you need to consider when conducting a Microscopy experiment?

.....
.....

Risks of microscopy experiments:

- Light levels can be too high and damage the eyes
- Microscope stains can be damaging (or can stain your skin for extended periods)
- Coverslips, slides and mounted needles are all sharp and can cut skin

The eyepiece and objective lenses both act to magnify a sample, so we use the magnification on both lenses to work out exactly how many times bigger we view a sample compared to the actual size

- e.g. If the eyepiece lens has a magnification of 10x and the objective lens has a magnification of 40x, the overall magnification of the microscope is $10 \times 40 = 400x$.

When completing microscope calculations, we use the equation:

- Magnification = Image size \div Actual size**

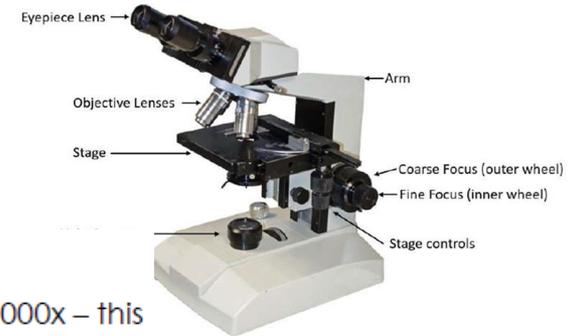
Handbook Activity 5:

- Write out your equation: Magnification = Image size \div Actual Size
- Combine the magnifications of the lenses by multiplying them together: $10 \times 100 = 1000x$ – this means the cell appeared 1000x bigger than it actually is.
- Convert your units to mm – this is the easiest unit to work with! $1.5 \text{ cm} = 15\text{mm}$
- Replace the words in your equation with values you know:

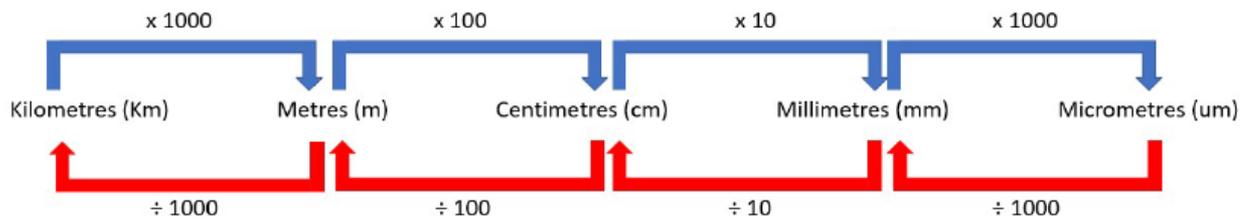
$$1000 = 15\text{mm} \div \text{Actual Size}$$

- Rearrange the equation to find the Actual size:

$$\text{Actual size} = 15\text{mm} \div 1000 = \mathbf{0.015\text{mm}}$$



Hint: when working out cell sizes, always double check your units. You can use the flow chart below to double check your maths!



Over to you!



Try this question:

- A liver cell is 0.075mm long. When observed down the microscope, the image appears to be 5.1cm. What is the magnification of this microscope?

$$\text{Magnification} = \text{Image Size} / \text{Actual}$$

$$= 50.1\text{mm} / 0.075\text{mm}$$

$$= 6680$$

Now try these:

The actual size of a woodlouse is 0.4mm but Robert drew is 5mm long. What is the magnification?

$$\text{Magnification} = \text{Image Size} / \text{Actual Size}$$

$$= 5\text{mm} / 0.4\text{mm}$$

$$= 12.5$$

A plant cell in a photograph measures 15 mm across. If the actual size of the cell is 0.015 mm, what is the magnification in the photograph?

$$\text{Magnification} = \text{Image Size} / \text{Actual Size}$$

$$= 15\text{mm} / 0.015\text{mm}$$

$$= 1000$$

The nucleus in a photograph of a cell measures 3 mm across. If the magnification in the photograph is $\times 500$, what is the actual size of the nucleus?

$$\text{Actual Size} = \text{Image Size} / \text{Magnification}$$

$$= 3\text{mm} / 500$$

$$= 0.006\text{mm}$$

Challenge Task:

Can you write your own magnification exam question? (With answers)



Light microscopes have a maximum magnification of 1500x so several organelles and cell structures cannot be seen using this tool. Electron microscopes can be used to see cells at a higher magnification – up to 1,000,000x!

There are two types of electron microscopes:

1. Scanning Electron Microscopes (SEM) which are often used to view the surface of structures
2. Transmission Electron Microscope (TEM) which are used to examine cells and tissues (these can be used in hospitals to help diagnose patient conditions)

Electron Microscopes are expensive to run and easily damaged, so schools do not have these to use. You will always use light microscopes, but you can be asked about Electron microscopes in your exams so make a note of the key facts!

Discussion question: light microscopes use a light source to illuminate a sample for observation. How might an electron microscope work? Discuss with your tutor.

Electron Micrographs

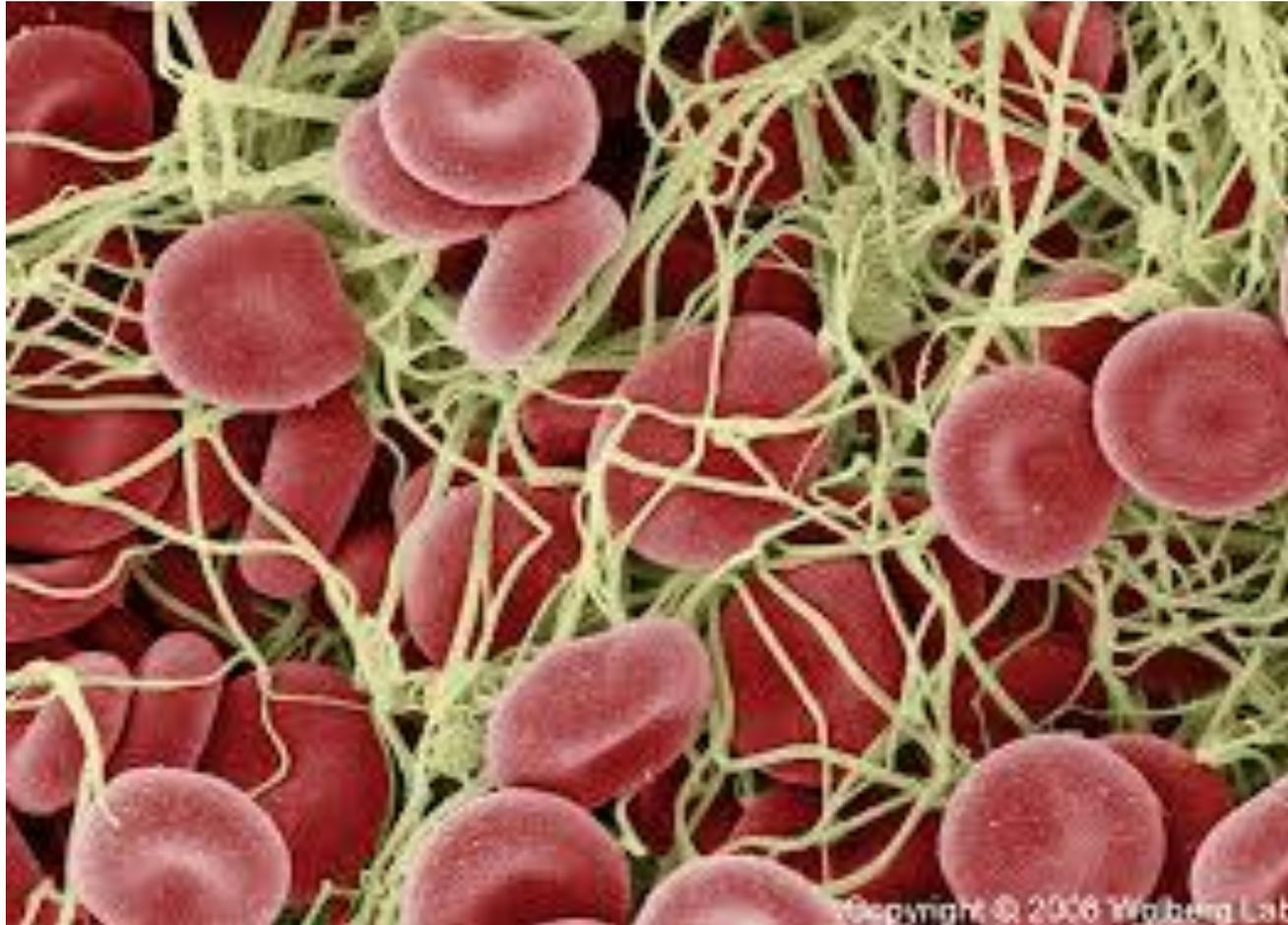


Image source: <https://www.med.unc.edu/wolberglab/scientific-images/>

Electron Micrographs



Image Source: <https://www.vox.com/2015/2/21/8071837/kidney-stones-under-microscope>

Electron Micrographs



Image source: <https://www.sciencephoto.com/media/874522/view/human-hair-with-dandruff-sem>

Electron Micrographs

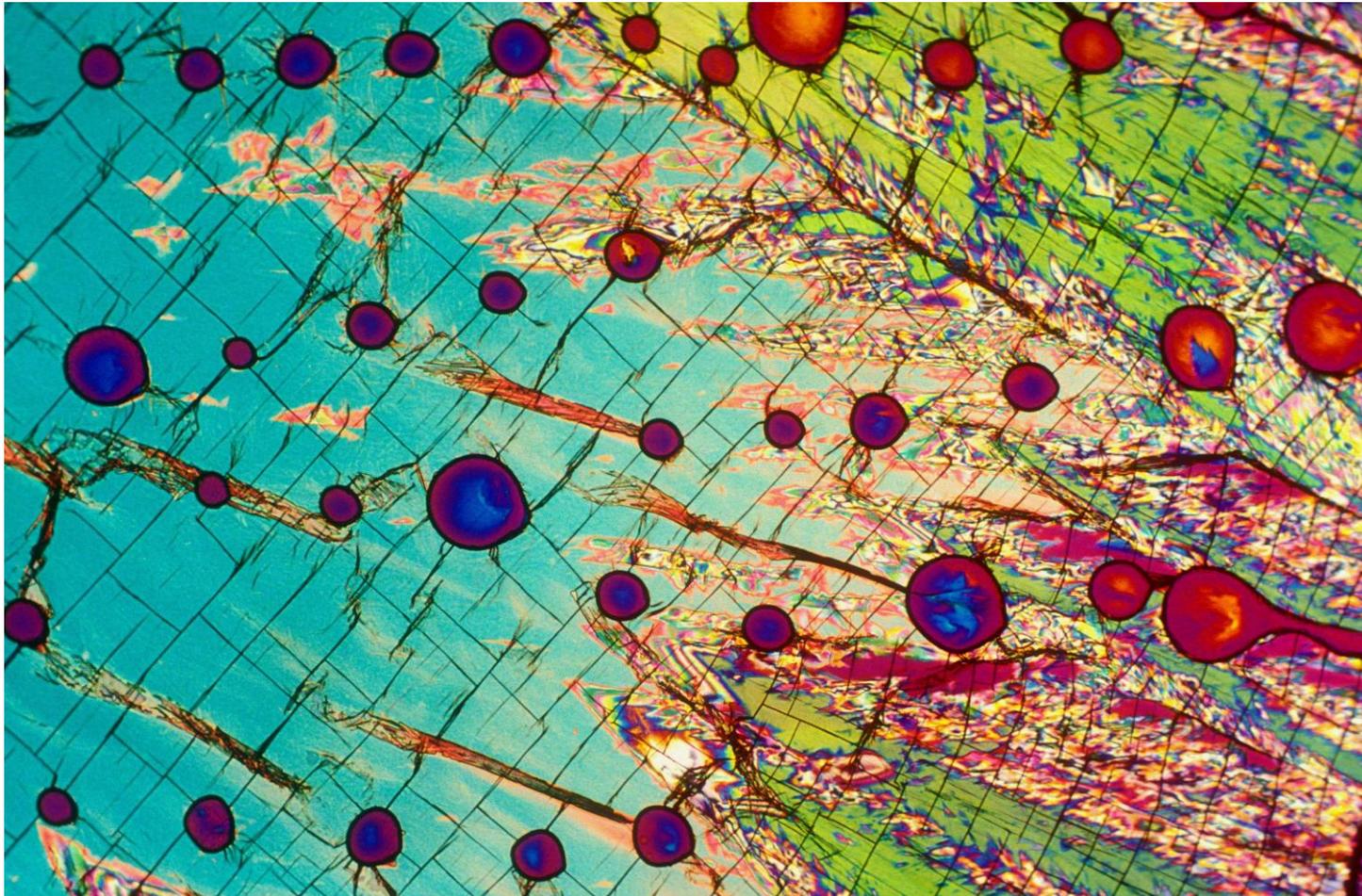


Image Source: <https://www.pinterest.com/pin/442619469604216192/>

Electron Micrographs

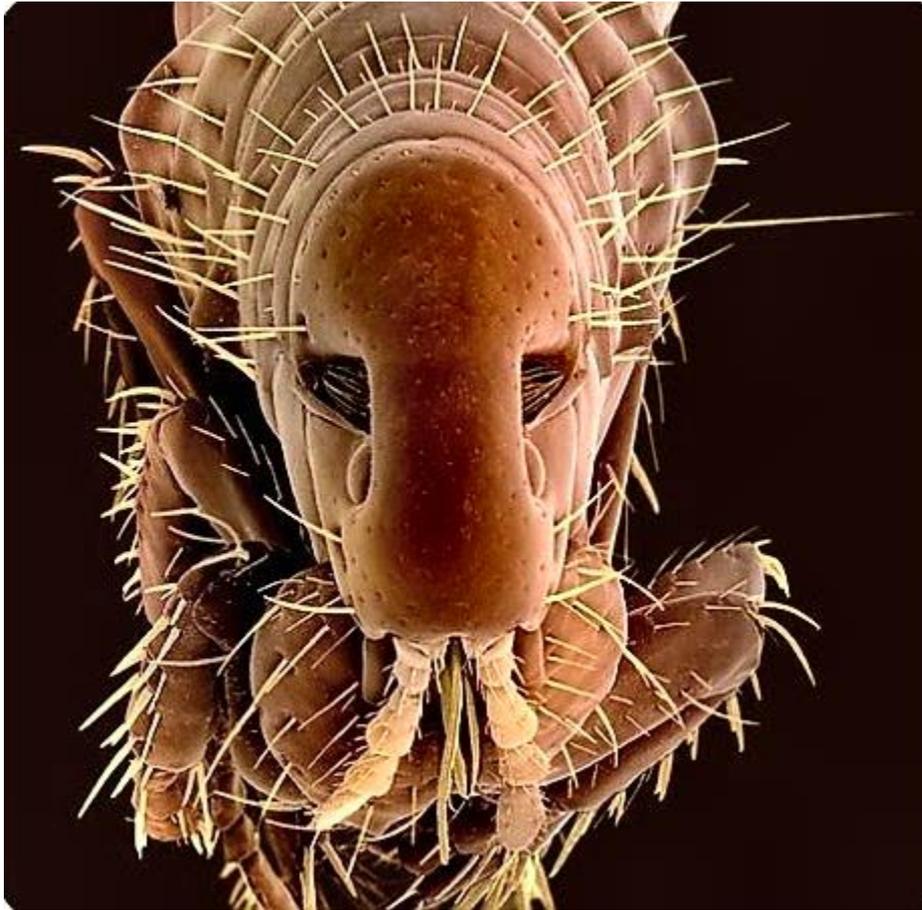


Image Source: <https://imgur.com/gallery/lfeWN4G>

Cell Transport



What are the three types of cell transport?

Cell Transport



What are the three types of cell transport? (can you unscramble the anagrams?)

FFIIDSUON

ISSMOOS

TIAVEC STONPARRT

Cell Transport



What are the three types of cell transport?

DIFFUSION

OSMOSIS

ACTIVE TRANSPORT

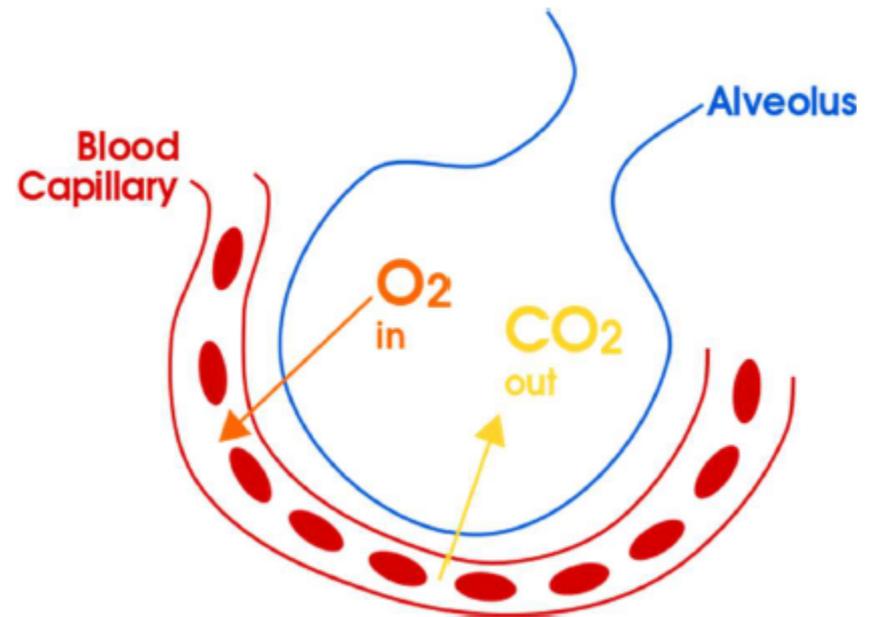
Diffusion



Diffusion is the movement of molecules from a high concentration to a low concentration. We say this movement is “down” the concentration gradient. One example is when Oxygen diffuses from a high concentration in the lungs to a low concentration in the blood during gas exchange. Diffusion is a passive process; this means it does not require energy.

Here the alveolus has a high concentration of Oxygen, and the blood has a low concentration of Oxygen, so the Oxygen diffuses from the alveolus into the blood and is carried to body cells for respiration.

Carbon Dioxide is at a high concentration in the blood (having been made in respiration and picked up from body cells) and a low concentration in the alveolus, so CO_2 diffuses from the blood into the alveolus and is breathed out.

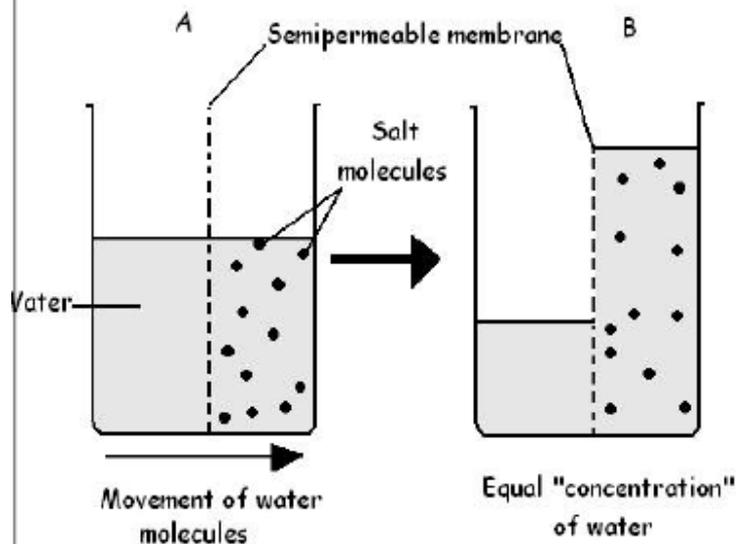


Osmosis

The definition for Osmosis is:

“The movement of water molecules from a dilute to a concentrated solution across a partially permeable membrane”.

A dilute solution means a solution with a high concentration of water molecules, while a concentrated solution has a low concentration of water molecules. The key points about osmosis are that only water can move by osmosis, and this movement occurs across a partially permeable (semi-permeable) membrane.



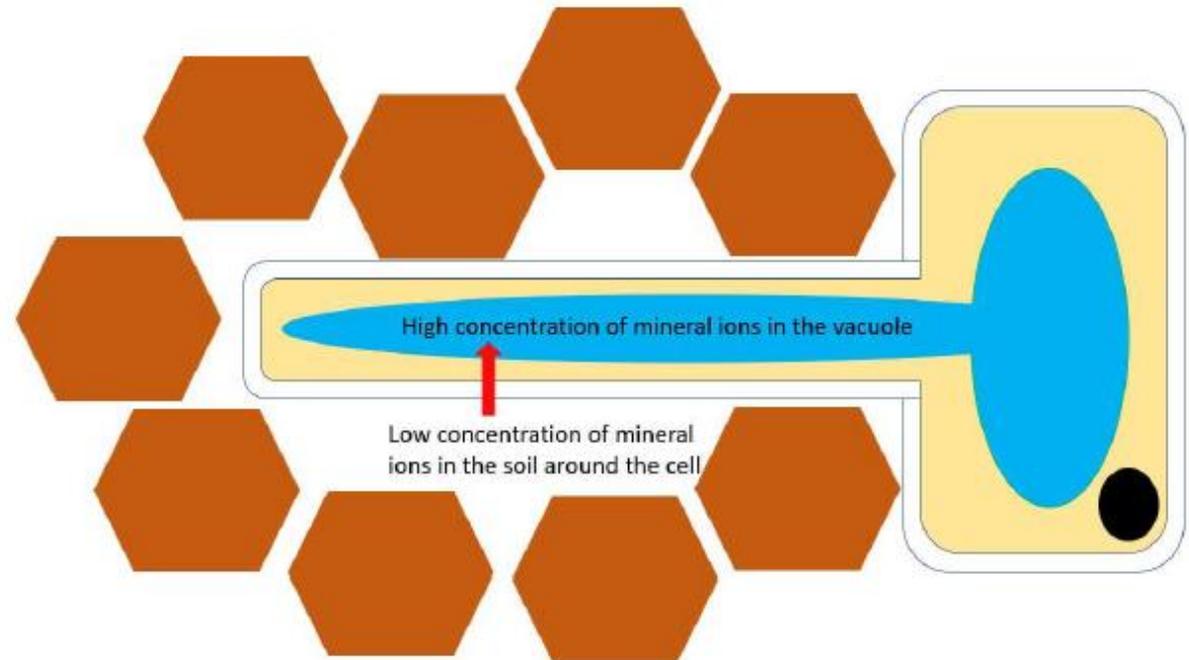
Here you can see that in the image A, one side of the membrane is dilute, while the other is a concentrated solution. Image B shows that osmosis has taken place, with water molecules moving from the dilute to the concentrated solution until both sides of the membrane have the same concentration of water.

One example of Osmosis is water moving into potato cells (as seen in your core practical). Osmosis is also a passive process and does not need energy.



Active Transport

Active Transport is the movement of molecules from a low concentration to a high concentration. This goes against the concentration gradient, so this does require energy. One example of active transport is the movement of minerals into root hair cells of plants.



Handbook Activity 7



Answer the questions below about cell transport mechanisms:

1. Glucose passes from the blood into body cells by diffusion. What does this mean about the concentration of glucose in the blood and in the body cells? (1)
2. An onion cell was submerged in pure water. Explain why the onion cell expanded in size and burst open (3)
3. Suggest why root hair cells have a high number of mitochondria (3)

Handbook Activity 8:



Convert the written definitions for the three types of cell transport into images. An example could be:

The Nucleus of a cell contains the DNA and controls the cell activities.



Diffusion	
Osmosis	
Active Transport	



Title/subheading

Over to you!

<<Insert learning activities here>>



Plenary activity heading

<<Insert plenary activity onto this slide>>



thebrilliantclub.org



Biology

Key Stage 4

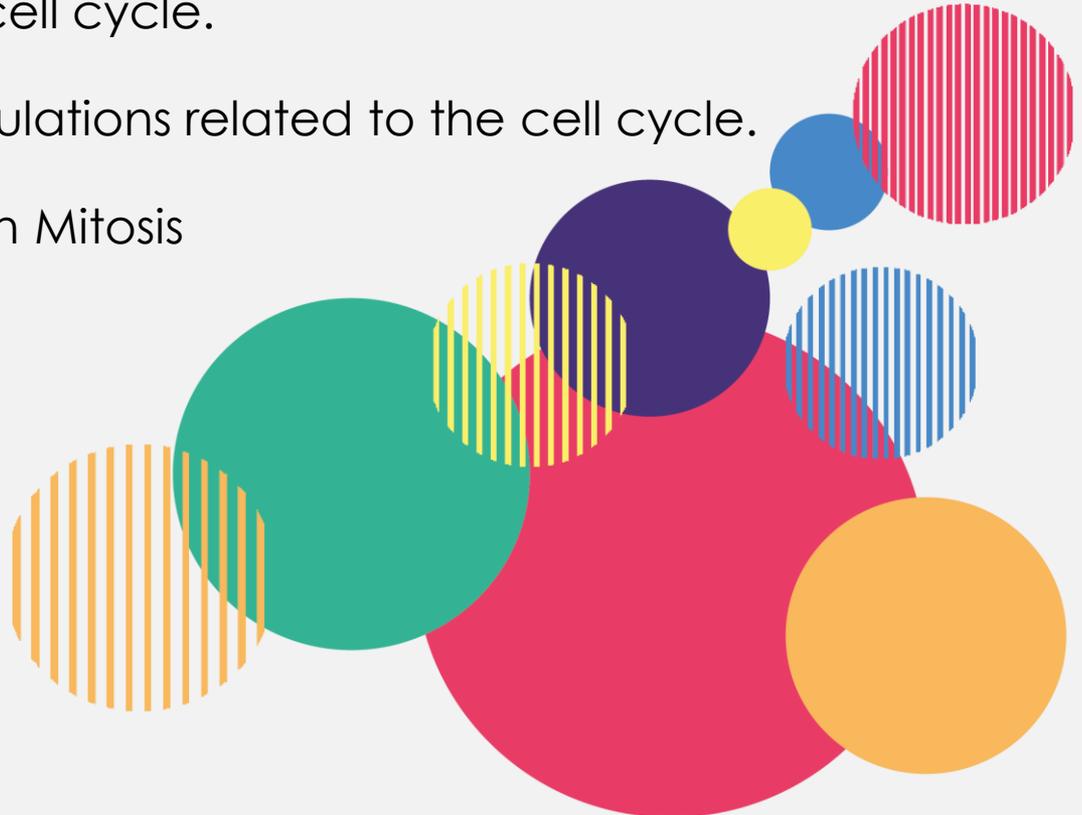
Tutorial 1.2

The Cell Cycle



In this tutorial we will look at:

- The three parts of the cell cycle.
- How to complete calculations related to the cell cycle.
- Comparing Meiosis with Mitosis





Starter Activity

Order the following by their size:

- Cell
- DNA
- Gene
- Nucleus
- Chromosome

Challenge: can you recall the definitions of each term?



Answers

DNA>Gene>Chromosome>Nucleus>Cell

Challenge: can you recall the definitions of each term?

DNA: DNA stands for deoxyribonucleic acid. It is a chemical made up of two long molecules. DNA carries genetic information. It has all the instructions that a living organism needs to grow, reproduce and function.

Gene: A gene is a small section of DNA on a chromosome, that codes for a particular sequence of amino acids , to make a specific protein.

Chromosome: Chromosomes are thin strands of DNA

Nucleus: Contains genetic material, including DNA, which controls the cell's activities.

Cell: Cells are the basic building blocks of all animals and plants.

DNA Recap



DNA is a molecule which carries the genetic code for animals, plants, and other organisms. Long strands of DNA are coiled into chromosomes, and every human cell has 23 pairs of these chromosomes (46 chromosomes total).



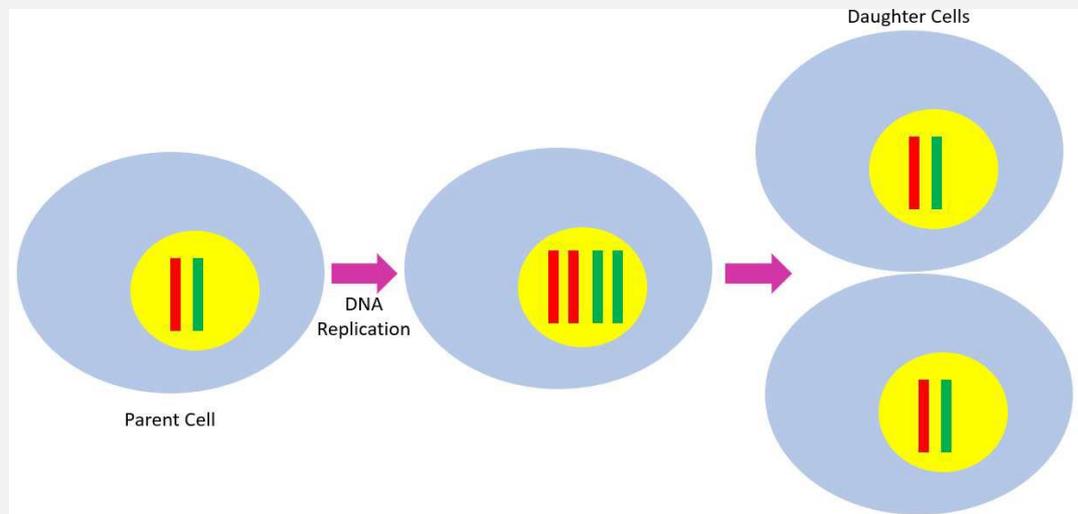
The Cell Cycle

The Cell Cycle has 3 stages:

- Stage 1: Growth and chromosome replication: the parent cell copies all its chromosomes
- Stage 2: Mitosis: the nucleus splits into two. Chromosome copies are pulled apart to opposite ends of the cell.
- Stage 3: The cytoplasm and cell membrane splits to form two identical daughter cells.

Handbook Activity 1:

Draw out the 3 stages of the cell cycle





Mitosis

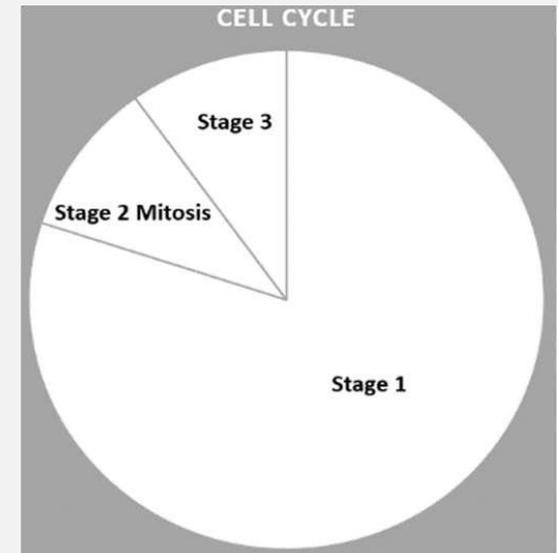
Mitosis produces daughter cells with a full complement of chromosomes i.e. these are clones of the original parent cell. This means these cells are reproducing asexually.

The cell cycle can also be represented as a circular process. The first stage is the longest due to the amount of time it takes to copy all 46 chromosomes. The process of dividing the nucleus and other organelles is much shorter by comparison.

We can be asked to use this with reference to time e.g. Mitosis lasts for 10% of the cell cycle and takes 40 minutes.

a) How many minutes does Stage 3 take?

b) How many minutes must Stage 1 take?





Mitosis

We can be asked to use this with reference to time e.g. Mitosis lasts for 10% of the cell cycle and takes 40 minutes.

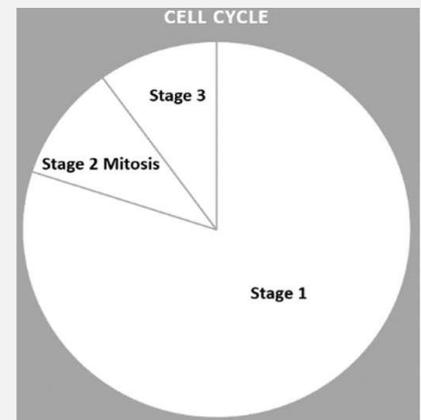
a) How many minutes does Stage 3 take?

We can see from the diagram that Stage 2 and 3 take the same amount of time, so Stage 3 must also take 40 minutes.

b) How many minutes must Stage 1 take?

Stage 2 and 3 are the same length and we know that Stage 2 takes 10% of the time of the full cycle so Stage 3 must also take 10% of the time. This means Stage 1 must take 80% of the cell cycle.

- 10% = 40 mins (we are given this information in the question)
- 80% = $40 \times 8 = 320$ mins
- $320/60 = 5$ hours and 20 minutes.

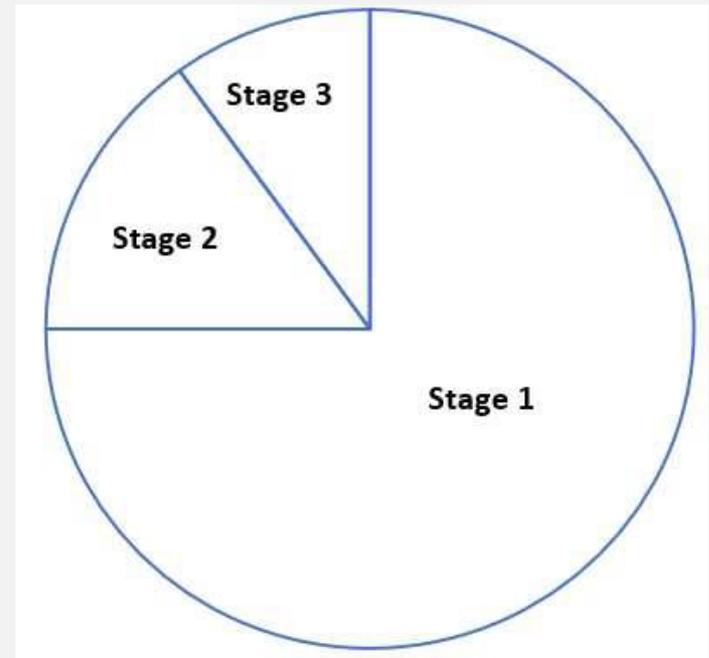




Handbook Activity 3

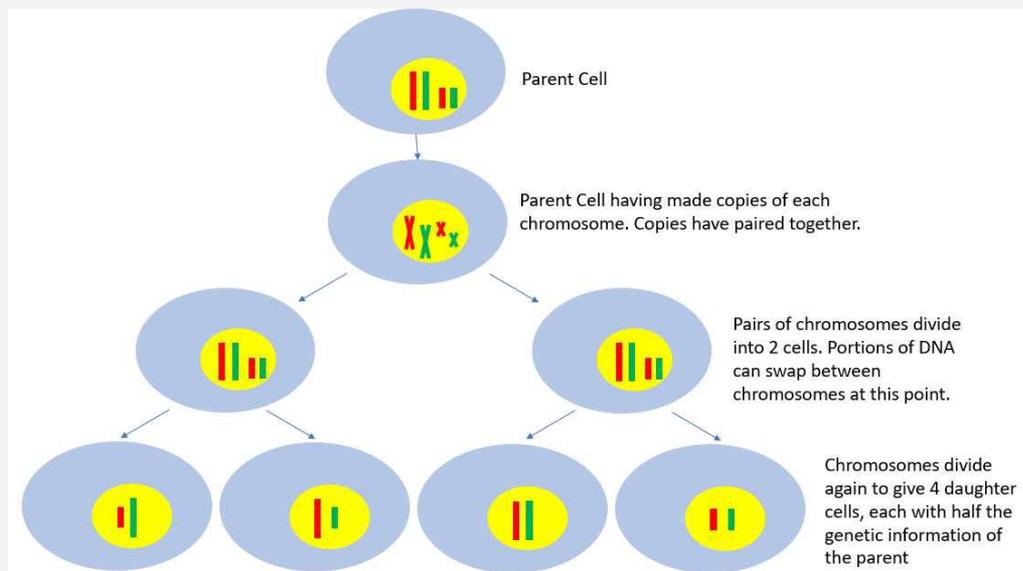
A scientist observes the division of carrot cells under a microscope. She calculates that Stages 2 and 3 of the Cell Cycle together took 55 minutes.

Calculate the length of Stage 1 in hours and minutes.



Thinking Questions

1. The process of Mitosis produces two identical daughter cells with the same number of chromosomes as the parent cell. Which cells in your body would use Mitosis for growth?
2. Which parts of your body would need to produce daughter cells that did not have the same number of chromosomes as the parent cell?

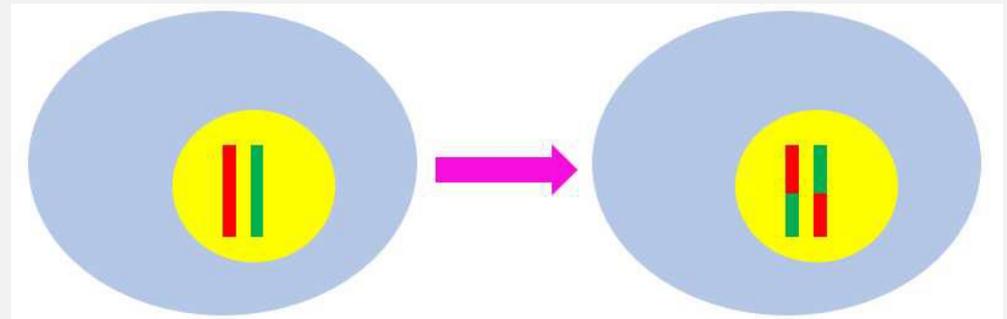




Meiosis

There is a second cell division process called “Meiosis” where parent cells divide to give 4 daughter cells, each with half the genetic information of the parent.

One key difference between Mitosis and Meiosis is that variation can be introduced through Meiosis. Once the two cells have formed from the original parent, chromosomes can swap parts of themselves to create new variants. This is called Genetic Reassortment. This version of cell division can be used to make gametes for reproduction e.g. egg and sperm cells.





Handbook Activity 5

Complete the boxes to show how these chromosomes would be inherited in gametes

T t G g			



Comparison Questions

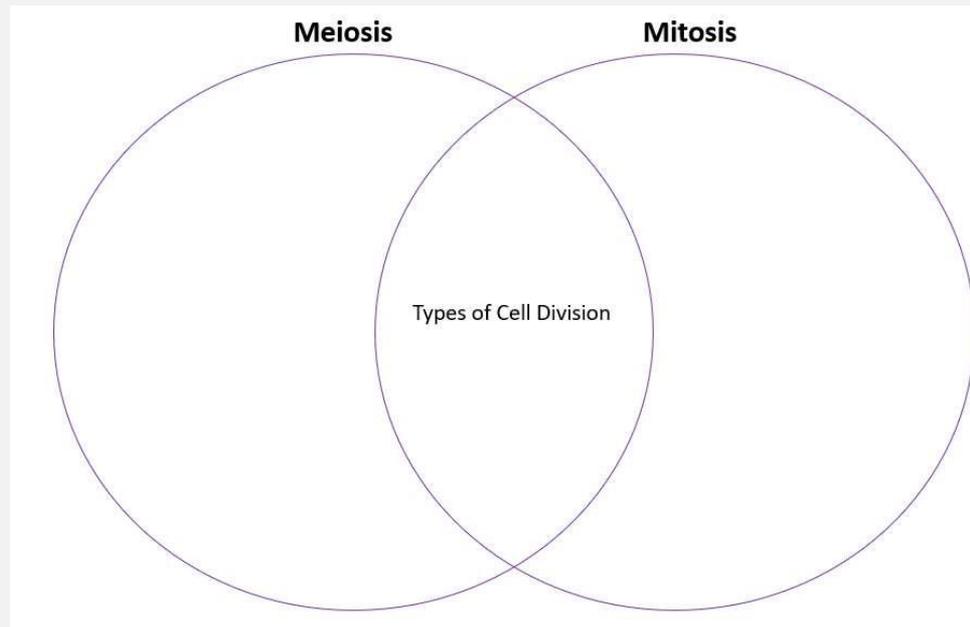
The best way to start comparison questions is to plan. Planning your answer before you begin gives your brain some time to process the question and think of important facts. Plans can also help you organise your ideas so your structure is clearer which can also improve your marks.

When planning a comparison question, you are trying to think of similarities and differences so a Venn diagram would make these very clear for you to use for your writing.

Handbook Activity 6



1. Complete the diagram without looking at your notes in blue pen.
2. Go back and check your notes – add any missing information in red or green (this colour change should help you revise later!)



Compare Meiosis and Mitosis with reference to their products (6 marks)



Thinking Question

Each egg cell and sperm cell is the result of Meiosis. Why do siblings not all look alike when they have the same mother and father?



Plenary Activity

The statements below either describe Mitosis, Meiosis, or both.
Decide which statements describe which!

End product is 2 daughter cells	Purpose is for growth and maintenance	In humans creates a cell with 46 chromosomes	Creates sex cells (eg sperm and egg)
Starts with one parent cell	End product is 4 daughter cells	In humans creates a cell with 23 chromosomes	Creates daughter cells
Purpose is for reproduction	DNA replication occurs	Creates body cells (eg, blood, muscle, liver, hair)	Creates daughter cells with half as many chromosomes as parent cells

Answers



End product is 2 daughter cells Mitosis	Purpose is for growth and maintenance Mitosis	In humans creates a cell with 46 chromosomes Mitosis	Creates sex cells (e.g sperm and egg) Meiosis
Starts with one parent cell Both	End product is 4 daughter cells Meiosis	In humans creates a cell with 23 chromosomes Meiosis	Creates daughter cells Both
Purpose is for reproduction Meiosis	DNA replication occurs Both	Creates body cells (e.g. blood, muscle, liver, hair) Mitosis	Creates daughter cells with half as many chromosomes as parent cells Meiosis



Reflect on your session today

1. What have you found interesting?
2. What topics do you feel confident in?
3. What would you like more help with?



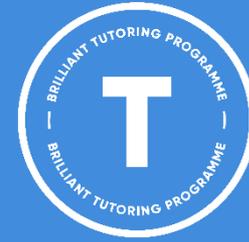
Title/subheading

Over to you!

<<Insert learning activities here>>



thebrilliantclub.org



Biology

Key Stage 4

Tutorial 1.3

Stem Cells



In this tutorial we will look at:

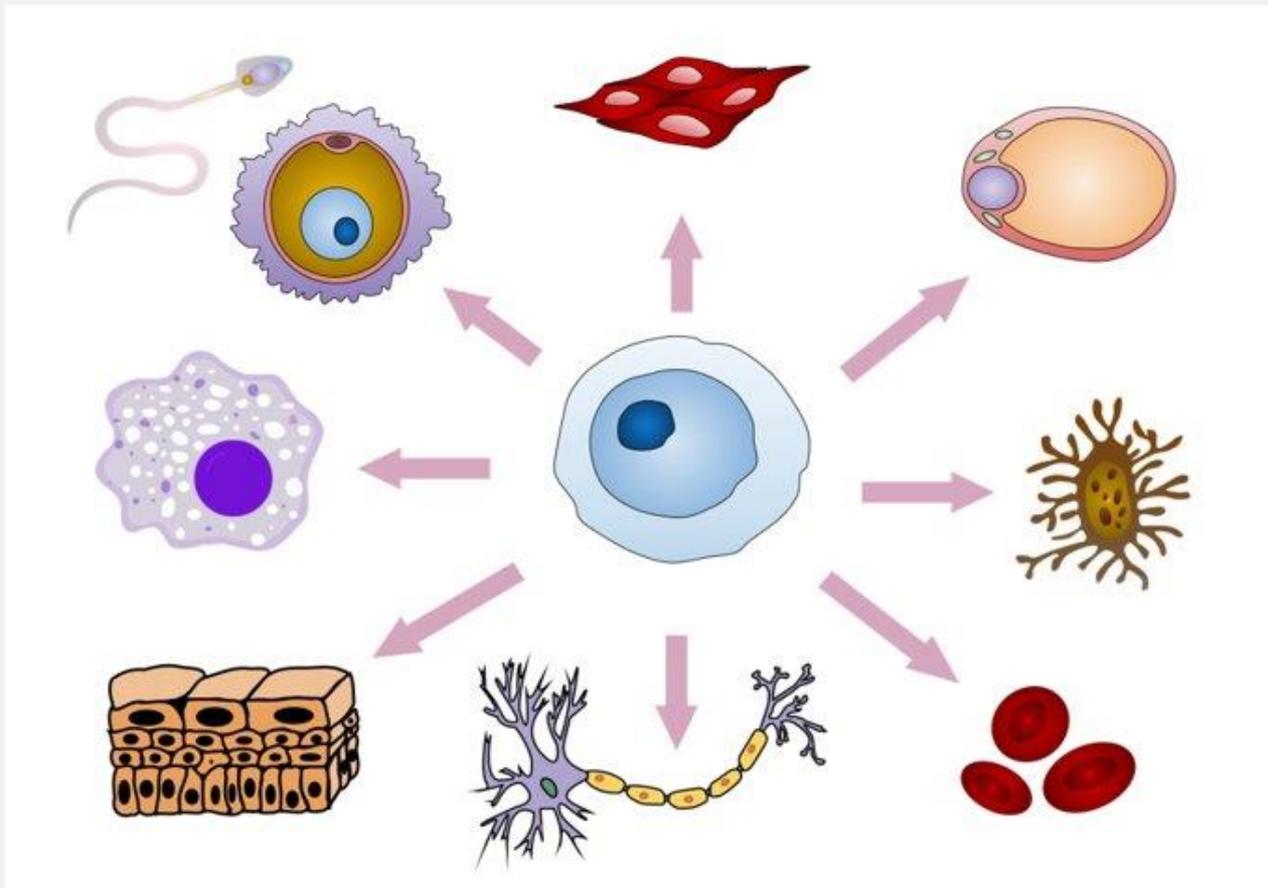
- The two types of stems cells, and how they are derived
- What is meant by ethics, and how this relates to stem cell use.
- Evaluating the use of stem cells in medicine.

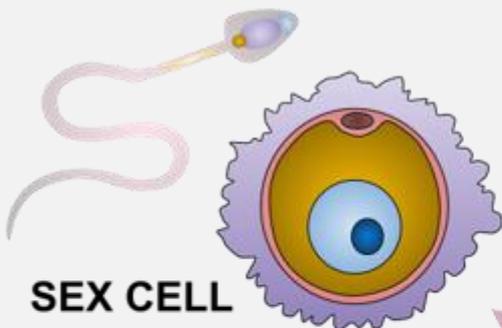




Starter Task

How many different types of body cell can you think of? Use these pictures to help you (and think of your own too!)

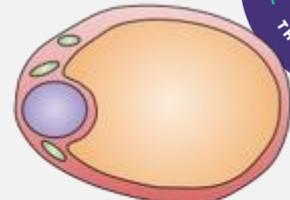




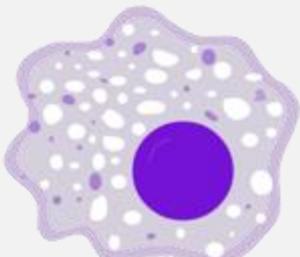
SEX CELL



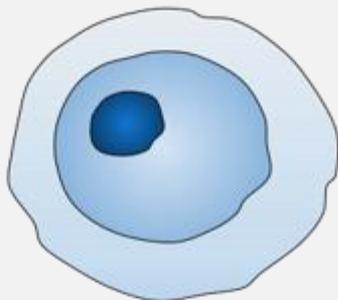
MUSCLE CELL



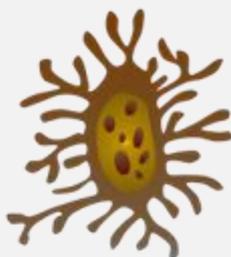
FAT CELL



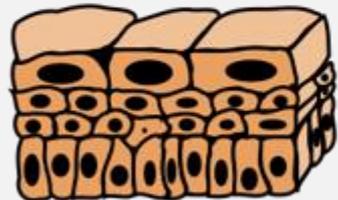
IMMUNE CELL



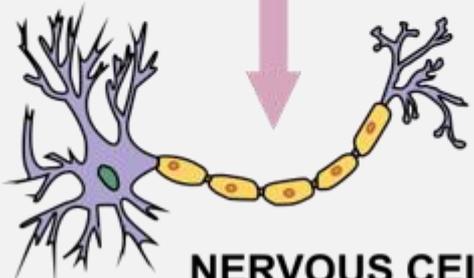
STEM CELL



BONE CELL



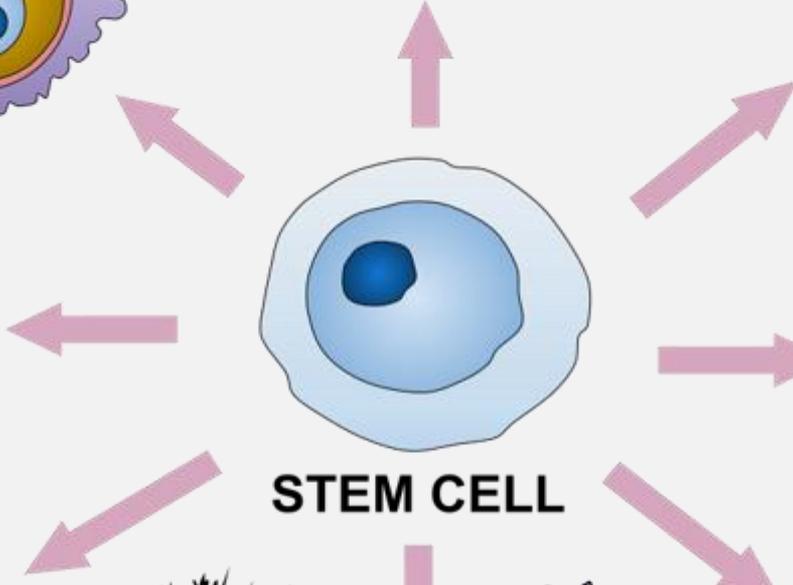
EPITHELIAL CELL



NERVOUS CELL



BLOOD CELL





What is a stem cell?

Sperm and egg cells fuse to form a Zygote which then undergoes multiple rounds of cell division. However, at some point our cells must differentiate i.e. they have to start specialising to do specific jobs in our body such as becoming muscle cells, blood cells etc.

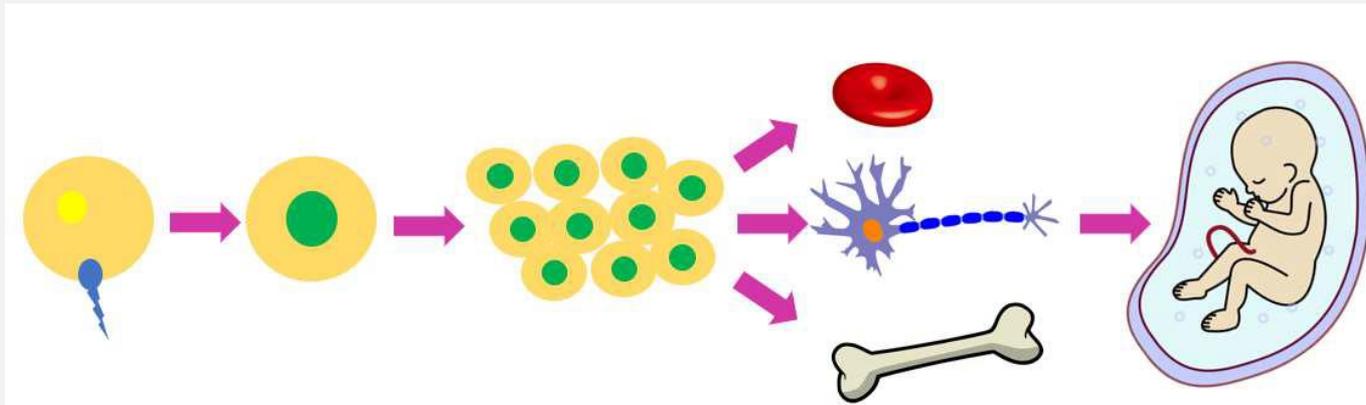
We need hundreds of different cell types in our body – **how do we get these from our original single-cell Zygote?**

An embryo develops through cell division of the Zygote formed in fertilisation.

The cells in the embryo are all identical and not specialised for any specific function – these are called embryonic stem cells. Stem cells are cells that can develop into any other cell type.

Embryonic stem cells are called “pluripotent” – this means they can develop into any kind of body cell (except the placenta).

These embryonic stem cells receive signals to switch on some genes in their DNA e.g. the genes to make themselves into a blood cell, and the cell will develop these characteristics and become this type of cell. Other cells will receive different signals and become all the other cell types we need to form all the tissues required for a foetus. This process is called differentiation: the process of a cell specialising to carry out a specific function.





Plant Stem Cells

Cell division in plants takes place in the meristems – these are specific regions in the plant roots and tips where growth occurs. Cells in these regions divide by mitosis, creating unspecialised stem cells which will differentiate into specific cell types as they move away from the meristem.

Complete the match up activity to check your keywords:

Stem Cell

Stem cells derived from early-stage embryos which can develop into any body cell type

Embryonic Stem Cell

The ability to develop into any cell type except placenta tissue

Adult Stem Cell

Part of a plant where cell division takes place

Differentiation

A cell that can differentiate into any cell type

Meristem

Cells receive signals to specialise into specific cell types e.g. muscle, blood, bone

Pluripotent

A stem cell found in the adult body which can differentiate into a limited number of cell types

Multipotent

The ability to develop into a limited number of cell types



Embryonic and Adult Stem Cells

Embryonic stem cells can be isolated during IVF treatment:

1. An egg cell is fertilised by a sperm cell
2. The resulting zygote is grown for up to 5 days in the laboratory
3. Embryonic stem cells are isolated and can be used in medicine and research

Adult stem cells can be harvested from:

- Your blood using a special machine. Blood is removed from the body and stem cells are separated out using a specific machine. The blood can then be returned to the body.
- The bone marrow of your hip bone. This process uses a large needle to access the bone marrow and remove stem cells.

Ethics



Medical ethics is the application of ethics to a medical treatment or scientific research i.e. what are the benefits and costs to an individual if they undertake this treatment? Medical ethics also tries to determine whether something is good or bad for society e.g. is it a good thing that we can genetically engineer embryos?

Stem cells can be used to treat a variety of medical conditions including diabetes, deafness, and paralysis. Several other diseases are under investigation as to whether stem cells could be used as treatments including cancers and Parkinson's Disease.

Embryonic stem cells are used in some treatments but the use of these is contentious because there is disagreement about the stage of development when an embryo becomes a person and has rights to life. Some people believe that a fertilised zygote has right to life, whereas others believe that these rights start later in pregnancy or even birth. This means they disagree about whether embryonic stem cells have the right to life as a person, or whether they can be used for research.

There is also concern that we might begin to see embryos as a commodity (something to use) as opposed to a potential person. For these reasons, some people do not believe stem cells should be used for medical purposes.

Question



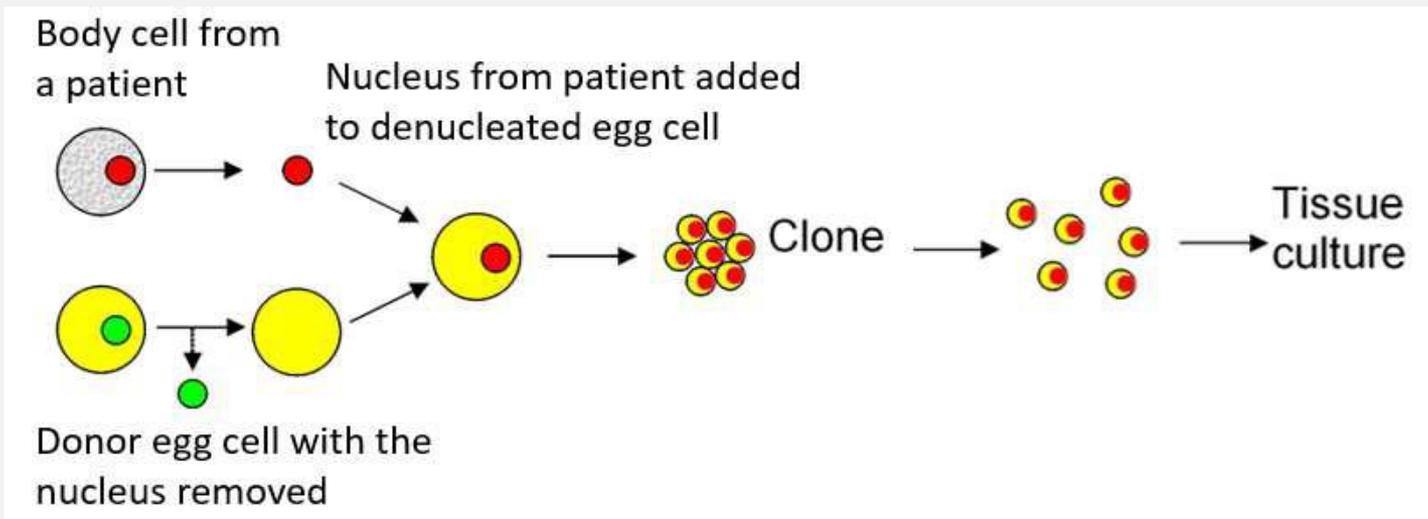
Do you think embryonic stem cells should be used for research and medicine? If so, why? If not, why not? Have a think for 2 minutes then discuss with your tutor.

Remember, it is OK to disagree with your classmates, but you need to respect each other's opinions and listen to each other's ideas.



Therapeutic Cloning

Therapeutic Cloning is the method of using an embryonic stem cell from one person and removing its nucleus. A nucleus from a different person (a patient) could be inserted into this “empty” stem cell and grown in a laboratory. This would then be grown with the chemicals that signal cells to differentiate in the body, so this cell could become a specific body tissue with the same genetic information as the patient. This tissue could be transplanted into the patient without being rejected as the cell would have the same genetic material as the patient.



Handbook Activity 3



Draw out the process of therapeutic cloning in your handbook

Read the statements below and write either A (Advantage) or D (Disadvantage) for each one:



- There is a risk of viral infection if adult stem cells are transferred from one human to another _____
- Stem cell clone tissues will not be rejected by the patient if their own stem cells are cloned _____
- In therapeutic cloning, stem cells are cloned, so that they have the same genes as the patient _____
- There is a risk that tumours will develop from a stem cell transplant _____
- Conditions such as Parkinson's Disease and diabetes may be treated _____
- Bone marrow stem cells can be used to replace a patient's faulty blood cells _____
- Embryonic stem cells could be used to produce new nerve cells, which could treat people who have been paralysed by spinal injuries _____
- Some people believe that every embryo has the right to become a baby and its cells should not be used in medical treatments _____

Can you think of any other advantages or disadvantages to using stem cells for medical treatment?



Evaluating the use of stem cells

What does the command word “Evaluate” mean?

An evaluation is the weighing up of a situation e.g. describing all the positives you can think of, then the negatives and deciding whether you think something is a good or bad idea.

Modelling

Listen as your teacher talks you through their approach to this question. Annotate any parts of the question as you listen, and make notes to follow their thought process. This will support you to you plan your own answers to similar questions.

Question: Evaluate the use of stem cells from a patient, rather than from an embryo (6)



Evaluating the use of stem cells

A Doctor is discussing treatment options with her patient who has a spinal injury. The Doctor wants to extract stem cells from a bone marrow donor, while the patient wants to use embryonic stem cells.

Evaluate each method and give a judgement on which method you think is best (6)

Self-assessment – listen to the mark scheme and mark your answer out of 6.

What did you do well?

What improvements could you make?



Title/subheading

Over to you!

<<Insert learning activities here>>

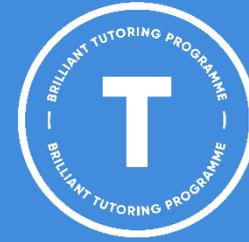
Plenary activity heading



<<Insert plenary activity onto this slide>>



thebrilliantclub.org



Biology

Key Stage 4

Tutorial 1.4

Lifestyle and Disease



In this tutorial we will look at:

- The causes and associated risk factors related to cancer.
- The impacts of smoking on adults and unborn babies.
- How Coronary Heart Disease develops and how the treatments for this disease work.





Starter activity

How many of these key terms do you know the definitions for?

Carcinogen

Benign

Risk Factor

Disease

Malignant

Mutation

Extension question: What factors do you know of that can make someone more likely to get cancer?

Answers:



Carcinogen: A substance linked to an increased risk of cancer. E.g. tar in cigarettes.

Risk Factor: Factors linked to an increased risk of a disease. E.g. Smoking is a risk factor for cancer. Obesity is a risk factor for Diabetes.

Malignant: When a tumor can travel in the bloodstream to different parts of the body and initiate more tumors elsewhere. I.e – it will spread

Benign: When a tumor stays within one area of the body and can therefore be easily removed.

Disease: Occurs in the body when cells are damaged, and signs and symptoms of an illness appear.

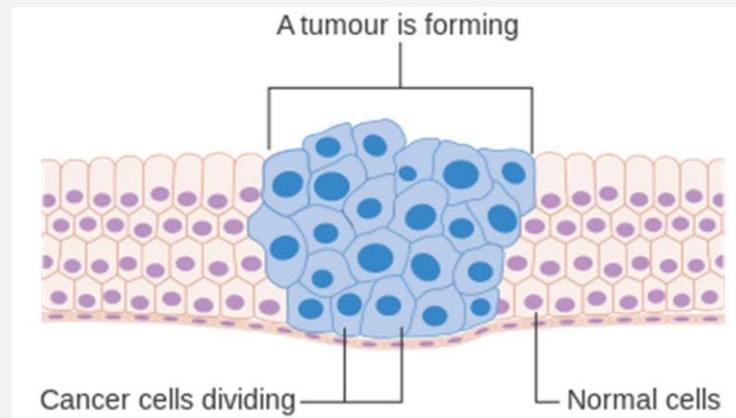
Mutation: A change in a gene or a chromosome

Extension question: What factors do you know of that can make someone more likely to get cancer?



Understanding Cancer

Cancer is the name for a group of diseases where a cell has undergone a mutation causing it to divide more frequently and rapidly than it should. This leads to the formation of a ball of cells where there should only be one – this is called a tumour and can appear under the skin as a lump.



Tumours can be benign or malignant. Benign tumours stay within one area of the body and can usually be removed requiring no further treatment. Malignant tumours can travel around the body in the bloodstream, invading different tissues and initiating more tumours to grow in other parts of the body.



Carcinogens

There are several factors that increase the risk of cancer development. Substances or types of radiation which are linked to an increased risk of cancer are called Carcinogens. Some examples of carcinogens include:

- UV light on sunbeds is linked to the development of skin cancer
- Ionising radiation (X-rays for example) is linked to multiple cancers
- Processed meats are linked to bowel cancer
- Smoking is linked to lung cancer
- Alcohol is linked to liver cancer
- The HPV virus has been linked to cervical cancer

Obesity is not a carcinogen but is linked to bowel and liver cancer. Obesity increases the risk of developing these cancers and is the result of a poor diet.



Handbook Activity 2

Read the statements and decide if they are True or False. If they are False, re-write the sentence so it is correct in your handbook:

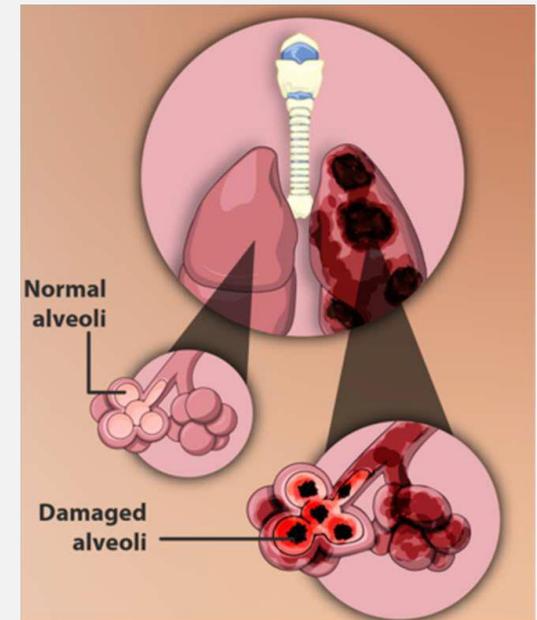
1. Cancers are caused by mutations in DNA _____
2. Mutations cause single cells to grow much bigger, creating a lump _____
3. Benign tumours can travel around the body _____
4. Malignant tumours can invade other tissues and cause more tumours to grow _____
5. Alcohol is a carcinogen _____
6. Alcohol is linked to lung cancer _____



Smoking

Cigarettes contain multiple chemicals which can do us harm, including Carbon Monoxide, Tar and Nicotine.

- **Nicotine** has been linked to heart disease as it raises heart rate making damage to the blood vessels and subsequent disease more likely.
- **Tar** is a carcinogen: it binds to the lung surface and can induce mutations in lung tissue leading to lung cancer. Tar also builds up in the alveoli causing the breakdown of the walls, leading to reduced surface area for gas exchange and diseases such as Emphysema.
- **Tar and Nicotine** both irritate the bronchi and lungs, causing goblet cells to produce more mucus, reducing gas exchange and leading to increased infections and breathing difficulties.
- **Carbon Monoxide** is a poisonous gas. When inhaled through smoking, Carbon Monoxide enters the lungs and binds to haemoglobin in red blood cells. This prevents red blood cells from carrying their maximum amount of Oxygen, so the body cells do not receive enough Oxygen, leading to fatigue and breathing difficulties.



Handbook Activity 3



Fill out the table below by summarising the effects of the three main ingredients in cigarettes:

Tar	
Nicotine	
Carbon Monoxide	



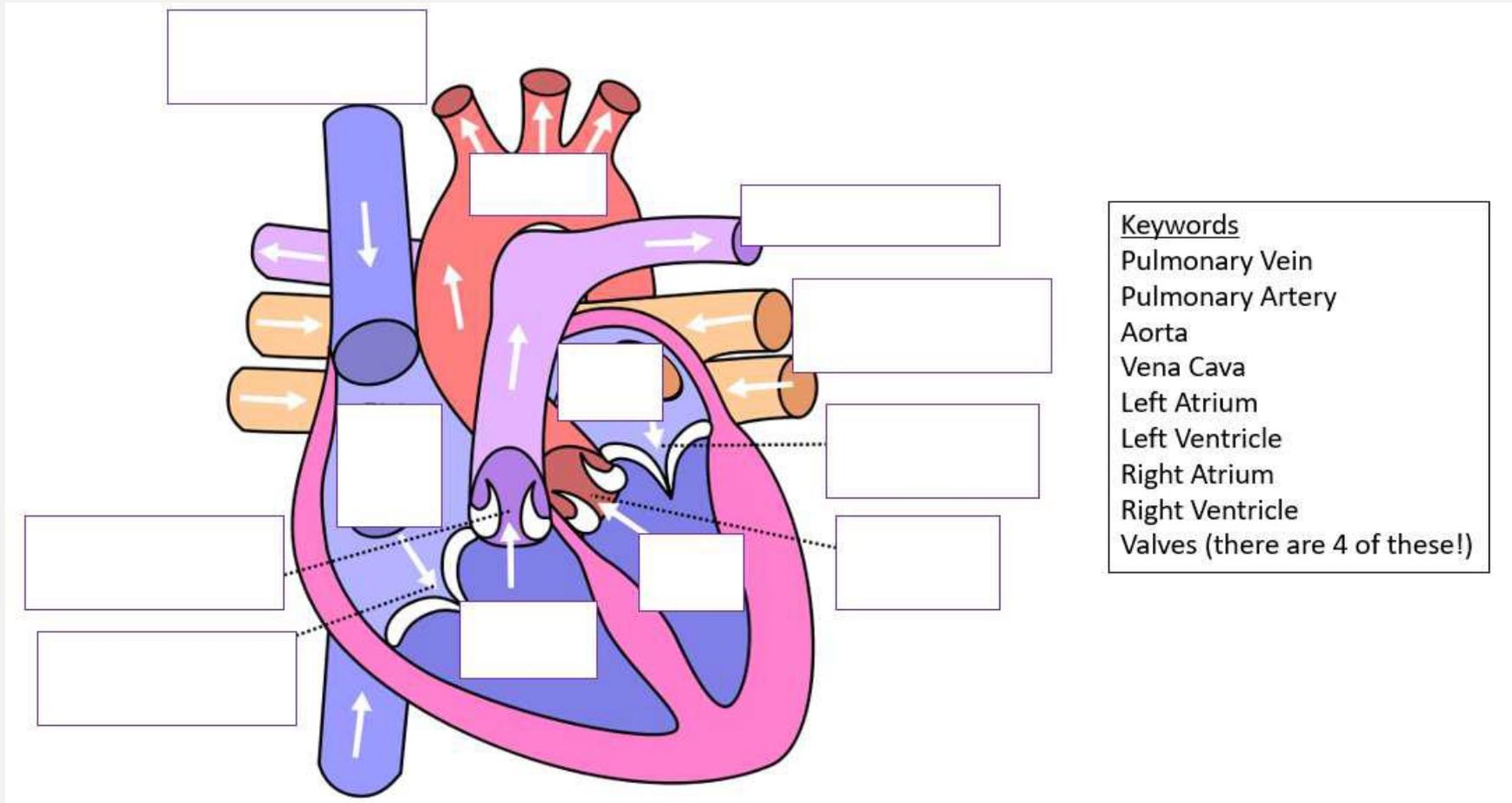
Discussion Question

Researchers have found that women who smoke are more likely to have babies with low birth weights, why might this be?



Coronary Heart Disease

Label the heart with the correct keywords in your handbook





Coronary Heart Disease

Coronary Heart Disease is where the coronary arteries become narrower, due to the deposition of material in the artery walls. This material is usually cholesterol due to a poor diet, or material from smoking. These substances are deposited in the artery walls over time, building up into a thick solid mass called Plaque. This plaque sits in the artery, reducing the space for blood to flow. Eventually the plaque will form a clot and block blood flow to the heart completely. This prevents Oxygen reaching the heart muscle, preventing respiration and contraction of the heart muscle. This causes a heart attack which, if not treated quickly, can be fatal.

Handbook Activity 6: Use the information above to explain how Coronary Heart Disease develops using only images.

Use the space in your handbook to plan your 6 steps before you start drawing.



There are 4 treatments for CHD

- **Statins:** these tablets reduce the amount of cholesterol in the blood, lowering the risk of this fat being deposited in the artery. This reduces the risk of heart disease and stroke, but these tablets must be taken daily (often people forget to take them) and the tablets have several side effects including headaches, memory loss and kidney failure.



There are 4 treatments for CHD

- **Stents:** these mesh tubes can be inserted into the artery to keep the blood vessel open, making sure blood can reach the heart. These tubes last for a long time once inserted and the recovery from surgery is rapid. However, they do require surgery for insertion which means they are not suitable for many people. There are risks associated with the surgery for people who do have



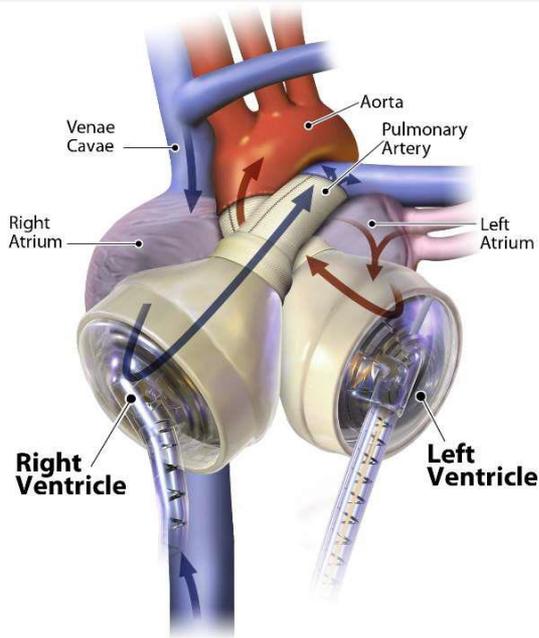
There are 4 treatments for CHD

- **Live heart transplants:** these are donated by people who have recently died, and these organs are transplanted immediately. These last for many years, but they can be rejected by the patient's body. The waiting list for a live heart transplant is long and some people die before they can receive a new heart.

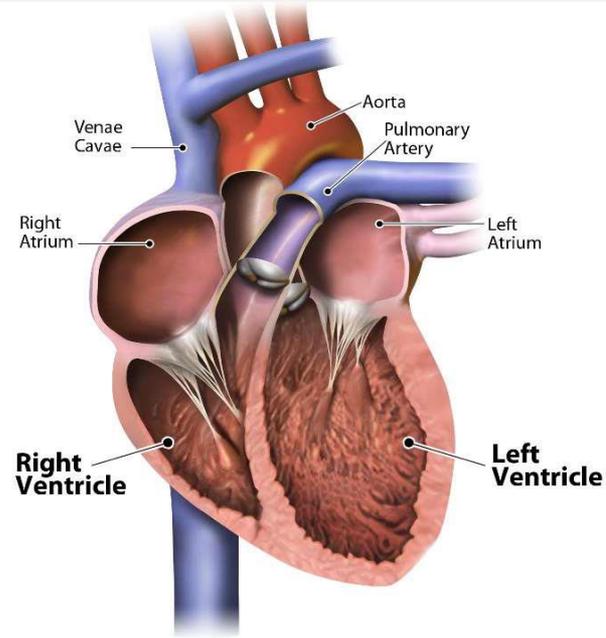


There are 4 treatments for CHD

- **Artificial heart transplants:** these mechanical devices act like the heart, pumping blood around the body, These are less likely to be rejected by the body than a live heart transplant and there is no need to wait for a heart to become available. However, artificial hearts are only a temporary solution and there is also a risk of device failure.



Total Artificial Heart



Human Heart

Discussion: which of the four treatments would you choose and why? Do your classmates and tutor agree with you?

Following today's lesson, what advice would you give someone wanting to avoid developing any lifestyle diseases? Explain your advice scientifically, using keywords where possible.



Consolidate: use the information from today's lesson to write 3 exam questions you think you could be asked about lifestyle diseases, then try to answer your questions!

- **Example question:** Describe the differences between benign and malignant tumours (2)
- **Answer:** Benign tumours remain localised while malignant tumours travel to other tissues in the bloodstream, causing secondary tumours to develop.

Challenge: Researchers have identified that CHD commonly affects multiple members of a family.

What might this mean about CHD?

Knowledge Check



This module aimed to help you:

1. Explain the differences in animal, plant, and bacterial cells and how substances move in and out of them.
2. Understand how to complete calculations relating to the cell cycle and magnification.
3. Explain mitosis, meiosis, and how stem cells are derived and used.
4. Explain the causes and risk factors of cancer, the impacts of smoking, and how Coronary Heart Disease is treated.



Knowledge Check #2

You can complete online, by going to: <https://forms.office.com/r/YSBZVdeFx1>



1. Cell division producing 2 identical daughter cell is known as
 - a) Mitosis
 - b) Meiosis
 - c) Transfusion
 - d) Reproduction
2. Root hair cells need mitochondria to
 - a) Provide energy to enable them to obtain water through passive transport
 - b) Provide carbon dioxide to enable them to obtain water through active transport
 - c) Provide energy to obtain water through active transport

Knowledge Check #2



3. Select the two types of Stem cells that can be derived from humans
 - a) Perinatal and adult stem cells
 - b) Adult and embryonic stem cells
 - c) Cytokine and embryonic stem cells

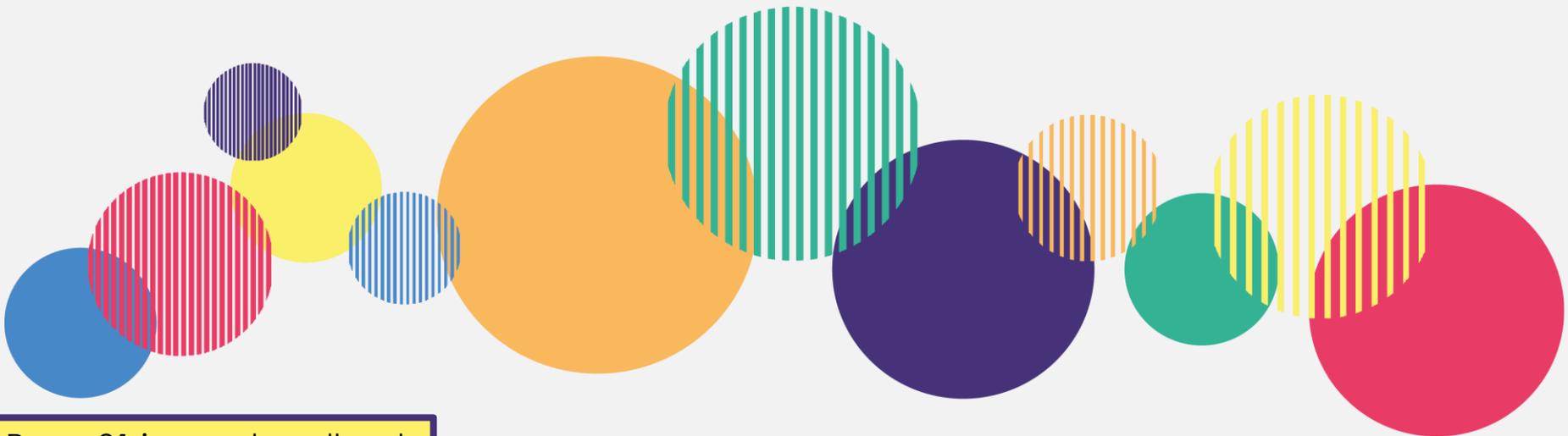
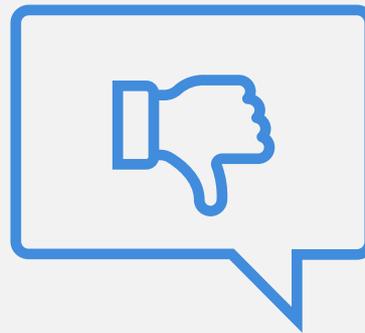
4. Select the incorrect reason for development of coronary heart disease
 - a) Fats are carried in the bloodstream and deposited in the artery, building up over time.
 - b) The presence of the fats in artery reduces the diameter/space inside the blood vessel reducing blood flow to the heart.
 - c) Proteins are building blocks of the body, which in excess causes coronary heart diseases

Knowledge Check #2



5. A skin cell is 0.3mm long. When observed down the microscope, the image appears to be 3cm. What is the magnification of this microscope?
- a) 1
 - b) 10
 - c) 100
 - d) 1000

Reflection





Title/subheading

Over to you!

<<Insert learning activities here>>



thebrilliantclub.org